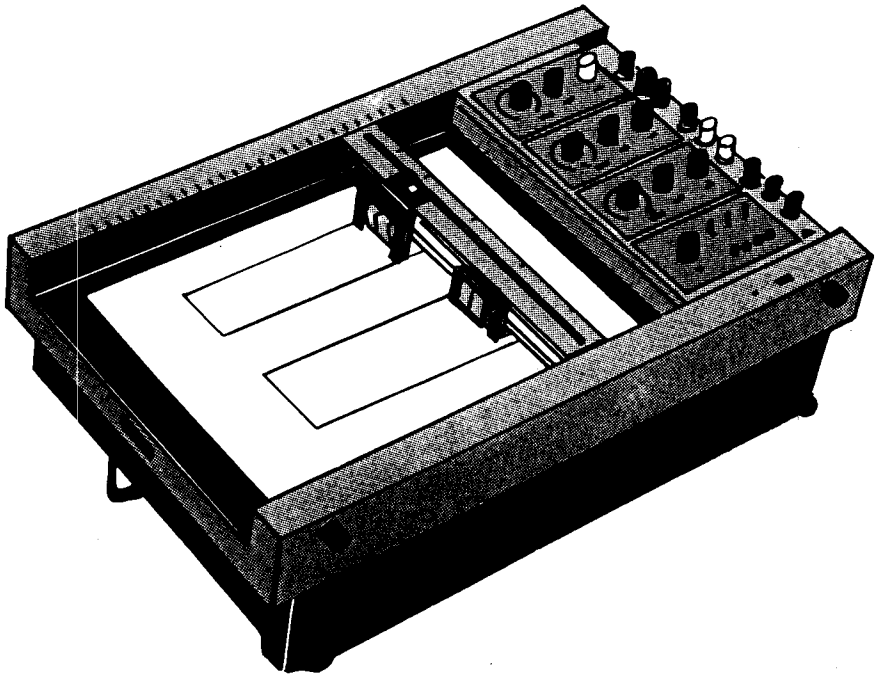
RD3025

A4 X-Y Recorder



OMEGA®

An OMEGA Technologies Company

Operator's Manual
M1345/0492

WARRANTY

OMEGA warrants this unit to be free of defects in materials and workmanship and to give satisfactory service for a period of **13 months** from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that our customers receive maximum coverage on each product. If the unit should malfunction, it must be returned to the factory for evaluation. Our Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective it will be repaired or replaced at no charge. However, this WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear or which are damaged by misuse are not warranted. These include contact points, fuses, and triacs.

We are glad to offer suggestions on the use of our various products. Nevertheless OMEGA only warrants that the parts manufactured by it will be as specified and free of defects.

OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED.

LIMITATION OF LIABILITY: The remedies of buyer set forth herein are exclusive and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

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

RETURN REQUESTS / INQUIRIES

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

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

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

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

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

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

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

OMEGA is a registered trademark of OMEGA ENGINEERING, INC.

Printed in U.S.A.

CONTENTS

WARNING

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.

UNPACKING

Remove the Packing List and verify that all equipment has been received. If there are any questions about the shipment, please call the OMEGA Customer Service Department at 1-800-622-2378 or (203) 359-1660.

Upon receipt of shipment, inspect the container and equipment for any signs of damage. Take particular note of any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE

The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

Throughout this manual you will see "1 pen model" and "2 pen model". 1 pen model recorders are those that are the RD3025-1 (1 pen, X-Y recorder, 8-1/2" x 11") and the RD3025-1/TIME (1 pen, X-Y recorder, 8-1/2" x 11", 16 speed, internal time base). 2 pen model recorders are those that are the RD3025-2 (2 pen, X-Y recorder, 8-1/2" x 11"), and the RD3025-2/TIME (2 pen, X-Y recorder, 8-1/2" x 11", 16 speed, internal time base).

1. GENERAL.

1-1. Description and Models.

The OMEGA RD3025 A4 X-Y recorder 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).

The A4 X-Y recorder (RD3024) provides easy-to-use felt-tip pens, time sweep and input offset function.

AVAILABLE MODELS

PART NUMBER	DESCRIPTION
RD3025-1	1 pen X-Y recorder, 8-1/2 x 11
RD3025-1/TIME	1 pen X-Y recorder, 16 speed, internal time base, 8-1/2 x 11
RD3025-2	2 pen X-Y recorder, 8-1/2 x 11
RD3025-2/TIME	2 pen X-Y recorder, 16 speed, internal time base, 8-1/2 x 11

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: ±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: OMEGA Part Number RD3025-RP
Roll Paper may be special ordered for use with the Chart Drive Unit option

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

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

Error between Ranges: ±0.1% of pen deflection width.

Dead Band: ±0.1% of effective recording span.

Voltage Range (for both X and Y axes) (reference range 50 mV/cm): 50 μV/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 uncaribrated vernier (ranges overlap each other).

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

Input Resistance: Approx. 1 MΩ constant on all ranges.

Maximum Signal Source Resistance (for given accuracy); 10 kΩ.

Zero Stability (Typical): ±(1.5 μV + 0.02% of effective recording span)/°C.

Maximum Allowable Input Voltage:
50 V DC (continuous) on 50 μV/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: ±20, 40, 80, 100 cm and 0 (OFF) 11 ranges.

Input Offset Accuracy: ±0.2% of offset value.

Input Offset Voltage Temperature Coefficient: ±100 ppm/°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: ±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 ±5°C.

Operating Ambient Temperature: 5 to 40°C.

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

Dielectric Strength and Insulation Resistance:
1500 V AC for one minute. More than 100 MΩ at 500 V DC between power line and case.
1500 V AC for one minute. More than 100 MΩ at 500 V DC between input-guard terminals and case.

Power Requirements:
100 V AC ±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 (metric 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 & Accessories

PART NUMBER	DESCRIPTION
RD3020-01	9 red pens, channel 1
RD3020-02	9 green pens, channel 2
RD3025-RP	Paper, A4 size, 100 sheets
Call Sales	Roll paper (15m)

2. NAMES AND FUNCTIONS OF COMPONENTS.

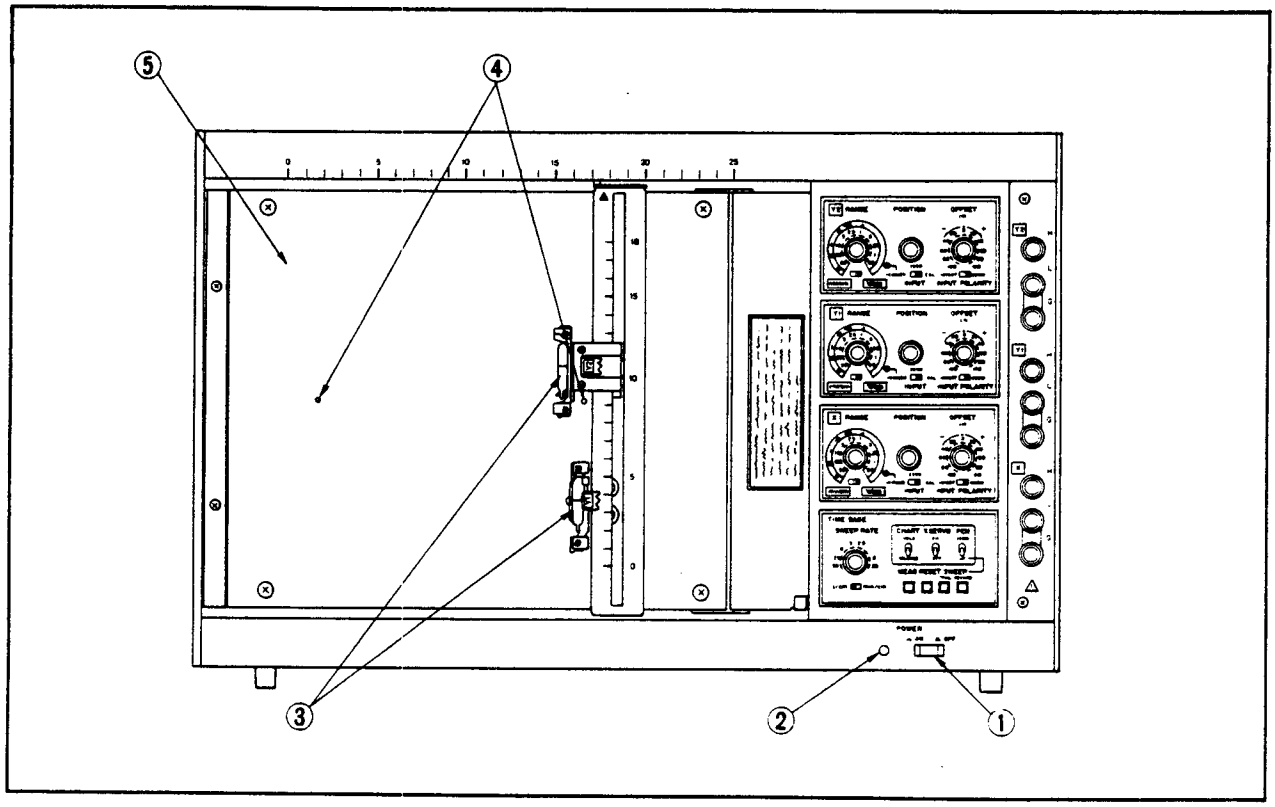


Figure 2-1.

