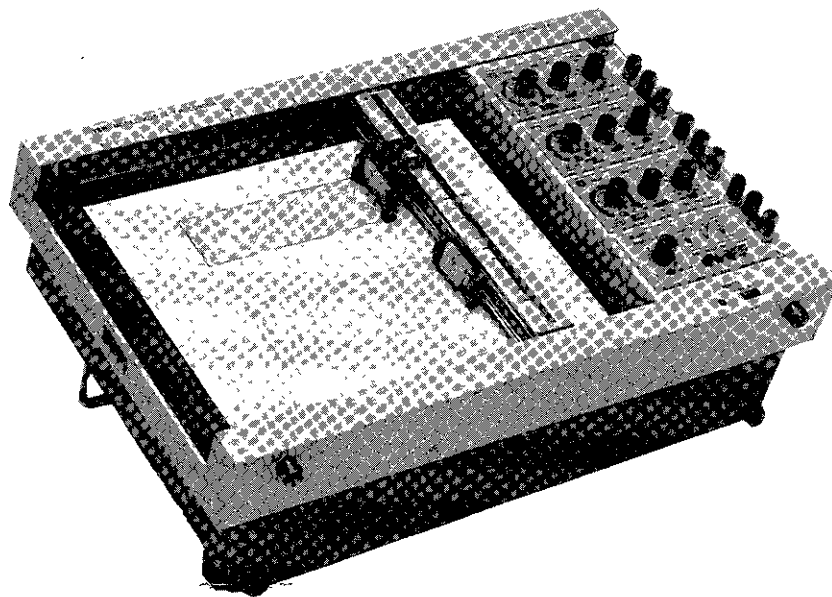


# Instruction Manual

Model 3025  
A4 X-Y RECORDER



**YEW**  
YOKOGAWA HOKUSHIN ELECTRIC

4th Edition  
IM 3025-01E

## **CERTIFICATION**

Yokogawa Hokushin Electric Corporation (YEW) certifies that this instrument underwent stringent inspections and performance tests before it was shipped from the factory, and was found to meet the specifications given in the specifications section of this document.

YEW also certifies that its calibration measurements are traceable to the Electro-technical Laboratory of the Ministry of International Trade and Industry (which maintains Japan's primary electrical standards) to the extent allowed by the organization's calibration facilities. Calibration measurements not traceable to that organization are traceable to the calibration facilities of other members of the International Electrotechnical Commission, or to those of International Organization for Standardization (ISO) members.

## **WARRANTY**

YEW warrants this product, for one year from the date of delivery, against defects in materials and workmanship. YEW will repair or replace a product which proves defective during the warranty period due to materials or workmanship defects, provided that the product is returned to YEW or a YEW representative authorized to perform in-warranty repair of the product. YEW reserves the right to determine whether product failures are due to defective materials or workmanship, or to other causes not covered by this warranty. No other warranty is expressed or implied. YEW is not liable for consequential damages.

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**Parts List**

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**WARNING**  
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Don't touch the moving parts such as X-axis carriage and pen-holder because it is driven by high torque servomotors at speed up to 2200 mm/s.

## 1. GENERAL:

### 1-1. Description.

The A4 X-Y Recorder Model 3025 provides recording pens with high speed, high acceleration and accuracy.

The maximum pen speeds are 2200 mm/s for Y-axis and 2000 mm/s for X-axis, and the maximum pen accelerations are 7.6 G for Y-axis and 5.1 G for X-axis, thus realizing one of the fastest recorder (world wide).

With the recent progress in measurement technology, high speed, more sensitive, and accurate recorders are requested. The A4 X-Y Recorder Model 3025 satisfies these needs and also features easy-to-use felt-tip pens, time sweep and input offset function, being ready for meeting further requirements.

### 1-2. Features.

- **Fast Pen Speed: 2200 mm/s (Y-axis), 2000 mm/s (X-axis).**  
By incorporating a high torque-inertia ratio DC servo motor and a new pen mechanism. Model 3025 provides much faster pen speed than before. Phase characteristics are also fully considered.
- **Large Acceleration: 7.6 G (Y-axis), 5.1 G (X-axis) for 1 pen model.**  
The 2 pen model, with acceleration of 7.0 G for Y-axis and 4.5 G for X-axis, records fast input change with high reliability and accuracy.
- **High Accuracy:  $\pm 0.25\%$ .**
- **Disposable Felt-tip Pens: Easy to maintain, provides a good quality recording.**  
The felt-tip pens give fine and distinct color traces and are easily replaced when required.
- **Electrostatic Paper Hold Down Method.**  
The recording chart paper, A4-size sheet attached or an ordinary graph paper, is held easily and securely on the bed.
- **Easy-to-Operate Design.**  
Operational factors considered in the design are those: secure single-purpose knobs, input terminals separated from the preamplifier, filter ON-OFF switch deleted because of improved anti-noise characteristics, and a servo ON-OFF switch enabling pens and chart to be replaced easily.
- **Light but Rigid Pen Mechanism for High-speed Recording.**  
Even at high-speeds, the pen movement is silent and gives clear records without any scratchy or intermittent trace.
- **Input-Offset Function (11 kinds) and Time Sweep Function (16 kinds).**  
The input-offset function is convenient for the extended recording of an input signal having DC component superimposed. The time sweep function (option) helps observing an input-signal change during a designated time.
- **Remote Control Function.**  
Several remote control functions are provided: the pen lift (i.e. up and down), the time sweep, and the start-stop of roll chart and its feeding rate change (when chart drive unit equipped) are controlled by external contact or TTL signals.

### 1-3. Specifications.

**Pen Drive System:** Automatic null-balancing DC servo-mechanism.

**Type of Input:** Floating, guarded and shielded.

**Writing System:** Ink writing using disposable felt-tip-pen cartridges.

**Number of Pens:**

1 Pen Type: 1

2 Pen Type: 2

**Recorder Ink Colors:**

1st pen (Y1): Red

2nd pen (Y2): Green

**Effective Recording Span:**

X axis: 254 mm

Y axis: 180 mm

**Chart Paper:**

YEW Type B9523VQ: JIS A4 size sheets.

YEW Type B9523VY: Roll chart (used with chart drive unit option).

**Chart Paper Hold-Down:** Electrostatic paper hold down with light spot paper alignment.

**Accuracy:**  $\pm 0.25\%$  of effective recording span (on reference range (50 mV/cm), includes non-linearity and dead band, under standard condition).

**Error between Ranges:**  $\pm 0.1\%$  of pen deflection width.

**Dead Band:**  $\pm 0.1\%$  of effective recording span.

**Voltage Range** (for both X and Y axes) (reference range 50 mV/cm): 50  $\mu$ V/cm, 0.1, 0.25, 0.5, 1, 2.5, 5, 10, 25, 50 mV/cm, 0.1, 0.25, 0.5, 1, 2.5, 5 V/cm 16 calibrated ranges plus uncalibrated vernier (ranges overlap each other).

**Zero Adjust:** Independent for each pen, pen zero position adjustable over full effective span.

**Input Resistance:** Approx. 1 M $\Omega$  constant on all ranges.

**Maximum Signal Source Resistance** (for given accuracy); 10 k $\Omega$ .

**Zero Stability** (Typical):  $\pm(1.5 \mu\text{V} + 0.02\%$  of effective recording span) $^{\circ}\text{C}$ .

**Maximum Allowable Input Voltage:**

50 V DC (continuous) on 50  $\mu$ V/cm to 50 mV/cm ranges.

250 V DC (continuous) on 0.1 V/cm to 5 V/cm ranges.

**Maximum Common Mode Voltage:**

250 Vrms or 350 V DC

**Common Mode Rejection:** More than 140 dB at power line frequency or at DC.

**Normal Mode Rejection:** 50 dB.

**Maximum Pen Speed** (Typical):

X axis: 2000 mm/s

Y axis: 2200 mm/s

**Maximum Acceleration** (Typical):

1 Pen Type:

X axis: 5.1 G, Y axis: 7.6 G

2 Pen Type:

X axis: 4.5 G, Y axis: 7.0 G

**Input Offset:**  $\pm 20, 40, 80, 100$  cm and 0 (OFF) 11 ranges.

**Input Offset Accuracy:**  $\pm 0.2\%$  of offset value.

**Input Offset Voltage Temperature Coefficient:**  $\pm 100$  ppm/ $^{\circ}\text{C}$  of offset value.

**Pen Lift:** All recording pens are simultaneously lifted and lowered.

**Operating Position:** Horizontal, vertical or tilt (with stand).

**Timebase:**

Sweep Speeds: 0.25, 0.5, 1, 2.5, 5, 10, 25 and 50 s/cm, min/cm (accuracy:  $\pm 0.5\%$ ).

Trial: Sweep with the pens lifted is possible.

Pens are lifted after a (normal) recording sweep is done or when the RESET button is pressed.