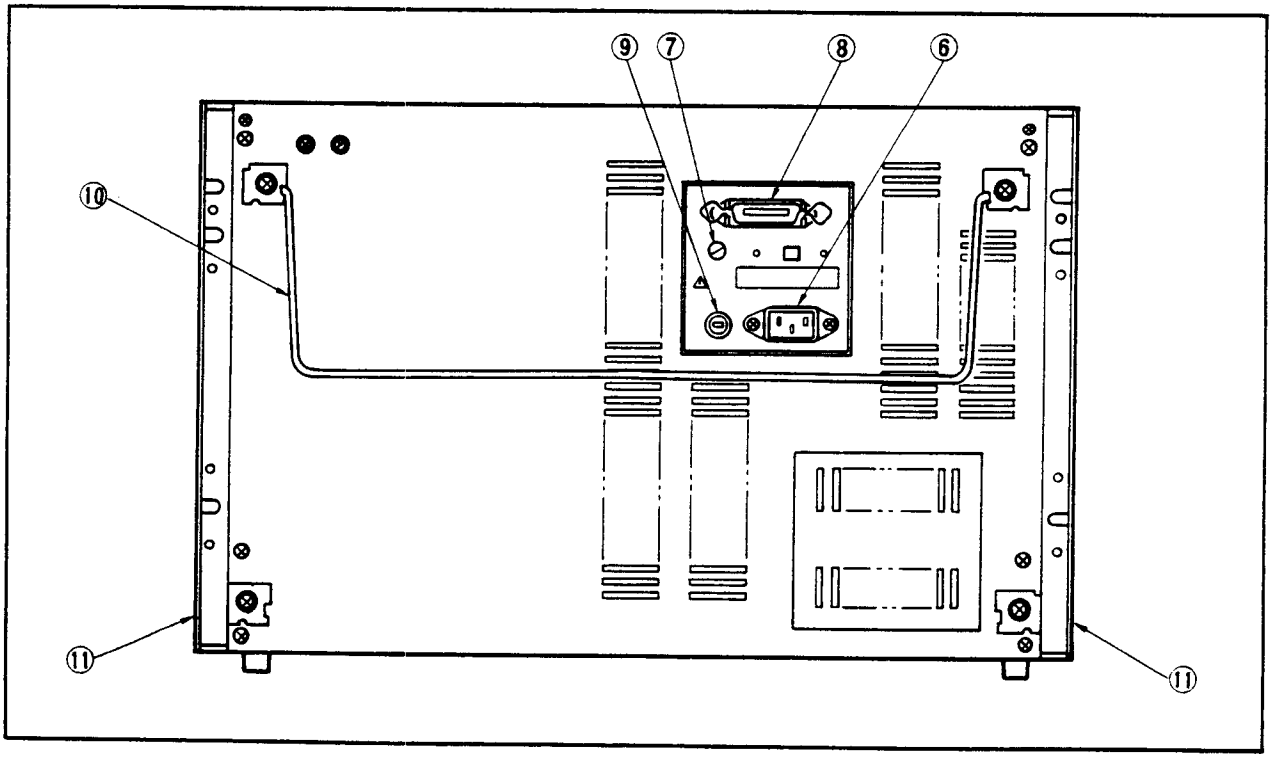


Figure 2-2.

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 opend 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 μV/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 is 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.

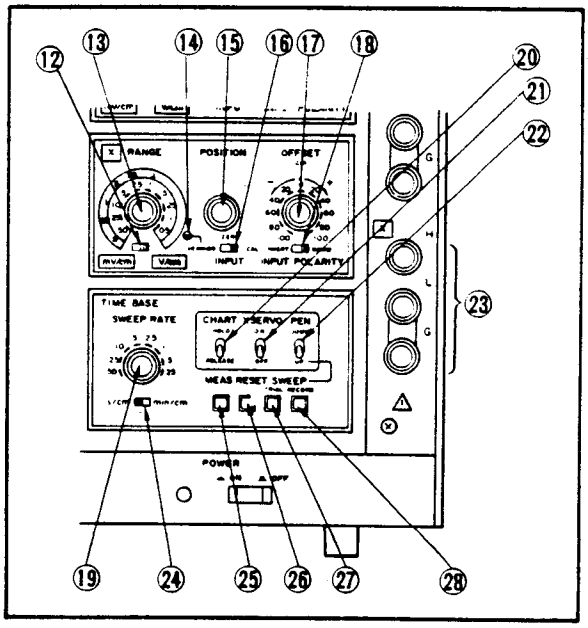


Figure 2-3.

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

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.

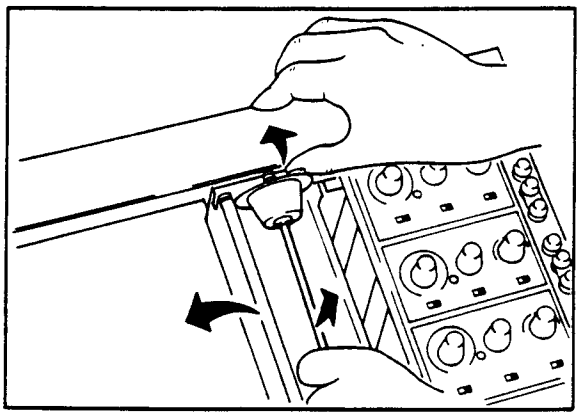


Figure 3-1.

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 Replacment.

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)
For 2nd pen (green)

(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.)

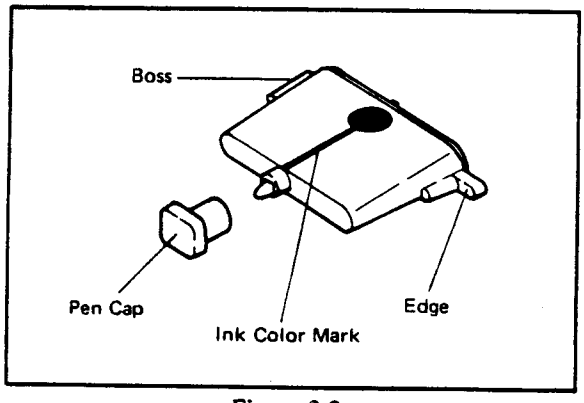


Figure 3-2.

(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.

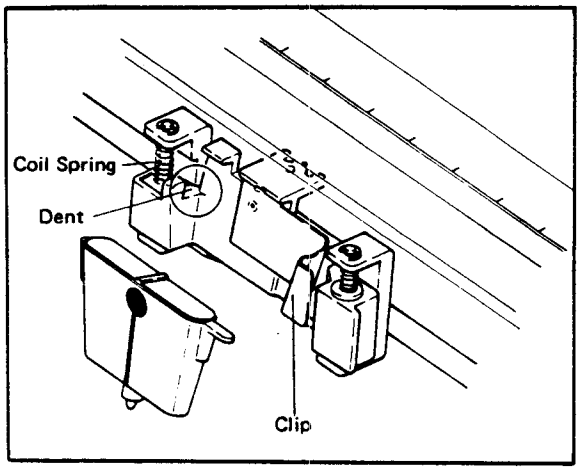


Figure 3-3.

(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).

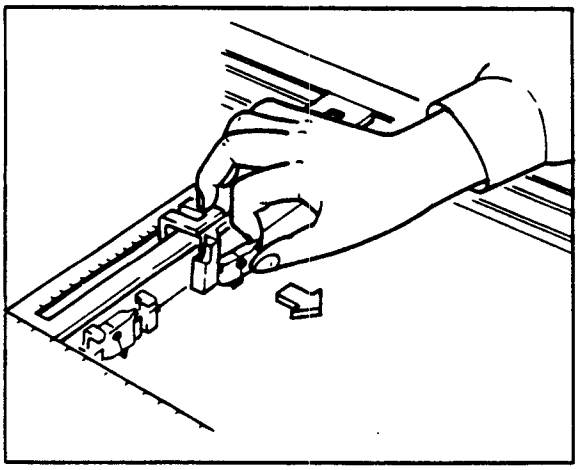


Figure 3-4.

(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.

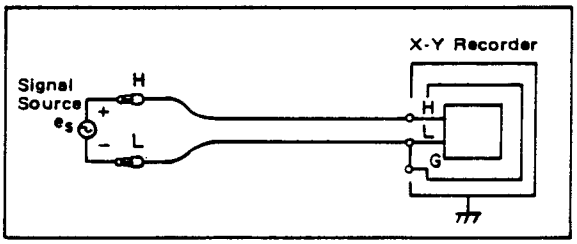


Figure 3-5.

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

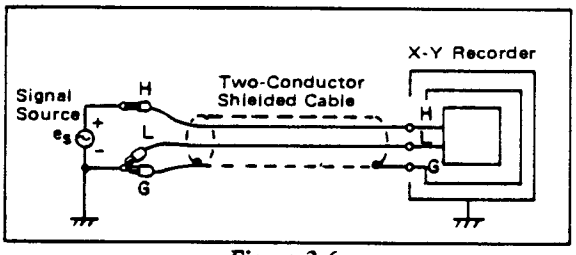


Figure 3-6.

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

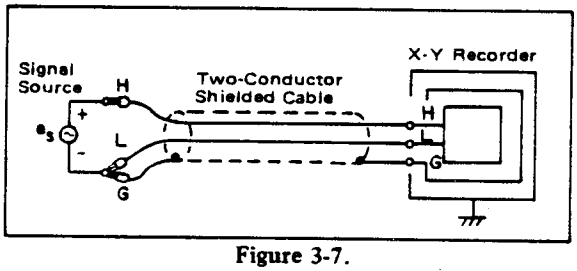


Figure 3-7.

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

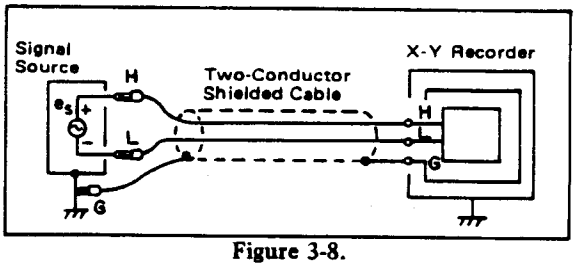


Figure 3-8.

3-5. Measurement and Recording.

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

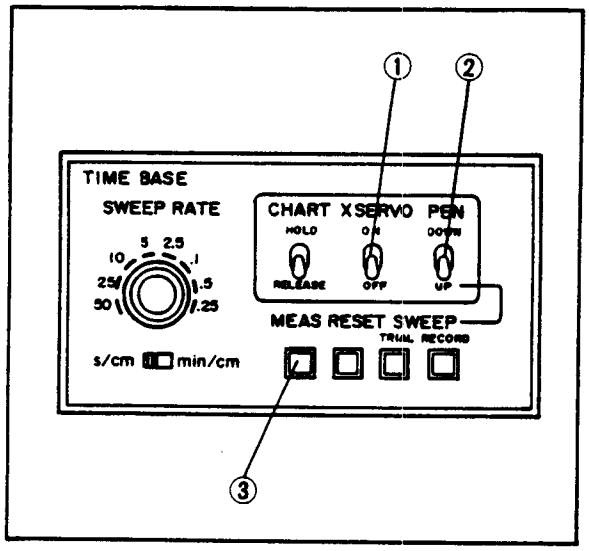


Figure 3-9.

(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.

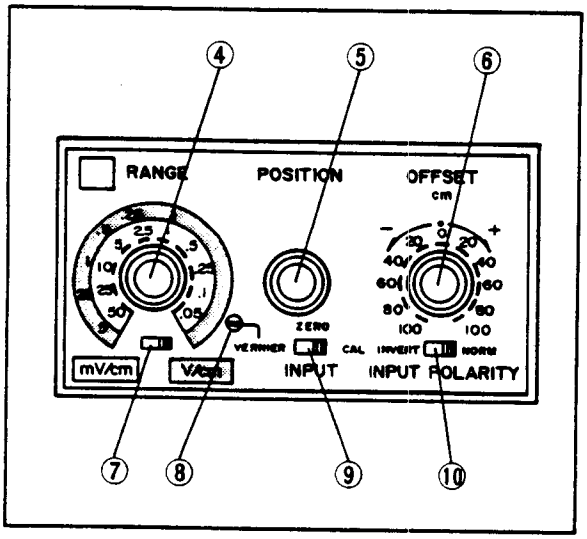


Figure 3-10.

(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 μV/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 kΩ. 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); therfore, 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.

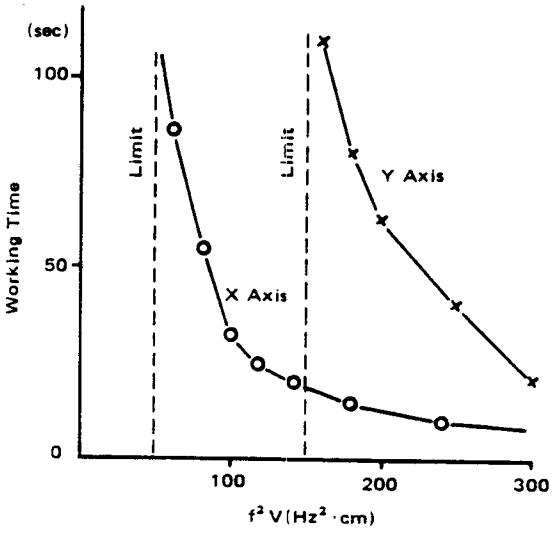


Figure 3-11. Thermal limiter characteristics for sinusoidal wave signal.

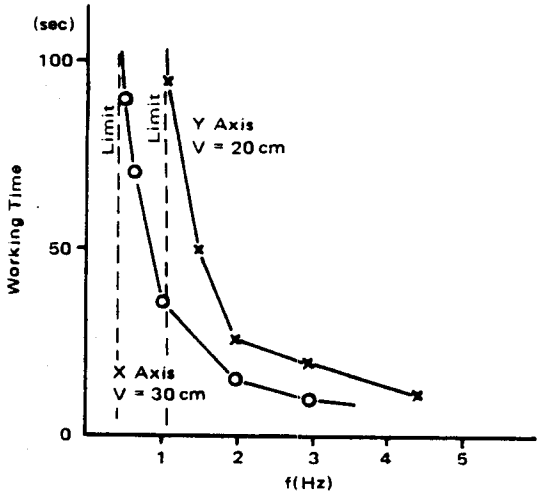


Figure 3-12. Thermal limiter characteristics for rectangular wave signal.

3-6. Time Sweep (option) /TIME 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)

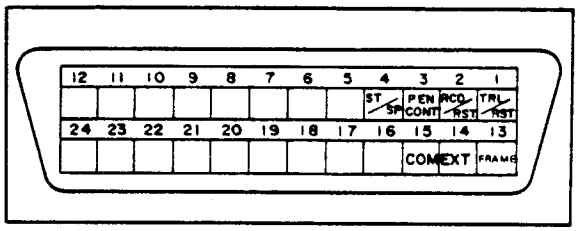


Figure 3-13.

(1) PEN CONTROL

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

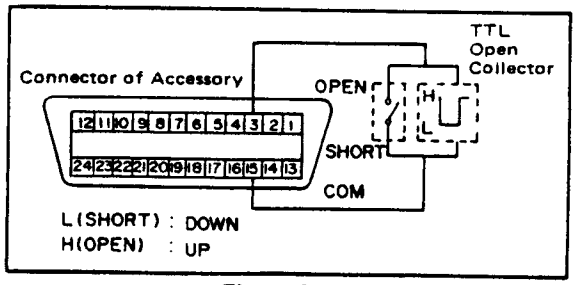


Figure 3-14.

(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.

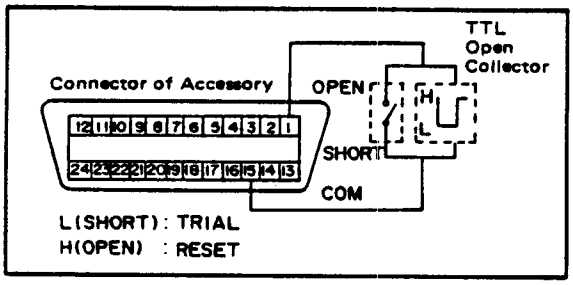


Figure 3-15.

(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.

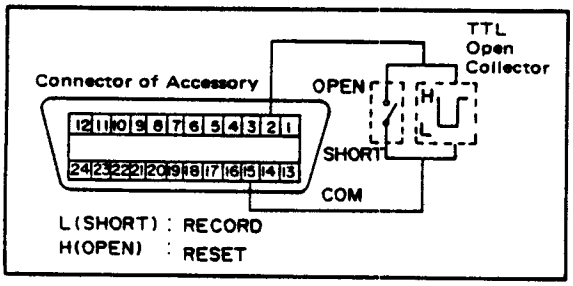


Figure 3-16.

(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.

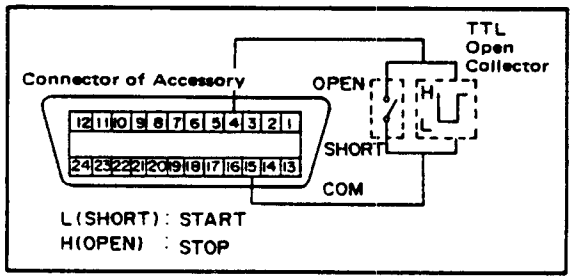


Figure 3-17.

(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.

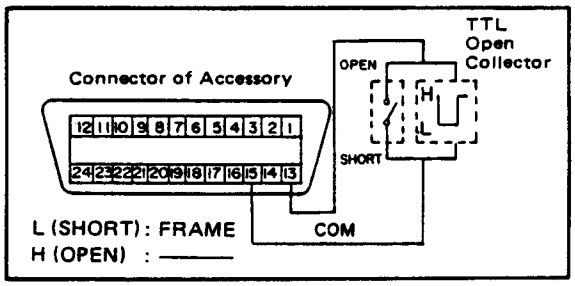


Figure 3-18.

(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.

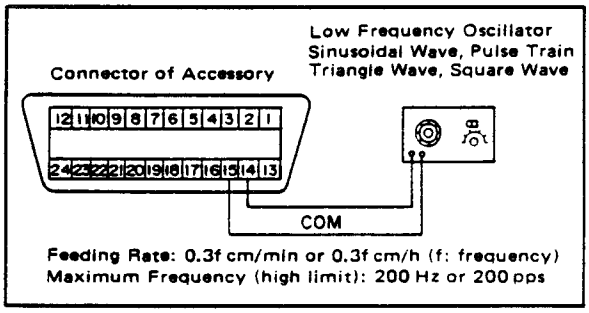


Figure 3-19.

Wave Form	Sinusoidal Wave, Triangle Wave, Square Wave	Pulse Train
Level	V_P $4\ V < V_P < 24\ V$	V_H T_{PI} V_L $+4\ V < V_H < +24\ V$ $-24\ V < V_L < +0.5\ V$ $T_P < 100\ \mu s$
Output Impedance of Oscillator	Less than 600 Ω	Less than 50 Ω
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.

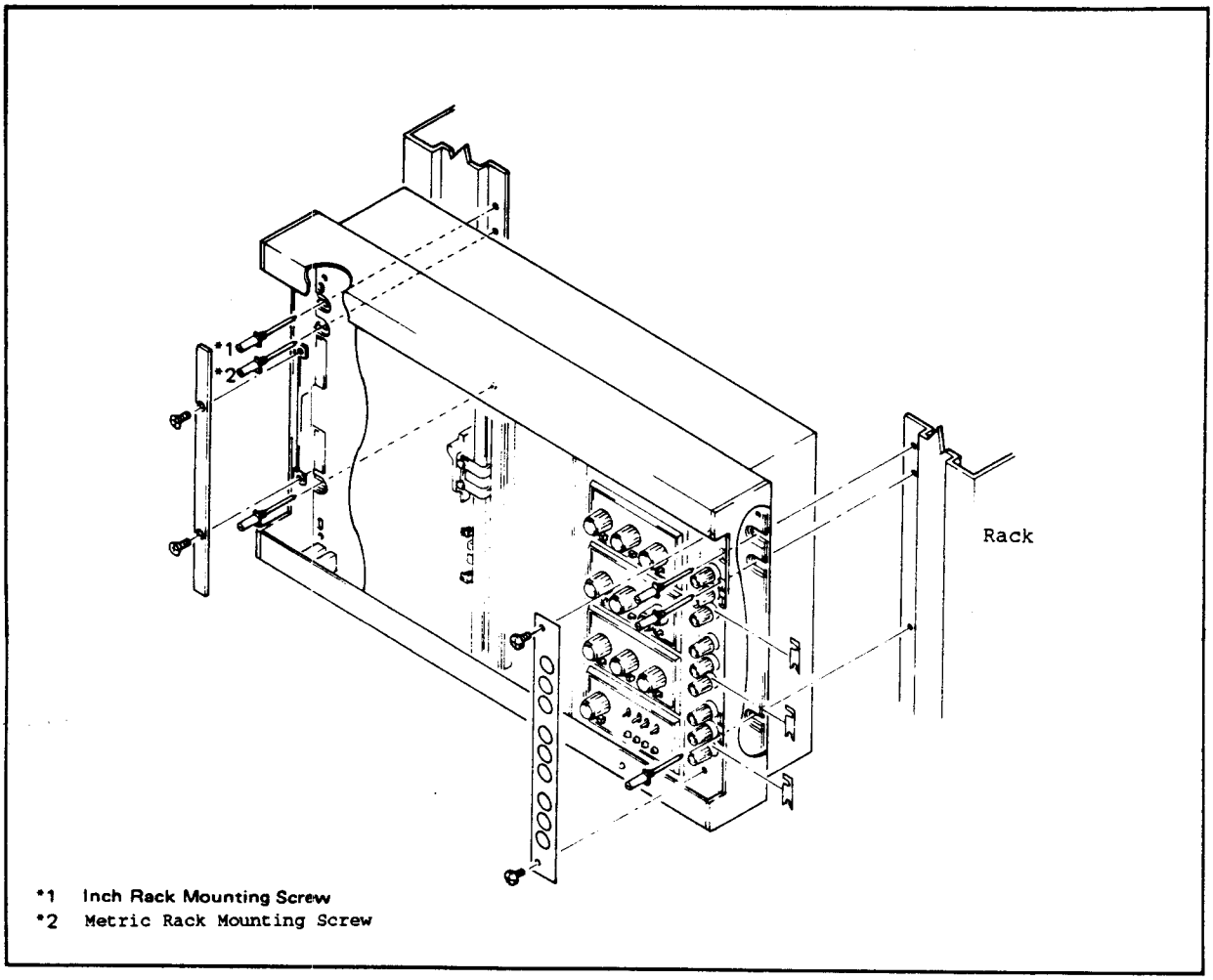


Figure 3-21.