**Normal Ambient Temperature:** 23  $\pm 5^{\circ}\text{C}$ .

**Operating Ambient Temperature:** 5 to 40  $^{\circ}\text{C}$ .

**Operating Ambient Humidity:** 40 to 80% R.H.

**Dielectric Strength and Insulation Resistance:**

1500 V AC for one minute. More than 100 M $\Omega$  at 500 V DC between power line and case.

1500 V AC for one minute. More than 100 M $\Omega$  at 500 V DC between input-guard terminals and case.

**Power Requirements:**

100 V AC  $\pm 10\%$  for both 50 and 60 Hz.

115, 200, 230 V AC must be specified.

**Power Consumption:**

1 Pen Type:

Maximum: Approx. 180 VA

Balanced: Approx. 40 VA

2 Pen Type:

Maximum: Approx. 210 VA

Balanced: Approx. 50 VA

**Dimensions:** Approx. 299 x 413 x 152 mm.

**Weight:**

1 Pen Type: Approx. 13 kg.

2 Pen Type: Approx. 14 kg.

**Accessories:**

Screws for Rack Mounting (4 pcs)

Power Cord (1 set)

Recording Paper (JIS A4 size 50 sheets)

Dust Cover (1 pc)

Fuse 2A (2 pcs)

Connector for Remote Control: A9025KC (1pc)

Pen Cartridge (red 3 pcs for 1 pen type, red 3 pcs and green 3 pcs for 2 pens type)

Note: The specifications described above apply to the recorder after warmup for at least 30 minutes.

**1-4. Spare Parts.**

Name	Part No.	Description
Pen Cartridge	B9543CL	Red for 1st pen
Pen Cartridge	B9543CM	Green for 2nd pen
Roll Chart	B9523VY	210 mm approx. 15 m (10 rolls)
JIS A4 Size Sheet	B9523VQ	100 sheets (1 set)
Connector for Remote Control	A9025KC	AMPHENOL 57-30240

**1-5. Accessory (needs additive order).**

Name	Part No.	Description
Measuring Lead Wire	B9409JW	Approx. 1m with guard

2. NAMES AND FUNCTIONS OF COMPONENTS.

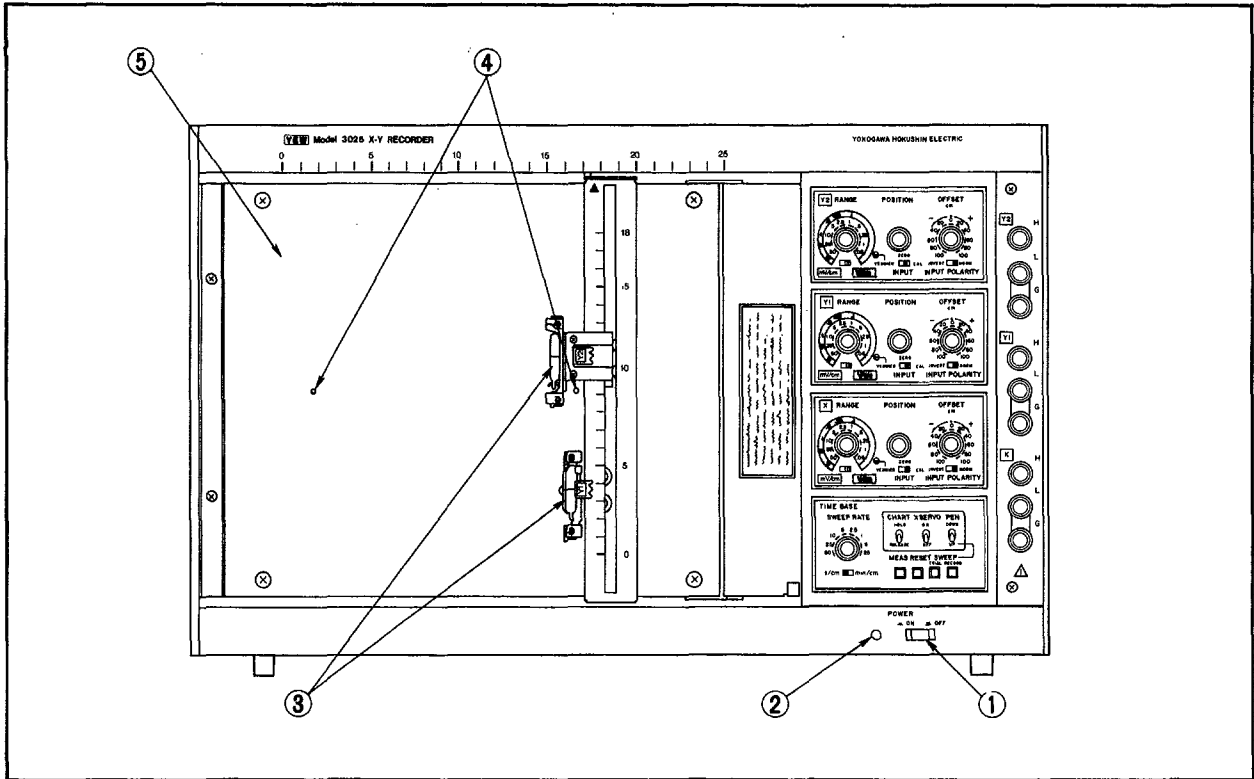


Figure 2-1.

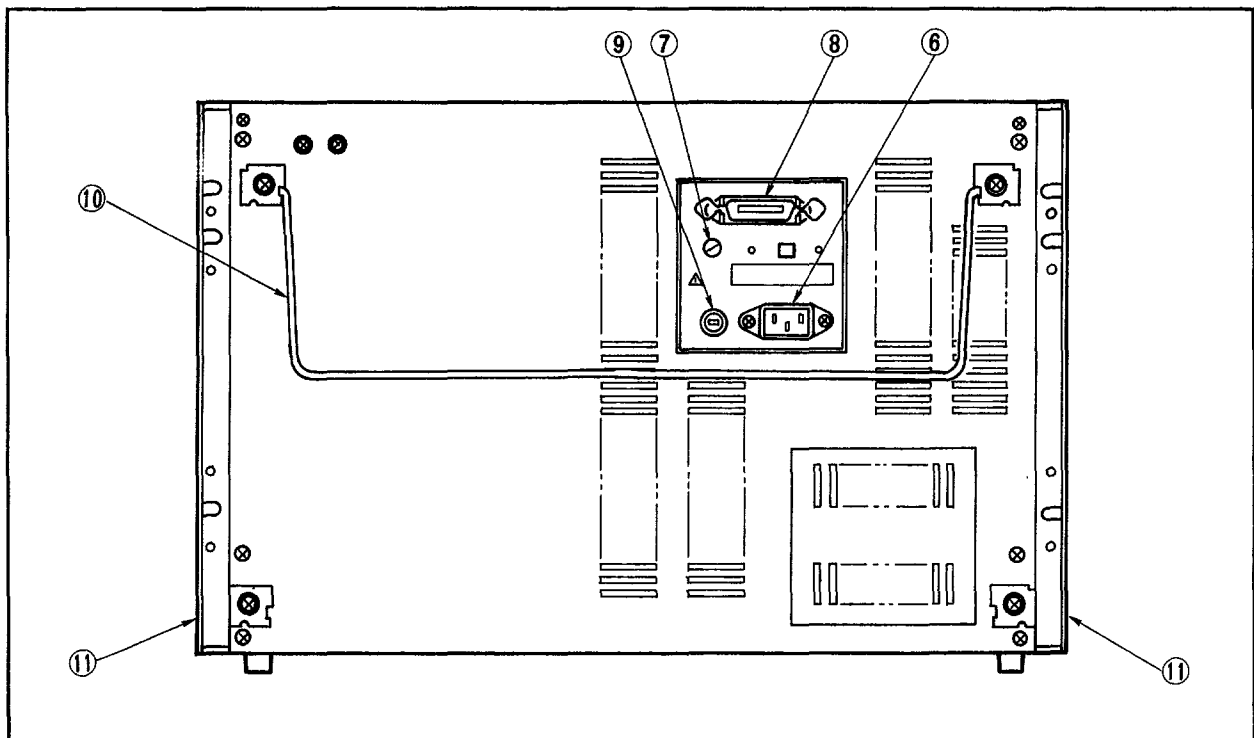


Figure 2-2.