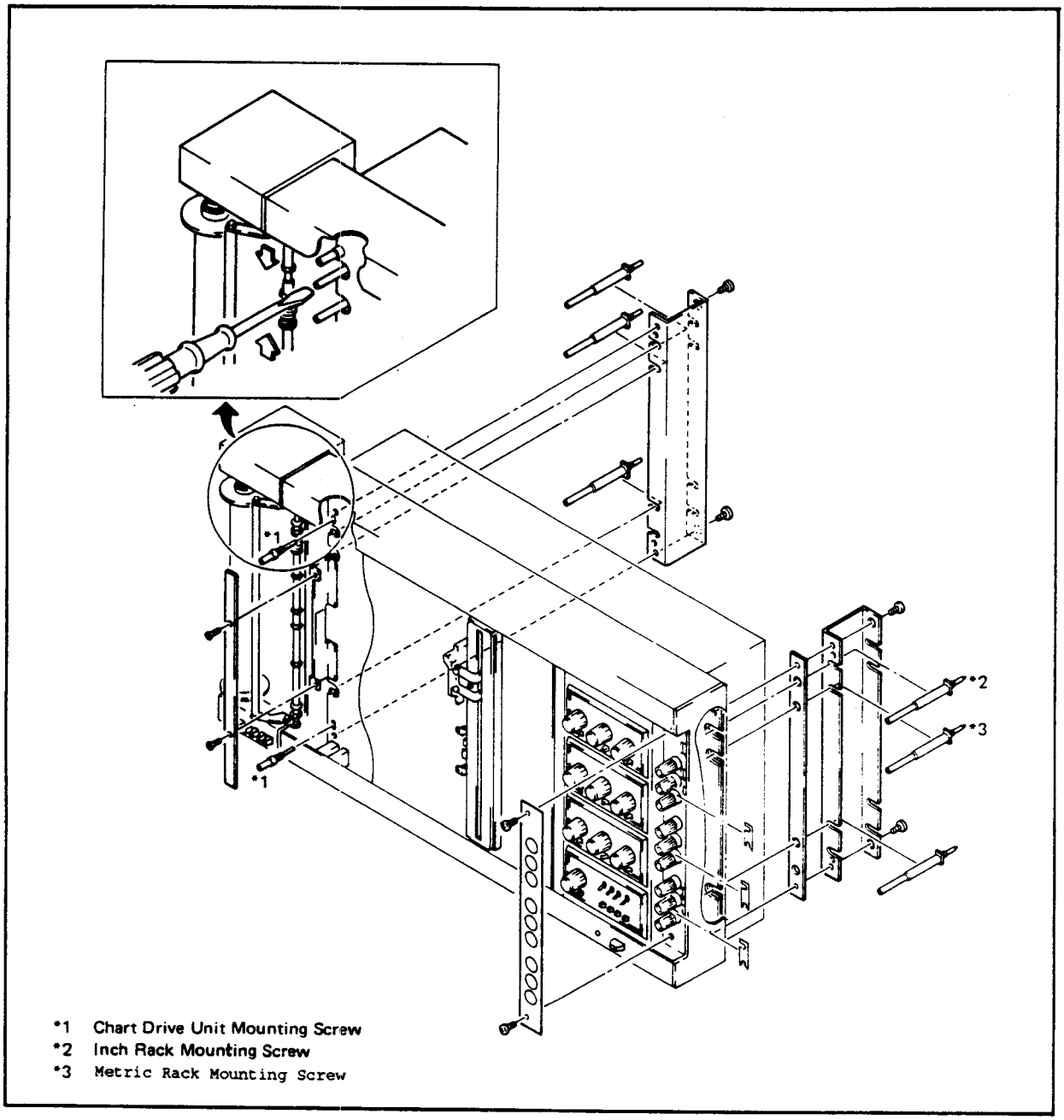

*1
*1
*2
*3
*1 Chart Drive Unit Mounting Screw
*2 Inch Rack Mounting Screw
*3 Metric Rack Mounting Screw

Figure 3-22.

3-9. Chart Drive Unit (Optional)

3-9-1. Description.

(1) The Chart Drive Unit, when combined with the X-Y recorder RD3025, 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 and be rolled up or just sent 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 ±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 oscilator.

Chart Take-up by External Oscillator Signal

Wave Form	Sinusoidal Wave, Triangle Wave, Square Wave	Pulse Train
Level	V_P	V_H, V_L, T_P
	$4V < V_P < 24V$	$+4V < V_H < +24V$ $-24V < V_L < +0.5V$ $T_P < 100\mu s$
Output Impedance of Oscillator	Less than 600 Ω	Less than 50 Ω
Chart Take-up Rate	0.3f cm/min or 0.3f 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.

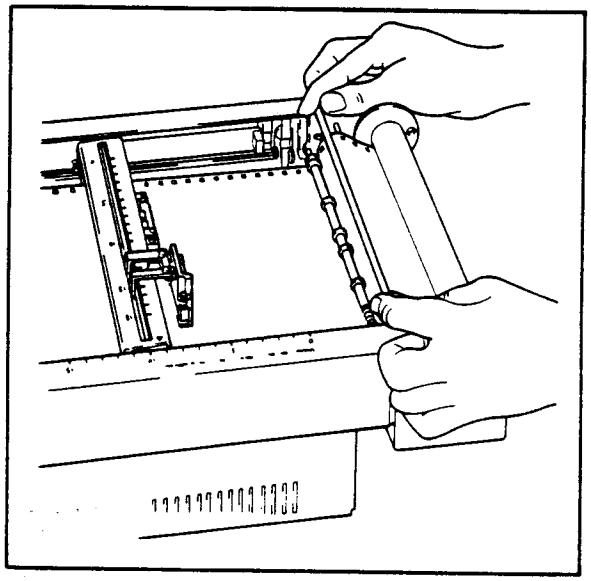


Figure 3-23.

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

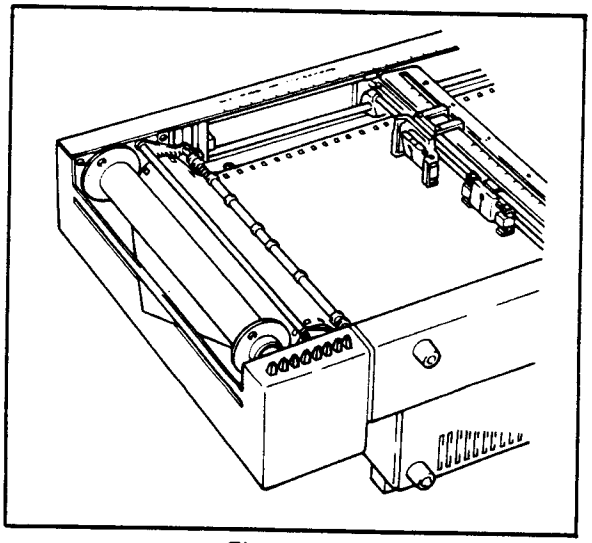


Figure 3-24.

(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.

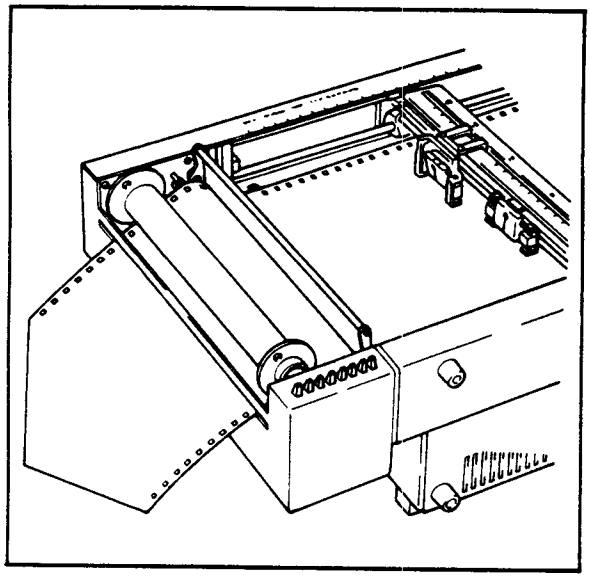


Figure 3-25.

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 faltbed 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.

(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 the approved special order OMEGA paper.

(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.

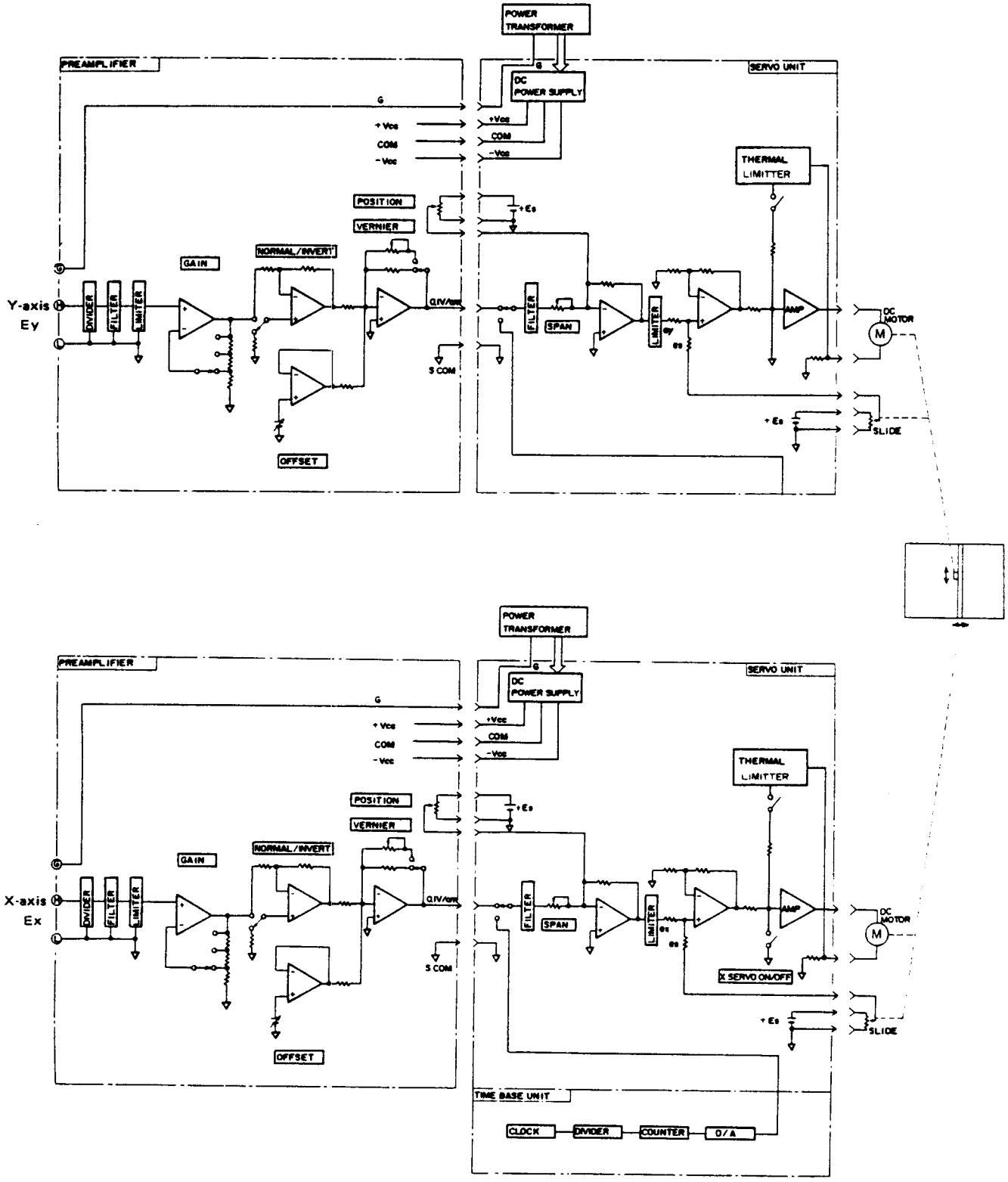


Figure 5-1.

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 Ex is first applied to a voltage divider and a preamplifier to increase up to an appropriate voltage ex (full scale 5 V), and supplied to the servo amplifier.

A voltage es 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 es + ex = 0. So that X-axis carriage then indicates the input (unknown) voltage Ex.

The Y-axis servo operation is similar to the X-axis described above, the pen arm moves in proportion to the input voltage Ey. 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.

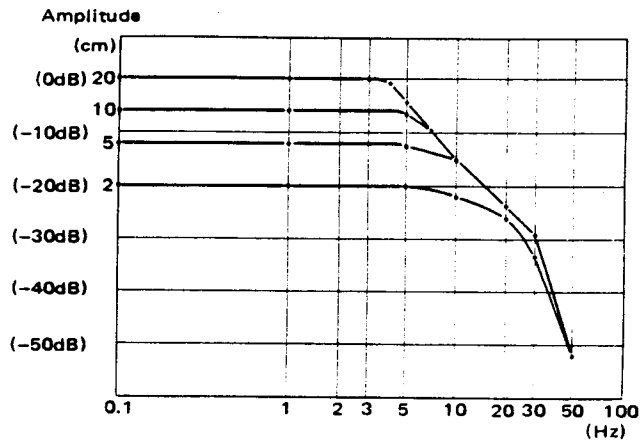


Figure 5-2. Frequency Characteristics (X-Axis).

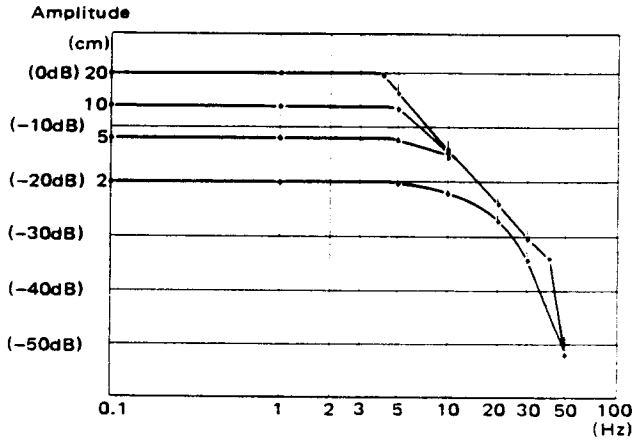


Figure 5-3. Frequency Characteristics (Y-Axis).

INTENTIONALLY

BLANK PAGE.

6. SCHEMATIC DIAGRAMS AND ELECTRONIC PARTS LIST.

INDEX

List of abbreviations

ac	=	alternating current
Ag	=	silver (ed)
Al	=	aluminum
amp	=	amplifier
ass'y	=	assembly
Au	=	gold
car flm	=	carbon film
cap	=	capacitor
cct	=	circuit
cer	=	ceramic
coef	=	coefficient
com	=	common
comp	=	composition
conn	=	connector
dc	=	direct current
dia	=	diameter
elect	=	electrolytic
FET	=	field effect transistor
flm	=	film
fxd	=	fixed
Ge	=	germanium
gnd	=	ground
IC	=	integrated circuit
L	=	inductor
met	=	metal (lized)
mfr	=	manufacturer
Ne	=	neon
nom val	=	nominal value
OSC	=	oscillator
pwb	=	printed wiring board
pcb	=	printed circuit board
plstc	=	plastic
polye	=	polyester
polys	=	polystyrene
pot	=	potentiometer
prec	=	precision (temperature coefficient, long term stability, and/or tolerance)
res	=	resistor
rng	=	range
rtry	=	rotary
Se	=	selenium
sect	=	section(s)
Si	=	silicon
sub-ass'y	=	sub-assembly
sw	=	switch
sys	=	system
sply	=	supply
Ta	=	tantalum
temp	=	temperature
trim	=	trimmer
TSTR	=	transistor
trans	=	transformer
var	=	variable
ww	=	wire wound

† = Request the item marked with † to OMEGA

†† = Replace the item marked with †† as a complete part set even when one of its parts is damaged. Request the complete part set to OMEGA

††† = Replace the item marked with ††† as an assembly even when a part of it is damaged. Request the assembly to OMEGA

†††† = Optimum value selected at factory, average value shown (part may be omitted).

Example

Conn : multi = multi connector
Cap : fxd Al elect = Fixed aluminum electrolytic capacitor
Cap : fxd met polye flm = Fixed metallized polyester film capacitor
PCB Ass'y = Printed circuit board assembly
Res : fxd car flm = Fixed carbon film resistor
Res : var ww = Wirewound variable resistor
Temp coef = Temperature coefficient

NOTES

1. **Components — especially ICs — which are equivalent to components shown in the schematic diagrams and parts list, but manufactured by other manufacturers, can in general be used in the instrument.**

2. **Subject to change without notice; changes may be made to improve the instrument's performance.**

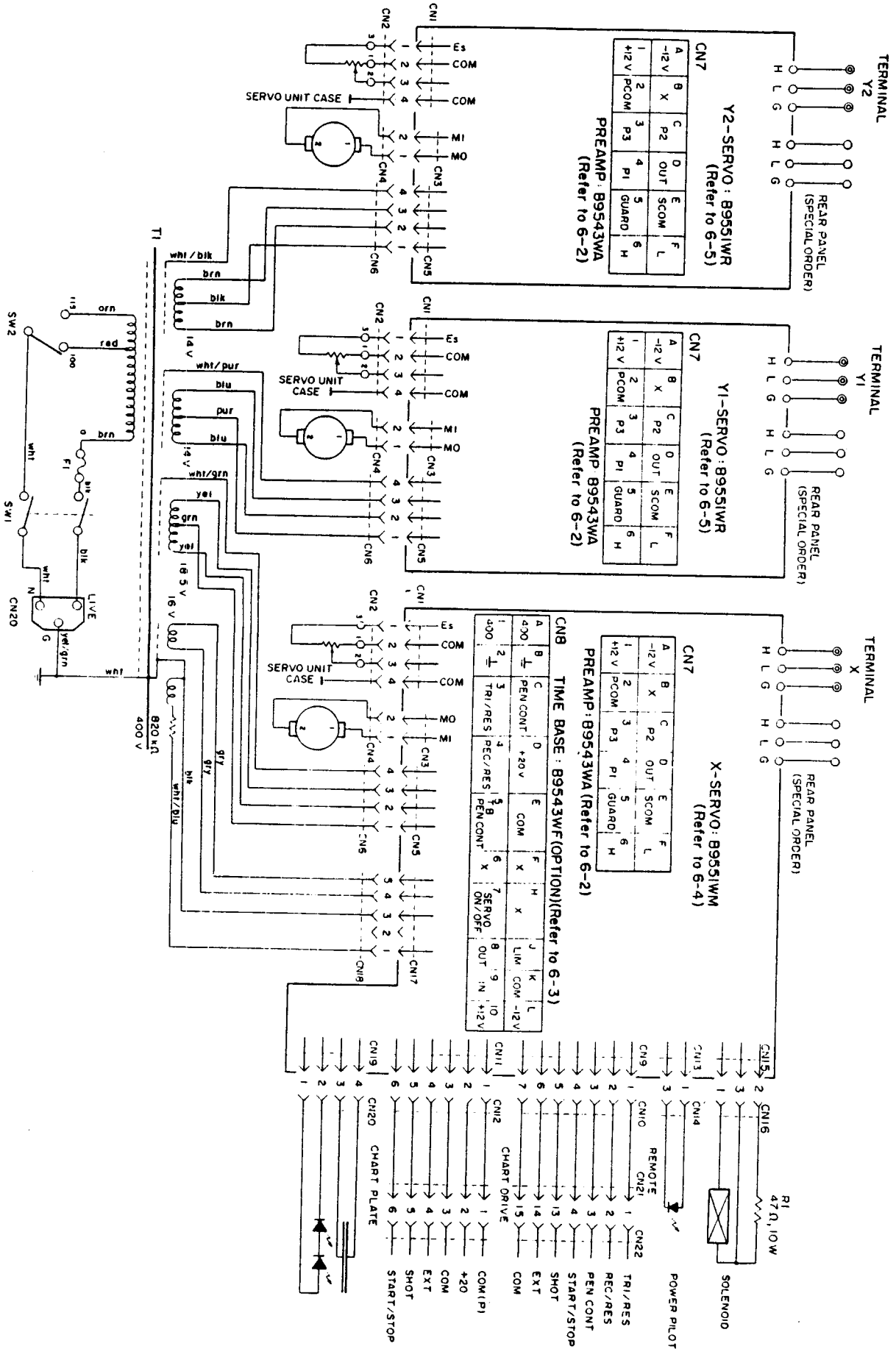


Figure 6-1. RD3025 A4 X-Y Recorder Overall Wiring.