- ① **POWER Switch:**  
Push button switch. Press to switch ON, press again to switch OFF.
- ② **POWER Pilot Lamp:**  
Lights when the power pushbutton is set ON.
- ③ **Pens:**  
Felt-tip pen cartridges are installed in penholder. 1st pen (Y1): red, 2nd pen (Y2): green.
- ④ **Chart Alignment Light Spots:**  
Align chart paper scale line with these light spots (LED).
- ⑤ **Flat Bed:**  
Use a paper sized as A4 or smaller.
- ⑥ **Power Supply Socket:**  
Connecting socket used for power supply cable.
- ⑦ **Earth Terminal:**  
Grounding wire should be low resistance.
- ⑧ **Remote Control Connector:**  
Connector for external contact or TTL-level signals.
- ⑨ **Fuse Holder:**  
Includes a 2 A (for 100 or 115 V AC power supply) or 1 A (for 200 or 230 V AC power supply) fuse.
- ⑩ **Retractable Stand:**  
Stand for tilt operating position.
- ⑪ **Rack-Mount Bracket:**
- ⑫ **mV/V Transfer Switch:**  
Changes the units used for input range adjustment between mV/cm and V/cm.
- ⑬ **RANGE Selector Switch:**  
Selects input voltage sensitivity.
- ⑭ **VERNIER Adjustor:**  
Continuously changes the selected sensitivity from 40% to 120%. Use a flat-tip screw driver to turn it.
- ⑮ **POSITION Knob:**  
Sets the pen position at zero input voltage.
- ⑯ **INPUT Switch:**  
Turns input to ON or OFF. At ZERO position of the switch, the input circuit of the recorder is shortened. At CAL position, the circuit is open to measure the input, and at VERNIER position, the vernier adjustor ⑭ becomes to be used.
- ⑰ **Input OFFSET Knob:**  
Being used to extend a changing signal which has DC component to be eliminated. Recording can be shifted a previously set length.
- ⑱ **INPUT POLARITY Switch:**  
Used to invert the polarity of an input signal. In general, used at NORM.
- ⑲ **SWEEP RATE Knob (option):**  
An input to be observed as a function of time is recorded along the X-axis. Any of sixteen sweep ranges can be selected from the range 0.25 s/cm (approx. 6.3 s/25 cm) to 50 min/cm (approx. 21 h/25 cm). To use it as an X-Y recorder, depress MEAS switch.

- ⑳ **CHART HOLD-RELEASE Switch:**  
The chart is held on the flat bed electrostatically at HOLD and is released at RELEASE.
- ㉑ **X-SERVO ON-OFF Switch:**  
Used to turn the X-axis function to ON or OFF. Its OFF state stops X-axis motion, releases the X-carriage movable to other position with hand, and it returns the former position by ON.
- ㉒ **PEN UP-DOWN Switch:**
- ㉓ **Measuring Input Terminals:**  
Used for input wires connection composed of H (red) +, L (black), -, and G (blue) guard. Maximum input voltage is 50 V DC (continuous input) for measuring range 50  $\mu$ V/cm to 50 mV/cm, or 250 V DC (continuous input) for 0.1 V/cm to 5 V/cm. Don't apply a larger input more than those maximum voltages.
- ㉔ **s/min Transfer Switch (option):**  
For changing the units used for time sweep between s/cm and min/cm.
- ㉕ **MEAS Switch:**  
Puts the unit (when it is used as X-Y Recorder) in the measuring mode.
- ㉖ **RESET Switch:**  
Returns the pen to its original position with the pen in the up position.
- ㉗ **TRIAL Switch (option):**  
When this switch is pressed, time sweep is carried out with the pen(s) in the UP position.
- ㉘ **RECORD Switch (option):**  
When this switch are pressed, time sweep is carried out with the pen(s) in the DOWN position. After time sweep is completed, the pen(s) stop automatically with the pen(s) lifted.

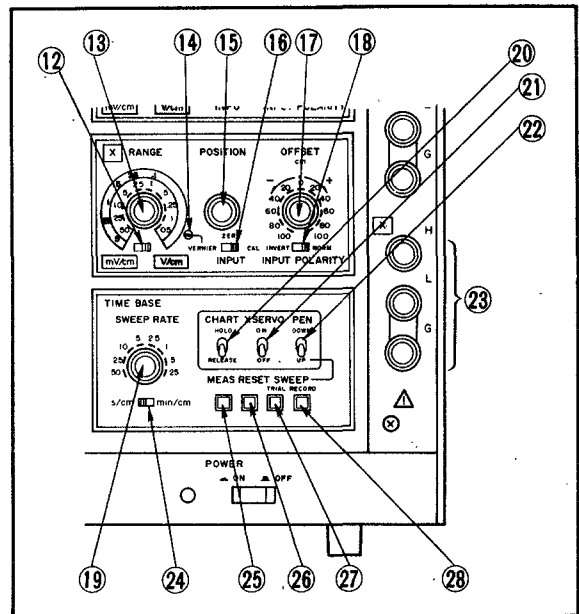


Figure 2-3.

### 3. OPERATION.

#### 3-1. Preparation for Use.

Before applying power and signals to the recorder, set the following items:

- (1) POWER Switch: OFF
- (2) PEN UP-DOWN Switch: UP
- (3) CHART HOLD-RELEASE Switch: RELEASE
- (4) INPUT Switch: ZERO for both X and Y axes
- (5) Power Cord: Plug the power cord into the outlet of a specified AC power line.
- (6) RANGE Selector Switch: 5 V/cm

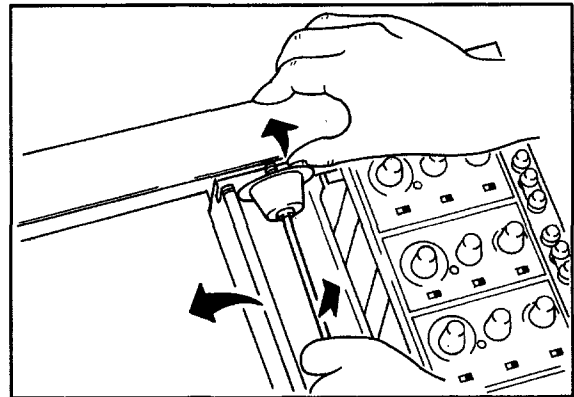


Figure 3-1.

#### 3-2. Chart Loading.

- (1) Turn the POWER switch ON.
- (2) Check the CHART HOLD-RELEASE switch is at RELEASE.
- (3) Place a sheet of chart paper on the flatbed and align the chart scale line with the red light spots on the flatbed.
- (4) Turn the CHART HOLD-RELEASE switch to HOLD to fix the chart on the bed certainly excluding the air between the paper and the bed.
- (5) If the chart scale line is shifted from the red light spots, turn the CHART HOLD-RELEASE switch to RELEASE again to realign them. Do not shift the chart paper with the switch turned to HOLD.
- (6) When the recording is finished, turn CHART HOLD-RELEASE switch to RELEASE and remove the sheet of chart paper.

#### Use of roll chart (option)

- (1) Pull the lever located to the lower right of the flatbed, gaining access to the roll chart compartment. Press the plate spring on the upper part and release the stock roller as shown in Figure 3-1.
- (2) Remove the stock roller flange (left-handed) and insert the roll chart. Make sure that the notch on the roll core matches the stock roller pin.
- (3) To mount the roll chart in its compartment, insert first the lower axle, then press the plate spring and insert the upper axle.
- (4) Pull out manually approx. 15 to 20 cm of chart paper and return the stock roller to its original position.

#### CAUTION

- Use a flat sheet of chart paper; do not fold down the corners.
- If the flatbed becomes dirty with dust, oily fingermarks, ink etc., the chart may not hold down securely. To clean the flatbed surface, wipe it with clean paper or cloth, moistened with water, and dry the surface thoroughly before use. Never attempt to clean its surface with synthetic detergent (neutral soap may be used).
- Always turn the CHART HOLD-RELEASE switch to RELEASE when unusing it.

#### 3-3. Pen Assembly, Insertion and Replacement.

The recorder uses disposable felt-tip pen cartridges that eliminate messy ink handling and pen adjustment.

Use the following specified felt-tip pens:

For 1st pen (red): B9543CL

For 2nd pen (green): B9543CM

- (1) The felt-tip pen cartridge is made of plastic and is marked with the ink color as shown in Figure 3-2. (Red for 1 pen version, red (Y1) and green (Y2) for 2 pen version.)

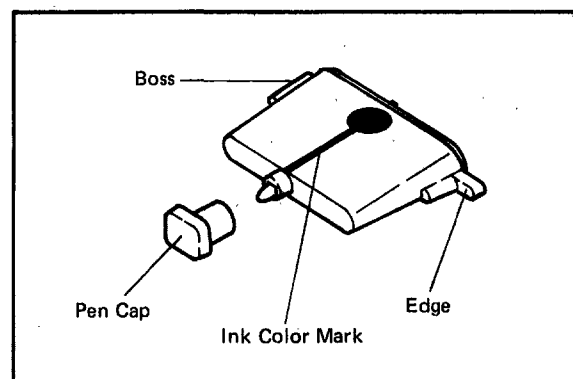


Figure 3-2.

- (2) Remove the pen cap and hold the pen cartridge with the colored line forward (see Figure 3-3). Be careful not to lose the removed pen cap. Install as follows: insert the left side boss of the cartridge into the dent, then press the right side edge into the clip.

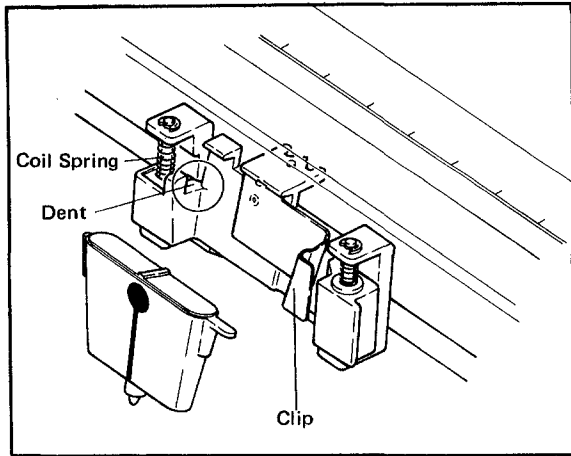


Figure 3-3.

- (3) Remove the pen cartridge from the penholder in the reverse order: press the edge of the cartridge towards you to put it out of the clip (Figure 3-4).

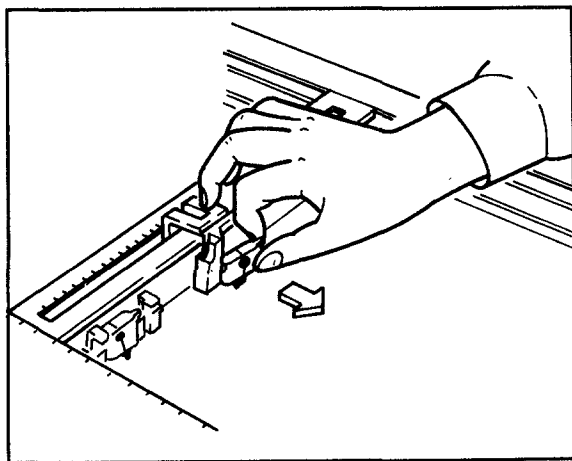


Figure 3-4.

- (4) When the instrument is not used for more than an hour, replace the pen caps to prevent ink dryout.

**CAUTION**

- As the pen tip is made of felt, do not crush it by applying strong pressure.
- When the felt-tip pen is new, sometimes ink does not immediately flow from pen-tip. In this case rub pen tip lightly against paper.

**3-4. Input Signal Connection.**

Input terminals on the front panel comprise of Red (H), Black (L) and Blue (G: GUARD) terminals.

For general or high voltage use, respective X- and Y-axis inputs should be applied to H (+) and L (-) terminals remaining a jumper link between L and G terminals as shown in Figure 3-5.

When the recorder is used on high sensitivity ranges (less than 5 mV/cm) or when common mode voltages may cause problems, a two-conductor shielded cable is recommended. Select the appropriate configuration from among Figures 3-6 to 3-8.

- (1) General use.

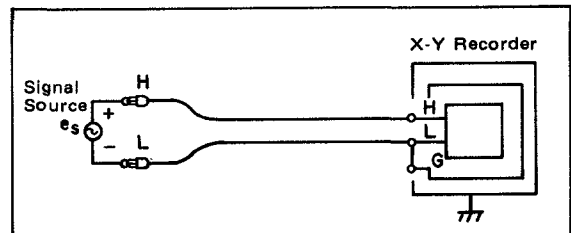


Figure 3-5.

- (2) When the signal source is grounded, connect the signal ground to G through the cable shield.

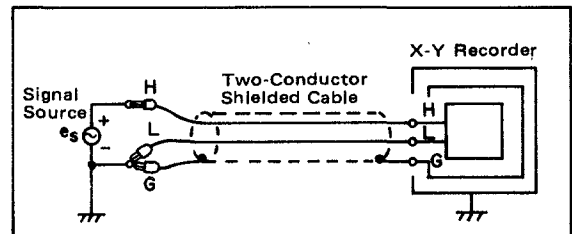


Figure 3-6.

- (3) When the signal source is not grounded, as a general rule, connect G and L to minus side at the signal source.

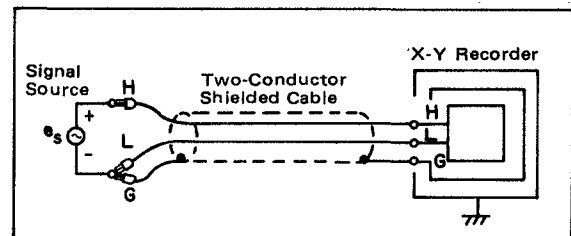


Figure 3-7.

- (4) When a signal source is shielded, terminal connection should be made as shown in Figure 3-8.

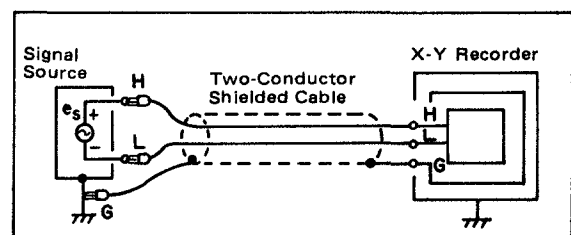


Figure 3-8.

3-5. Measurement and Recording.

- (1) Turn on both time sweep MEAS switch ③ and X-SERVO ON-OFF switch ①.

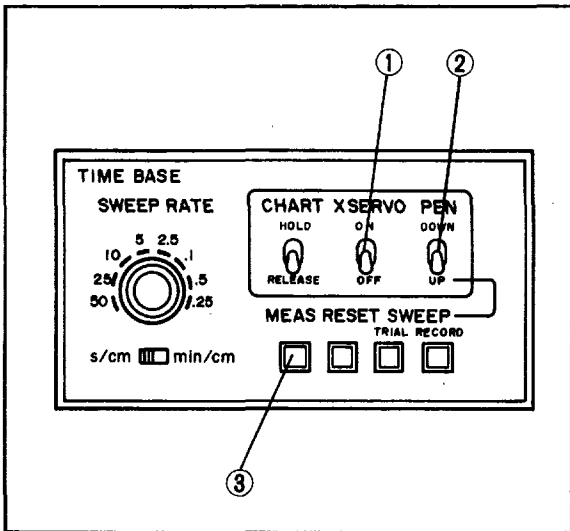


Figure 3-9.

- (2) Adjust the X- and Y-axis POSITION knobs ⑤ to set zero point of the X and Y pens respectively when the INPUT switch ⑨ should be at ZERO.

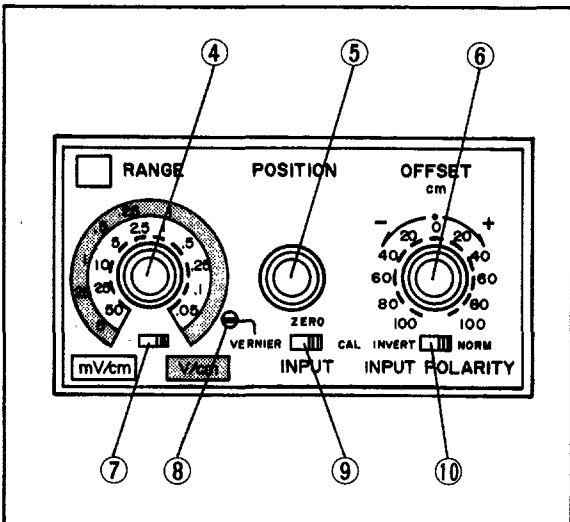


Figure 3-10.

- (3) Set the RANGE selector switch ④ to a voltage range appropriate for the input voltage. If the input signal range is an unknown one, turn the knob gradually to select the proper range, changing it from the maximum one (5 V/cm) downward the minimum. When the mV/V transfer switch ⑦ is placed at V/cm, the range 0.1 or less cannot be used. It should be made carefully when the unknown range seems large one.

Note: That the maximum allowable input voltage is approximately +250 V DC for 0.1 V/cm to 5 V/cm, +50 V DC for 50  $\mu$ V/cm to 50 mV/cm range.

- (4) Turning the VERNIER adjustor ⑧ fully clockwise corresponds to approximately 120% of range, and turning it fully anticlockwise corresponds to approximately 40% of range.
- (5) For extended recording of the input signal variation superimposed by a DC component, the pen can be shifted a preset length by turning OFFSET knob ⑥. For example, to provide an offset of 100 V at 5 V/cm range, set the knob at position 20 cm.
- (6) Setting INPUT switch ⑨ to CAL and PEN UP-DOWN switch ② to DOWN starts the recording operation.
- (7) Setting X-SERVO ON-OFF switch ① to OFF halts the X-axis movement, and then X-axis pen position can be moved arbitrarily.
- (8) For reversing input polarity, set INPUT POLARITY switch ⑩ from NORM to INVERT.

CAUTION

• Don't touch the moving parts such as X-axis carriage and penholder because it is driven by high torque servomotors at speed up to 2200 mm/s.