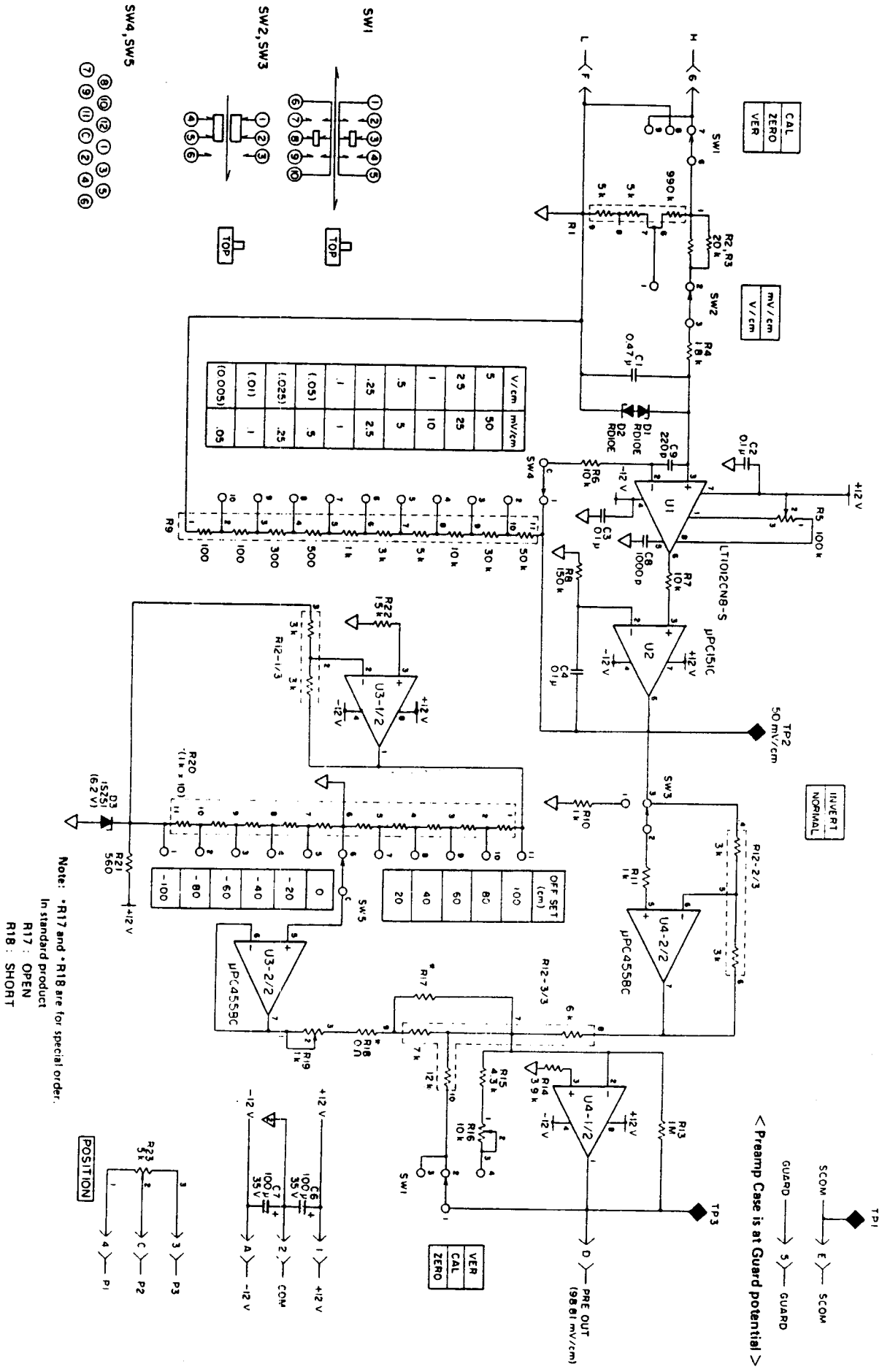


Figure 6-2a. Preamp PCB Ass'y: B9543WA Schematic Diagram.

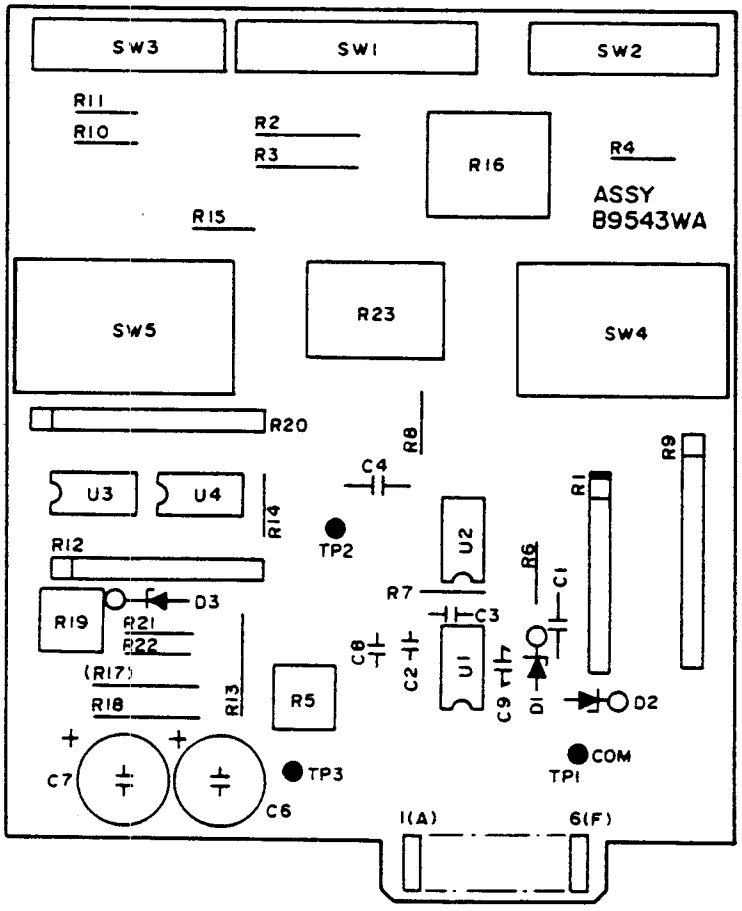


Figure 6-2b. Preamp PCB Ass'y: B9543WA Components Location Diagram.

6-2. Preamp PCB Ass'y: B9543WA.

Item	Part No.	Part Name and Description					Remarks
R1	A9142RL	Res: module				MRP1294	
R2, R3	A9829RM	Res: fxd met flm	20kΩ	±1%	½W	ERO-50CKF 2002	
R4	A9683RM	Res: fxd met flm	1.8kΩ	±1%	¼W	ERO-25CKF 1801	
R5	A9386RV	Res: var cermet	100kΩ	±20%	¼w	ET-6P 100kΩ	
R6, R7	A9701RM	Res: fxd met flm	10kΩ	±1%	¼W	ERO-25CKF 1002	
R8	A9729RM	Res: fxd met flm	150kΩ	±1%	¼W	ERO-25CKF 1503	
R9	A9156RL	Res: module				MRP1360	
R10	A9677RM	Res: fxd met flm	1kΩ	±1%	¼W	ERO-25CKF 1001	
R11	A9677RM	Res: fxd met flm	1kΩ	±1%	¼W	ERO-25CKF 1001	
R12	A9158RL	Res: module				MRP1362	
R13	A9870RM	Res: fxd met flm	1MΩ	±1%	½W	ERO-50CKF 1004	
R14	A9691RM	Res: fxd met flm	3.9kΩ	±1%	¼W	ERO-25CKF 3901	
R15	A9692RM	Res: fxd met flm	4.2kΩ	±1%	¼W	ERO-25CKF 4201	
R16	G9066RX	Res: var cermet	10kΩ	±20%	½W	GFP16 15SB 10kΩ	
(R17)							for special order
R18	A9005RY	Jumper	0Ω				
R19	A9265RV	Res: var cermet	1kΩ	±20%	¼W	ET-6P 1kΩ	
R20	A9157RL	Res: module				MRP1361	
R21	A9671RM	Res: fxd met flm	560Ω	±1%	¼W	ERO-25CKF 5600	
R22	A9681RM	Res: fxd met flm	1.5kΩ	±1%	¼W	ERO-25CKF 1501	
R23	A9976RV	Res: var conductive plastic	5kΩ	±20%	½W	EWS-MCA S40 E53	
C1	A9359CY	Cap: fxd polye flm	0.47μF	±5%	100V	ECQ-E1474JN	
C2, C3	A9114CC	Cap: fxd cer	0.1μF		50V	RPE112-127F104Z50	
C4	A9229CY	Cap: fxd polye flm	0.1μF	±10%	100V	ECQ-E1104KZ	
C5							not assigned
C6, C7	A9336CA	Cap: fxd Al elect	100μF		35V	ECE-A1VS101R	
C8	A9244CY	Cap: fxd polye flm	1000pF	±10%	50V	MFL5002-102K	
C9	A9029CN	Cap: fxd mica	220pF	±10%	100V	DM05C 221K1	
D1, D2	A9306HD	Diode: zener				RD10E	
D3	A9337HD	Diode: zener				1SZ51	
U1	A9230LA	IC: analog				LT1012CN8-S	
U2	A9078LA	IC: analog				μPC151C	
U3, U4	A9082LA	IC: analog				μPC4558C	
SW1	A9066SM	Sw: slide				SSY323	non-shorting
SW2	A9069SM	Sw: slide				SSY322-(= 9-NS	
SW3	A9065SM	Sw: slide				SSY322	shorting
SW4	A9378SR	Sw: rtry				RP7X 1-1-10	
SW5	A9379SR	Sw: rtry				RP7X 1-1-11	
TP1~TP3	A9574KP	Test point				VTC-1-1	
	B9543WB	Printed board					
	B9543RG	Bracket	(1 pc)				
	Y9304LB	Screw	(2 pcs)				M3 x 4