• When the instrument is used on high sensitivity ranges (less than 50 mV/cm), keep the input cord as short as possible. If long input cords are used, induced noise may cause pen vibration.

• Set the INPUT switch to ZERO before disconnecting the input circuit or when unworking measurement.

• Ensure external signal source impedance is below 10 k $\Omega$ . If not, pen may vibrate or ZERO drift may occur.

• Don't turn the X-SERVO ON-OFF switch OFF while operating the recorder otherwise failure may occur.

• Thermal Shutdown

This recorder features fast pen speed and its large acceleration; further, equipped with the thermal limiter to prevent the servo system overheat caused by continuous operation with high speed recording. When the thermal limiter works (or under thermal shutdown), the driving power is lowered so that the pen speed considerably decreases. In that case, if the position of INPUT switch turns to ZERO, the limiting is cancelled to resume normal recording after about 60 seconds.

Relations between working time and its limitation starting the thermal shutdown are shown in Figures 3-11 and 3-12. When the input signal is a sinusoidal wave, the length of the axis of abscissa is the product of the square of the frequency (f Hz) and the amplitude (V cm); therefore, lowering the preamplifier sensitivity to reduce signal amplitude is also effective to prevent starting the thermal limiter or increasing work time.

When the input signal is a rectangular (as shown in Figure 3-12), the axis of abscissa indicates frequency because it is less affected by the amplitude than that of the sinusoidal.

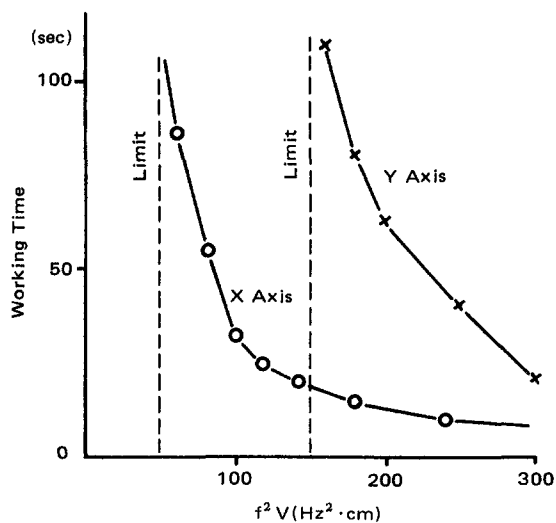


Figure 3-11. Thermal limiter characteristics for sinusoidal wave signal.

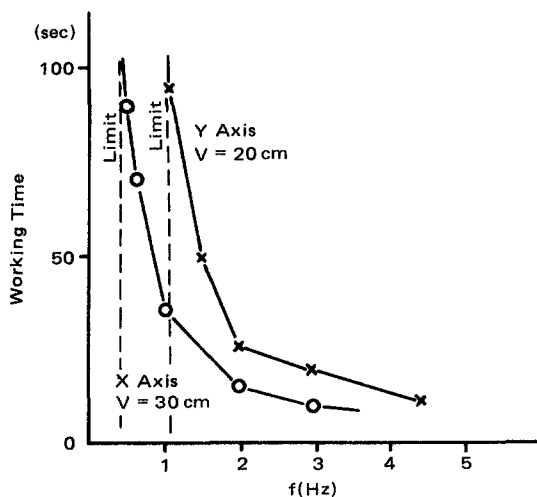


Figure 3-12. Thermal limiter characteristics for rectangular wave signal.

### 3-6. Time Sweep (option)

This is used for time-sweeping X-axis at rate 0.25 s/cm (approx. 6.3 s/25 cm) to 50 min/cm (approx. 21 h/25 cm). Set the sweep rate as appropriate value for the input measured.

- (1) Depress the RESET switch on the TIME BASE panel.
- (2) Set the PEN UP-DOWN switch to UP.
- (3) Adjust the POSITION knob on the X-axis panel to set pen starting point.
- (4) Set the sweep time required with the SWEEP RATE knob on the TIME BASE panel.
- (5) When the SWEEP mode TRIAL switch is depressed, the pen will sweep while lifted. Depress the RECORD switch, the pen will lower and start to record.
- (6) When sweep is finished, the pen will automatically lift.
- (7) When the RESET switch is pressed, pen will return to the original point while it is lifted.

### 3-7. Remote Control Operation.

The following remote control functions are equipped. Connect control signals to the remote control connectors on the rear panel. The remote control terminals on the rear panel are not isolated from the recorder case (grounded commonly). COM terminal is used commonly for each remote terminal.

- PEN CONTROL (PEN CONT)
- SWEEP TRIAL (TRL/RST) (option)
- SWEEP RECORD (RCD/RST) (option)

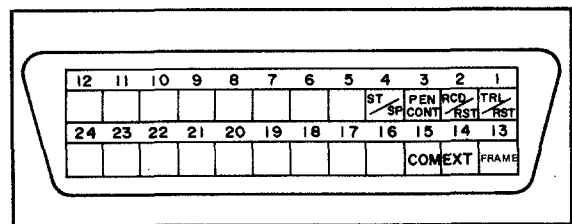


Figure 3-13.

#### (1) PEN CONTROL

Remote pen UP/DOWN control uses at external pen UP/DOWN control uses at external contact or TTL-level signal between pins No.3 and No.15 of the remote control connector.

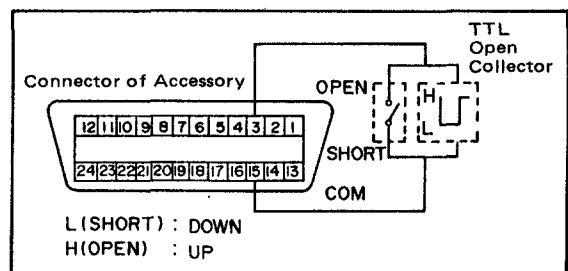


Figure 3-14.

(2) Remote SWEEP TRIAL Control (option)

Time sweep can be performed with the pens lifted using an external contact or TTL-level signal between pins No.1 and No.15.

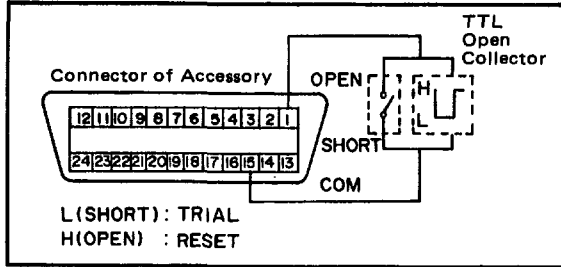


Figure 3-15.

(3) SWEEP RECORD (option)

X-axis time sweep can be performed with the pens lowered using an external contact or TTL-level signal between pins No.2 and No.15.

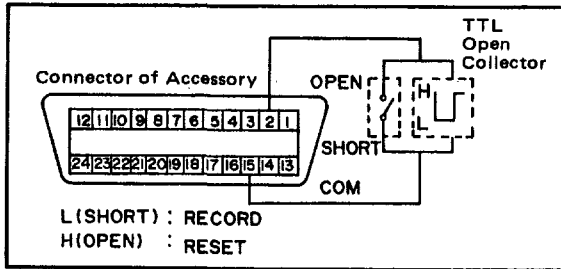


Figure 3-16.

(4) START/STOP (option)

When the chart drive unit is equipped, roll chart can be fed by applying an external contact or TTL-level signal between pins No.4 and No.15.

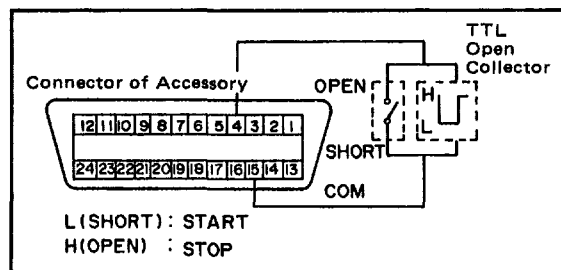


Figure 3-17.

(5) FRAME (option)

With the chart drive unit equipped, applying an external contact or TTL signal between pins No.13 and No.15 feeds one frame (300 mm) of roll chart and automatically halts it. Apply input signal with pulse width 10 ms to 1 s for FRAME feeding. START signal entered is disabled during FRAME feeding. FRAME feeding is enabled when the chart drive unit is in STOP state.

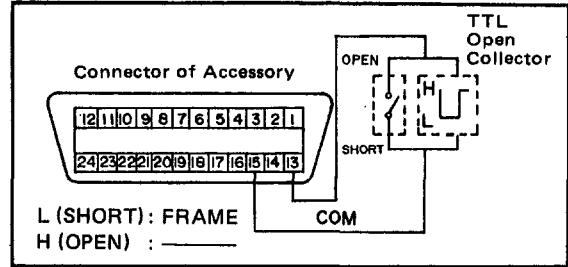


Figure 3-18.