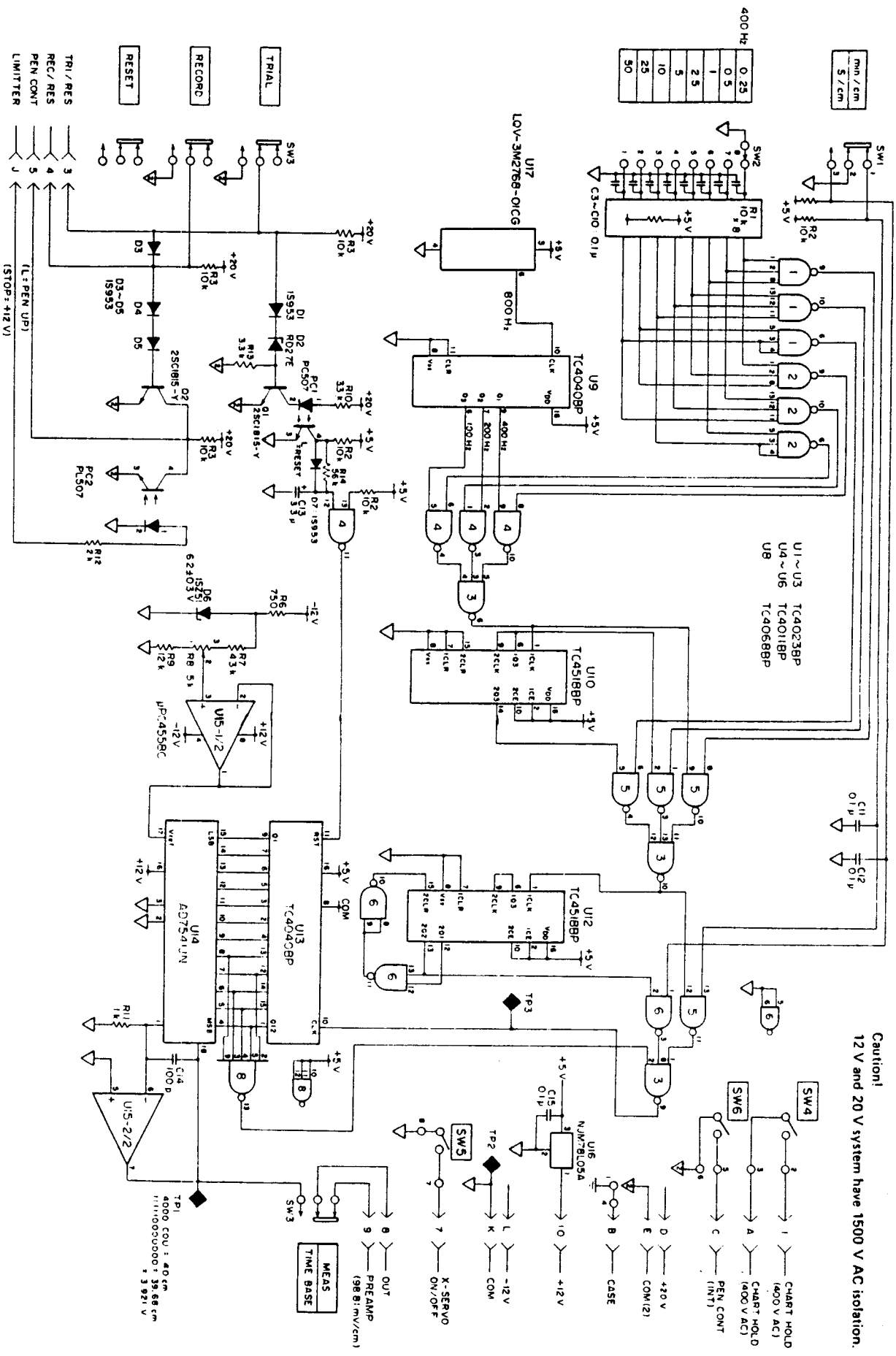


Figure 6-3a. Time Base PCB Ass'y: B9543WF (Option) Schematic Diagram.

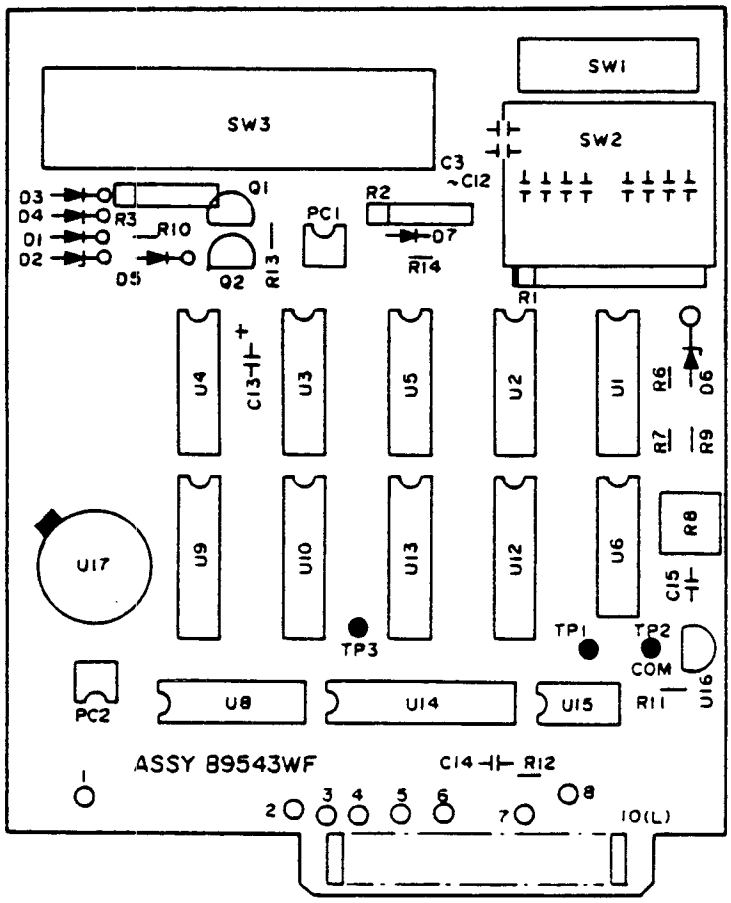


Figure 6-3b. Time Base PCB Ass'y: B9543WF (Option) Components Location Diagram.

6-3. Time Base PCB Ass'y: B9543WF (Option).

Item	Part No.	Part Name and Description					Remarks
R1	A9095RL	Res: module	10kΩ	±5%	1/8W	RK1/8 88 10kΩJ	8 elements
R2, R3	A9029RL	Res: module	10kΩ	±5%	1/8W	RK1/8 84 10kΩJ	4 elements
R4							not assigned
R5							not assigned
R6	A9046RG	Res: fxd met flm	750Ω	±1%	¼W	LF¼ 750ΩF	radial type
R7	A9064RG	Res: fxd met flm	4.3kΩ	±1%	¼W	LF¼ 4.3kΩF	radial type
R8	A9266RV	Res: var cermet	5kΩ	±20%	¼W	ET-6P 5kΩ	
R9	A9075RG	Res: fxd met flm	12kΩ	±1%	¼W	LF¼ 12kΩF	radial type
R10	A9061RG	Res: fxd met flm	3.3kΩ	±1%	¼W	LF¼ 3.3kΩF	radial type
R11	A9049RG	Res: fxd met flm	1kΩ	±1%	¼W	LF¼ 1kΩF	radial type
R12	A9056RG	Res: fxd met flm	2kΩ	±1%	¼W	LF¼ 2kΩF	radial type
R13	A9061RG	Res: fxd met flm	3.3kΩ	±1%	¼W	LF¼ 3.3kΩF	radial type
R14	A9091RG	Res: fxd met flm	56kΩ	±1%	¼W	LF¼ 56kΩF	radial type

6-3. Time Base PCB Ass'y: B9543WF (Option) (Cont'd).

Item	Part No.	Part Name and Description					Remarks
C1, C2							not assigned
C3~C10	A9114CC	Cap: fxd cer	0.1μF		50V	RPE112-127F104Z50	
C11, C12	A9114CC	Cap: fxd cer	0.1μF		50V	RPE112-127F104Z50	
C13	A9232CT	Cap: fxd Ta elect	3.3μF	±20%	16V	245M1602-335M	
C14	A9025CN	Cap: fxd mica	100pF	±10%	100V	DM05C 101K1	
C15	A9114CC	Cap: fxd cer	0.1μF		50V	RPE112-127F104Z50	
D1	A9248HD	Diode: Si				1S953	
D2	A9170HD	Diode: zener				RD2.7E	
D3~D5	A9248HD	Diode: Si				1S953	
D6	A9337HD	Diode: zener				1SZ51	
D7	A9248HD	Diode: Si				1S953	
Q1, Q2	A9340HQ	TSTR: Si NPN				2SC1815-Y	
U1~U3	A9016LM	IC: digital				TC4023BP	MOS
U4~U6	A9030LM	IC: digital				TC4011BP	MOS
U7							not assigned
U8	A9074LM	IC: digital				TC4068BP	MOS
U9	A9052LM	IC: digital				TC4040BP	MOS
U10	A9129LM	IC: digital				TC4518BP	MOS
U11							not assigned
U12	A9129LM	IC: digital				TC4518BP	MOS
U13	A9052LM	IC: digital				TC4040BP	MOS
U14	A9159LM	IC: digital				AD7541JM	MOS
U15	A9082LA	IC: analog				μPC4558C	
U16	A9205LA	IC: +5V voltage regulator				NJM78L05A	-5V, 100mA
U17	A9113EX	IC: oscillator/freq. divider				LQV-3M2768-01CG	MOS
PC1, PC2	A9049HL	Photo coupler				PC507	
SW1	A9065SM	Sw: slide				SSY322	shorting
SW2	A9377SR	Sw: rtry				RP7X 1-1-8	shorting
SW3	A9199SP	Sw: push				KE0420IDP	
	A9100KU	Knob (black)	(1 pc)			1D911	black (for SW3)
	A9101KU	Knob (gray)	(3 pcs)			1D951	gray (for SW3)
TP1~TP3	A9574KP	Test point				VTC-1-1	
	B9543WG	Printed board					
	B9543RH	Bracket	(1 pc)				
	Y9204KB	Screw	(1 pc)				M2.3 x 4