(6) EXTERNAL (EXT)

With the chart drive unit equipped, chart feeding rate can be set at required one by applying the frequency input (from an external oscillator) between pins No.14 and No.15.

The frequency input specifications are shown in Figure 3-20.

The unit (cm/min or cm/h) of chart speed depends on the chart drive panel setting.

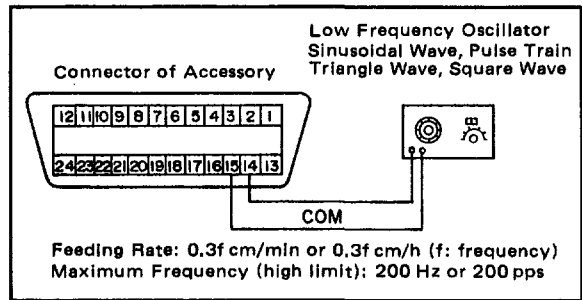


Figure 3-19.

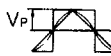
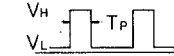
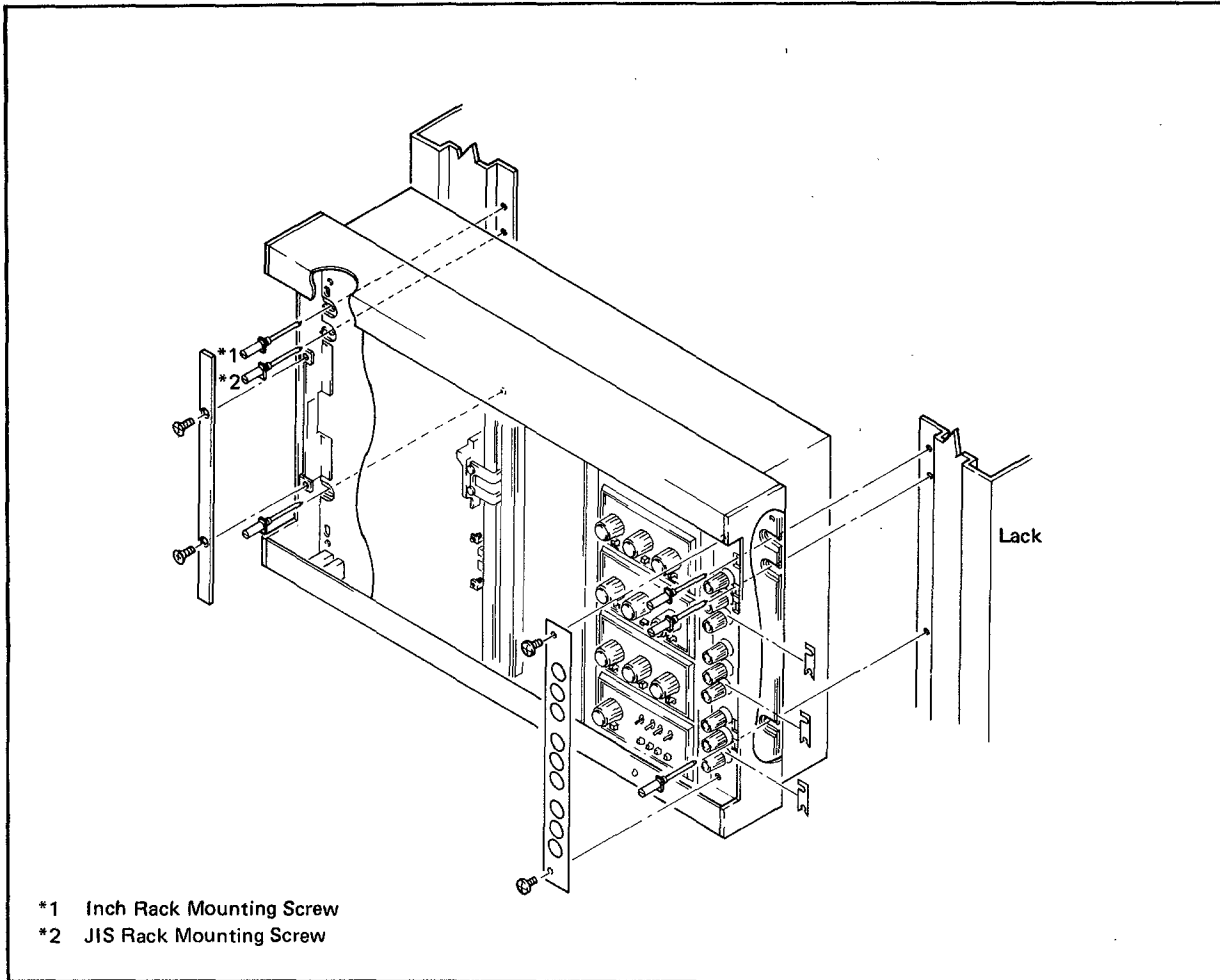
Wave Form	Sinusoidal Wave, Triangle Wave, Square Wave	Pulse Train
Level	 $4\text{ V} < V_p < 24\text{ V}$	 $+4\text{ V} < V_H < +24\text{ V}$ $-24\text{ V} < V_L < +0.5\text{ V}$ $T_p < 100\ \mu\text{s}$
Output Impedance of Oscillator	Less than 600 $\Omega$	Less than 50 $\Omega$
Chart Feeding Rate	0.3f cm/min or 0.3f cm/h (f = Frequency)	
Maximum Frequency	200 Hz	400 pps

Figure 3-20. Chart Feeding by External Oscillator Signal.

**3-8. Rack-Mounting Procedure.**

For rack mounting of the X-Y recorder, refer to the Figures. 3-21 and 3-22.

Brackets are not necessary for mounting of the main unit only, and when the recorder is mounted together with a chart drive unit, brackets are necessary.



**Figure 3-21.**

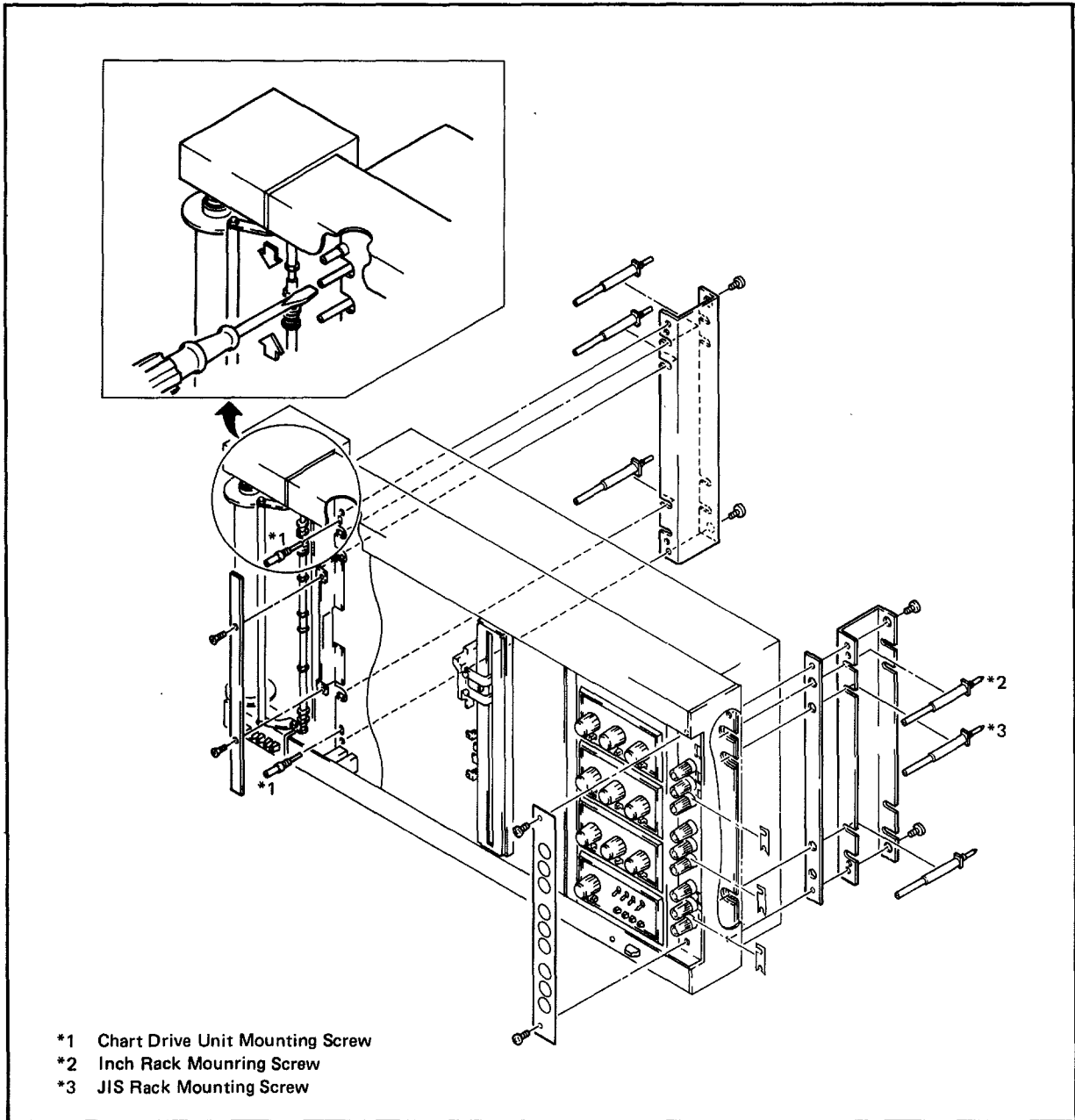


Figure 3-22.

### 3-9. The Chart Drive Unit Model 308951 (option).

#### 3-9-1. Description.

- (1) The Chart Drive Unit Model 308951, when combined with the X-Y Recorder 3025, takes up chart paper at a constant speed along the X-axis. This makes possible recording of the input signal time-wise variations in 1 or 2 channels.
- (2) Chart paper can be rolled up or just send out.
- (3) The recorder can be mounted on a rack even with the drive unit attached.
- (4) It is possible to control the start, stop, paper take-up speed and 1-frame take-up function from a distance, through the Remote Control Connector on the X-Y Recorder.  
For details on connector pin Nos., etc., refer to the 3-7 section.

#### 3-9-2. Specifications

##### Chart paper take-

up speed: 60, 20, 6, 2 cm/min & cm/h  
(accuracy:  $\pm 0.25\%$ )

FRAME function: Takes up 1 frame (300 mm) of chart paper.

EXT function: Takes up chart paper at a speed selected from an external oscillator.

##### Chart Take-up by External Oscillator Signal

Wave Form	Sinusoidal Wave, Triangle Wave, Square Wave	Pulse Train
Level		
	$4V < V_P < 24V$	$+4V < V_H < +24V$ $-24V < V_L < +0.5V$ $T_P < 100\mu s$
Output Impedance of Oscillator	Less than 600 $\Omega$	Less than 50 $\Omega$
Chart Take-up Rate	$0.3f \text{ cm/min}$ or $0.3f \text{ cm/h}$ ( $f$ =Frequency)	
Maximum Frequency	200 Hz	200 pps

#### 3-9-3. Mounting Procedure

This device consist of the paper take-up part and the chartroller.

For mounting, remove the oblong plate to the left of the flatbed (refer to Figure 3-22), and fix the Chart Drive Unit using the included screws, but leaving them just a little loose.

#### 3-9-4. Chart Paper Roll-up Operation

- (1) Pull out paper from the chart paper compartment, hold up the paper bail and pass the paper under it as shown in Figure 3-23. To facilitate this procedure, you may fold up the initial 3 to 5 cm of paper.

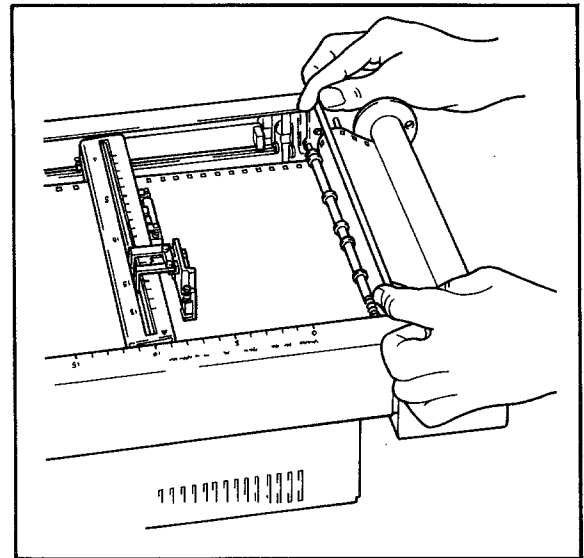


Figure 3-23.

- (2) Make the perforations on both sides of the chart match with the teeth on the sprockets, and lower the paper bail.

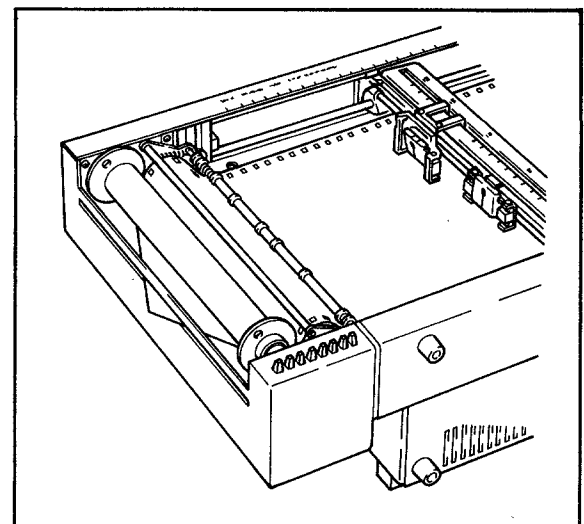


Figure 3-24.

- (3) Attach the end of the chart paper to the roller with a piece of adhesive tape or the like, and wind it 1 or 2 turns. Make sure that the chart paper contacts the roller evenly.
- (4) Adjust the chart drive unit mounting position until the alignment light spots are parallel to the paper, and tighten the mounting screws.

#### 3-9-5. Chart Paper Send-Out Operation.

Steps (1) and (2) are the same of roll-up operation. After matching the paper perforations with the sprocket teeth, pass the chart paper under the roller, and then through the narrow slot on the side of the device. Use the edge of the slot to cut the chart paper.

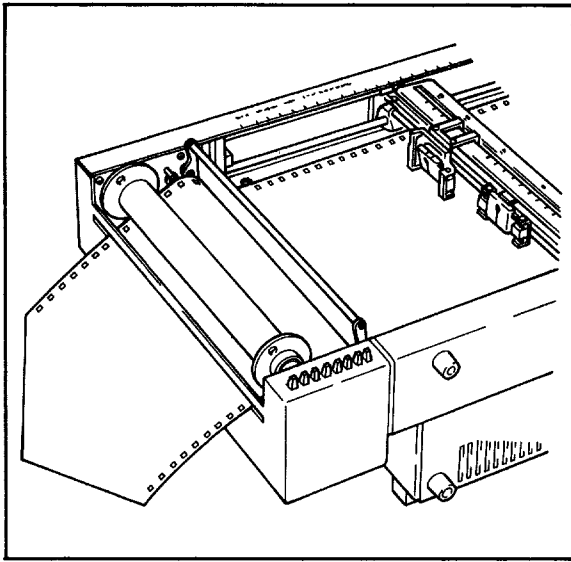


Figure 3-25.

## 4. MAINTENANCE.

### (1) Operating Environment

To ensure accurate measurements, maintain the instrument in good condition. Avoid operating or storing this recorder in any of the following environments:

- Where the instrument is exposed to high temperature or direct sunlight.
- Where the humidity is excessive.
- Where the atmosphere contains dirt, dust, salt or corrosive gases.
- Where the instrument will be subjected to severe vibration.
- Where the instrument is exposed to strong magnetic field or electrical noise.

### (2) Notices of Pen Cartridge

- Always replace the pen caps after use to prevent gradual ink dryout.
- Pen cartridges can be stored for a maximum of one year. Longer storage may result ink deterioration.

### (3) Flatbed Cleaning

If the flatbed becomes dirty, with dust, oily finger marks, etc., the chart may not hold down securely. Clean its surface with water – or alcohol (for oily surface) – moistened paper or clean cloth. Do not attempt to clean its surface with solvents such as thinner or with an oily cloth, because the surface coating may be damaged. Never attempt to clean it with synthetic detergent (neutral soap may be used).

### (4) Correction of Chart Paper Expansion or Shrinkage.

Chart paper expands or contracts as ambient humidity varies. When accurate measurements are required, compensate the effect by calibrating with a DC voltage standard (for example YEW Type 2553 or 2554).

### (5) Roll Chart Replacement

Red 40 cm RENEW CHART and 20 cm RENEW CHART indications appear on the chart paper at 40 and 20 cm before the end of the paper. The chart should be replaced only with one bearing the YEW mark, its code is B9523VY.

### (6) If the Power Fuse is Blown

If the power fuse is blown, it should be replaced by the specified one shown below.

A9121KF (2 A) for 100 or 115 V AC power supply

A9050KF (1 A) for 200 or 230 V AC power supply

### (7) Shipping and Transportation

Before shipping or transporting the recorder, remove the pen cartridges, and pack them in a separate case. If possible, use the original packing case to enclose the recorder.

5. PRINCIPLES OF OPERATION.

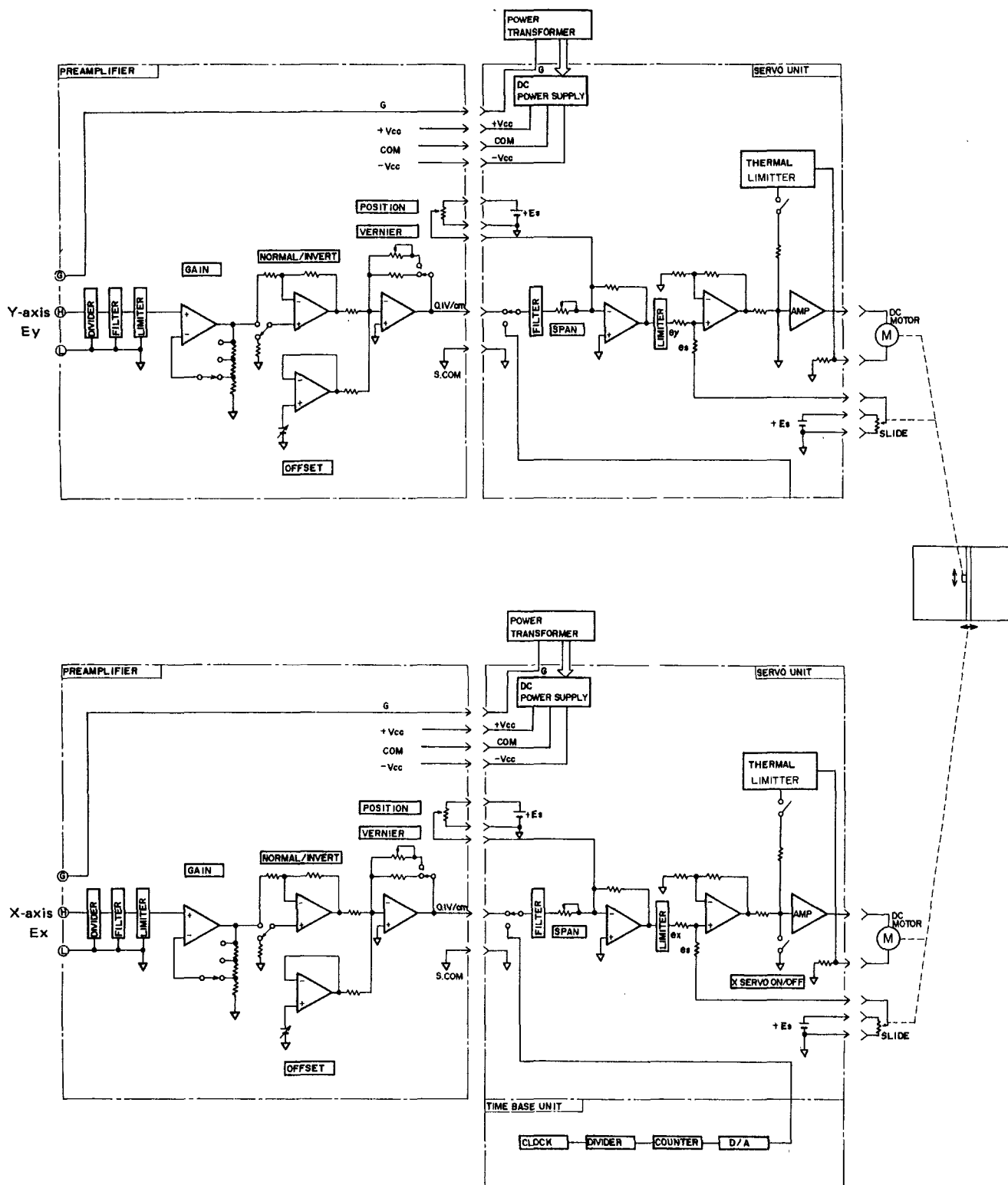


Figure 5-1.

Model 3025

A block diagram of the recorder is shown in Figure 5-1. The fundamental principles of operation are the same for each axis, therefore only the X-axis servo system is explained.

The input terminal voltage  $E_x$  is first applied to a voltage divider and a preamplifier to increase up to an appropriate voltage  $e_x$  (full scale 5 V), and supplied to the servo amplifier.

A voltage  $e_s$  is fed back from the potentiometer through the damping network to the servo amplifier, where it is summed with the preamplifier output. Thus the servomotor rotates, moves X-axis carriage and the potentiometer until it balances with  $e_s + e_x = 0$ . So that X-axis carriage then indicates the input (unknown) voltage  $E_x$ .

The Y-axis servo operation is similar to the X-axis described above, the pen arm moves in proportion to the input voltage  $E_y$ . Thus, the instrument records a pattern  $Y = f(x)$  on a chart.

The zero point can be positioned anywhere within the chart using the position adjuster shown in Figure 5-1.

High torque, low-inertia and small size DC servomotors, and high resolution long-life conductive plastic potentiometers are used.

Time sweep of X-axis is made by output voltage of a D/A converter in TIME BASE UNIT. Clock pulse applied to a counter connected to the D/A converter increases an output voltage as a proportional function of time. The servo unit of X-axis is driven by this voltage also proportionally to the time. Figures 5-2 and 5-3 are examples of frequency characteristics of respective X- and Y-axis' amplitudes given by sinusoidal input waves.

Recorder servo frequency response seems to depends on the input signal amplitude, due to servo-amplifier saturation characteristics.

There Figures show how response distortion is affected by sinusoidal wave amplitude whose peak-to-peak value is 20 cm, 10 cm, 5 cm or 2 cm.

These Figures show how response is affected by sinusoidal wave amplitude whose peak-to-peak value is 20 cm, 10 cm, 5 cm or 2 cm. be carefully measured because it includes various frequency signals.

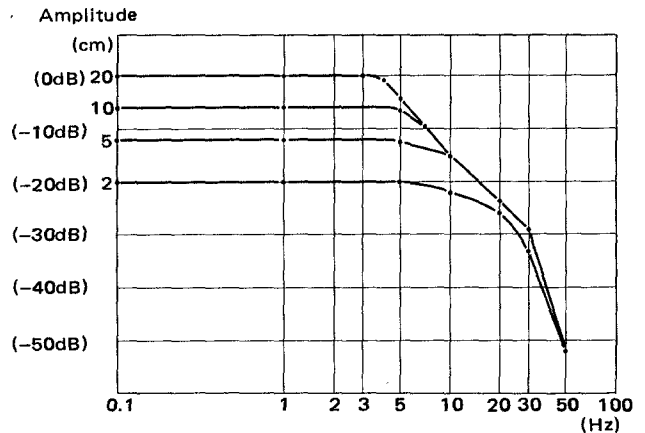


Figure 5-2. Frequency Characteristics (X-Axis).

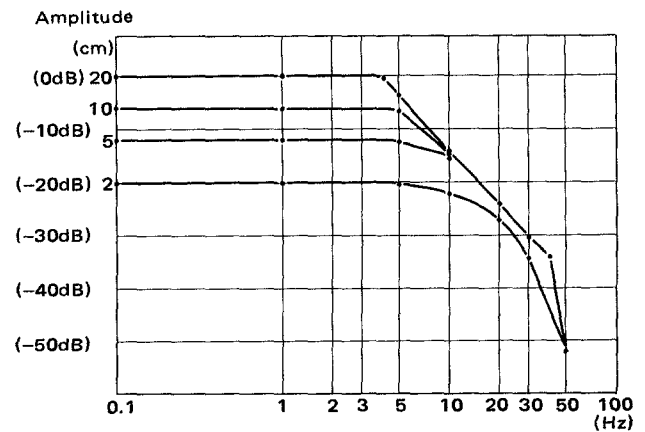


Figure 5-3. Frequency Characteristics (Y-Axis).

**6. SCHEMATIC DIAGRAMS AND ELECTRONIC PARTS LIST.**

Par.	Description	Ass'y No.	Fig. No.	Page
1	Model 3025 A4 X-Y Recorder Overall Wiring		6-1	6-3
2	Preamp PCB Ass'y Schematic Diagram	B9543WA	6-2a	6-4
	Preamp PCB Ass'y Components Location Diagram		6-2b	6-5
3	Time Base PCB Ass'y (Option) Schematic Diagram	B9543WF	6-3a	6-6
	Time Base PCB Ass'y (Option) Components Location Diagram		6-3b	6-7
4	X-Axis Servo Amp PCB Ass'y Schematic Diagram	B9551WM	6-4a	6-8
	X-Axis Servo Amp PCB Ass'y Components Location Diagram		6-4b	6-9
5	Y-Axis Servo Amp PCB Ass'y Schematic Diagram	B9551WR	6-5a	6-12
	Y-Axis Servo Amp PCB Ass'y Components Location Diagram		6-5b	6-13
6	Model 308951 Chart Drive Unit (Option) Overall Wiring		6-6a	6-15
	Chart Drive PCB Ass'y Components Location Diagram	B9570EQ	6-6b	6-16
	Switch PCB Ass'y Components Location Diagram	B9570ES	6-6c	6-17