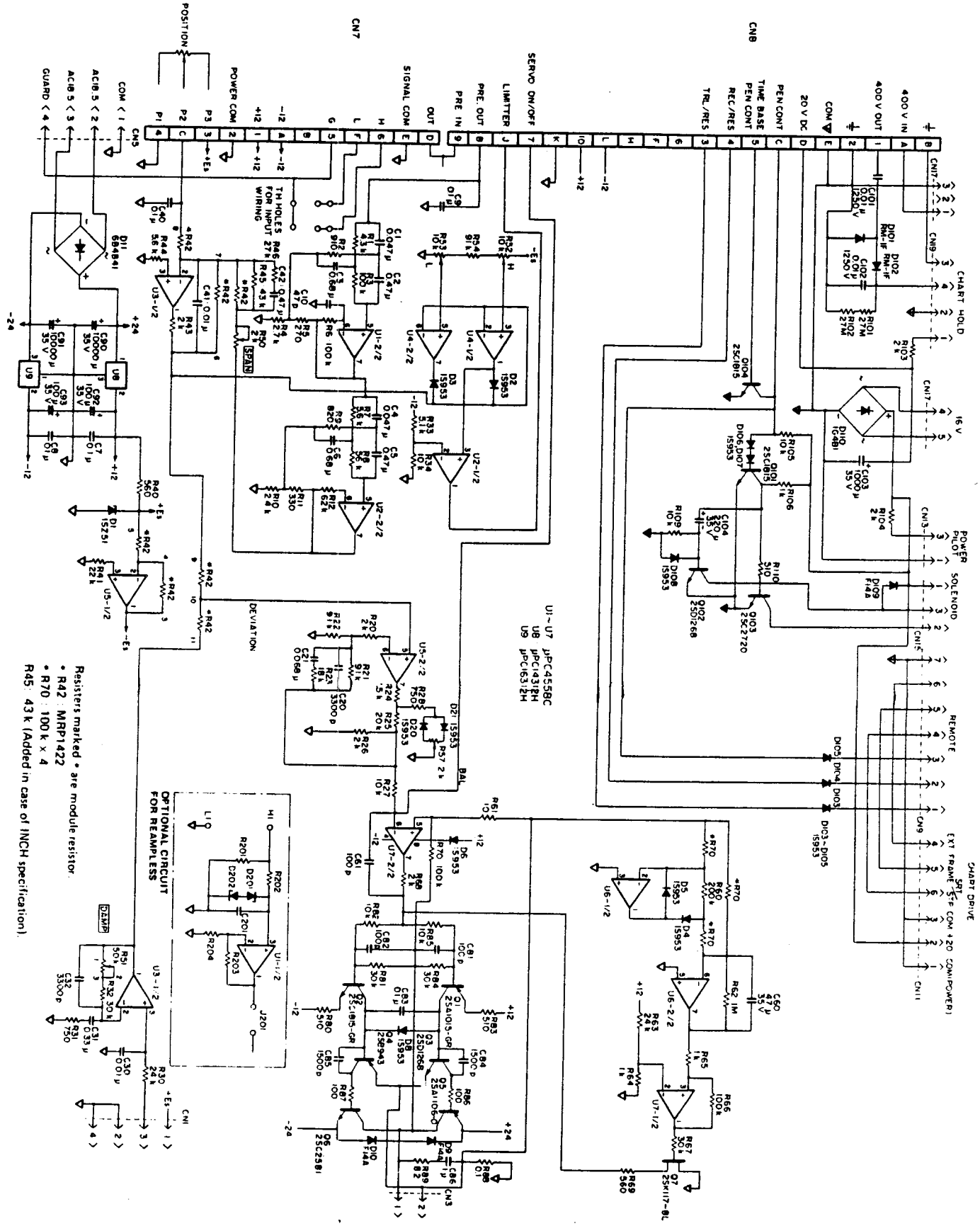
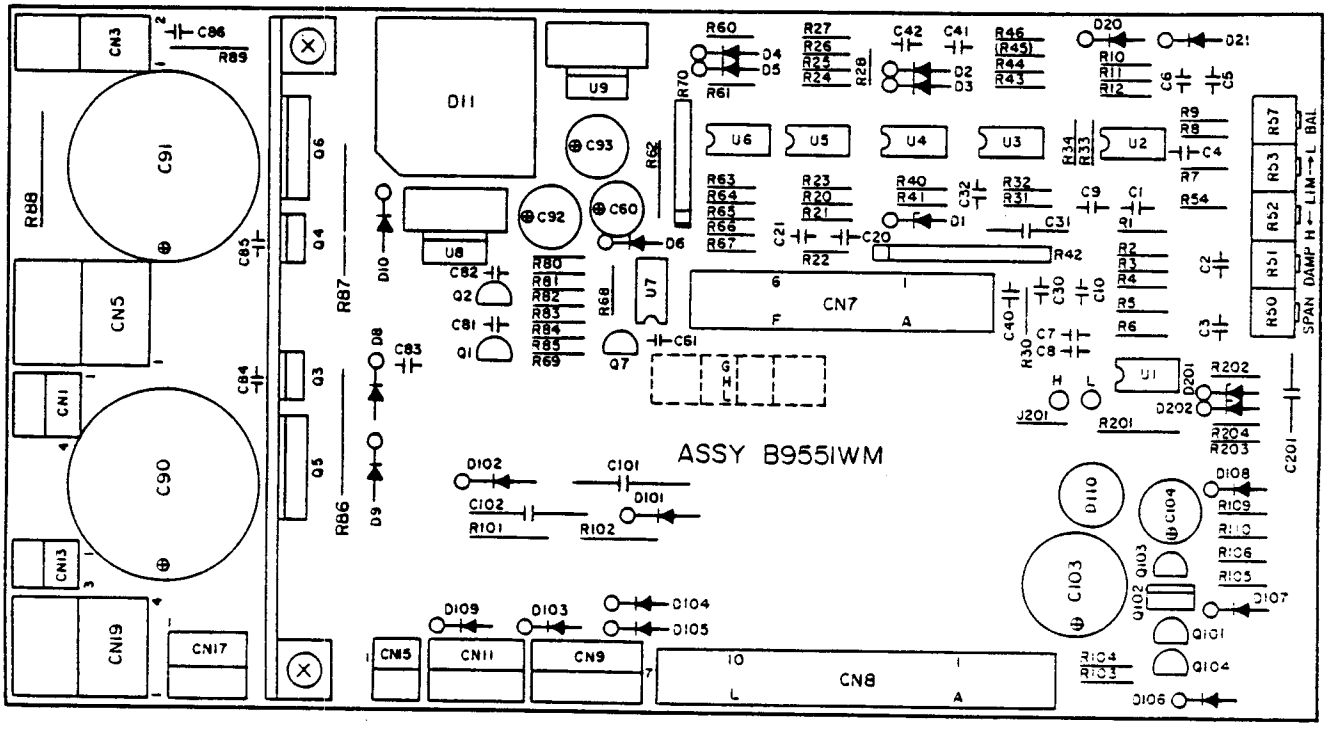


Figure 6-4a. X-Axis Servo Amp PCB Ass'y: B9551WM Schematic Diagram.



Notes: 1. R45 is equipped with INCH specifications.
2. Parts with Item nos. of 200 order are used only in PREAMPLESS (OPTION) version.

Figure 6-4b. X-Axis Servo Amp PCB Ass'y: B9551WM Components Location Diagram.

6-4. X-Axis Servo Amp PCB Ass'y: B9551WM.

Item	Part No.	Part Name and Description					Remarks
R1	A9692RM	Res: fxd met film	4.3kΩ	±1%	¼W	ERO-25CKF 4301	
R2	A9676RM	Res: fxd met film	910Ω	±1%	¼W	ERO-25CKF 9100	
R3	A9725RM	Res: fxd met film	100kΩ	±1%	¼W	ERO-25CKF 1003	
R4	A9687RM	Res: fxd met film	2.7kΩ	±1%	¼W	ERO-25CKF 2701	
R5	A9663RM	Res: fxd met film	270Ω	±1%	¼W	ERO-25CKF 2700	
R6	A9725RM	Res: fxd met film	100kΩ	±1%	¼W	ERO-25CKF 1003	
R7	A9695RM	Res: fxd met film	5.6kΩ	±1%	¼W	ERO-25CKF-5601	
R8	A9719RM	Res: fxd met film	56kΩ	±1%	¼W	ERO-25CKF-5602	
R9	A9675RM	Res: fxd met film	820Ω	±1%	¼W	ERO-25CKF 8200	
R10	A9686RM	Res: fxd met film	2.4kΩ	±1%	¼W	ERO-25CKF 2401	
R11	A9665RM	Res: fxd met film	330Ω	±1%	¼W	ERO-25CKF 3300	
R12	A9720RM	Res: fxd met film	62kΩ	±1%	¼W	ERO-25CKF 6202	
R20	A9684RM	Res: fxd met film	2kΩ	±1%	¼W	ERO-25CKF 2001	
R21	A9724RM	Res: fxd met film	91kΩ	±1%	¼W	ERO-25CKF 9102	
R22	A9700RM	Res: fxd met film	9.1kΩ	±1%	¼W	ERO-25CKF 9101	
R23	A9707RM	Res: fxd met film	18kΩ	±1%	¼W	ERO-25CKF 1802	
R24	A9681RM	Res: fxd met film	1.5kΩ	±1%	¼W	ERO-25CKF 1501	
R25	A9708RM	Res: fxd met film	20kΩ	±1%	¼W	ERO-25CKF 2002	
R26	A9684RM	Res: fxd met film	2kΩ	±1%	¼W	ERO-25CKF 2001	
R27	A9701RM	Res: fxd met film	10kΩ	±1%	¼W	ERO-25CKF 1002	
R28	A9674RM	Res: fxd met film	750Ω	±1%	¼W	ERO-25CKF 7500	
R30	A9710RM	Res: fxd met film	24kΩ	±1%	¼W	ERO-25CKF 2402	
R31	A9674RM	Res: fxd met film	750Ω	±1%	¼W	ERO-25CKF 7500	
R32	A9712RM	Res: fxd met film	30kΩ	±1%	¼W	ERO-25CKF 3002	
R33	A9694RM	Res: fxd met film	5.1kΩ	±1%	¼W	ERO-25CKF 5100	
R34	A9701RM	Res: fxd met film	10kΩ	±1%	¼W	ERO-25CKF 1002	
R40	A9671RM	Res: fxd met film	560Ω	±1%	¼W	ERO-25CKF 5600	
R41	A9709RM	Res: fxd met film	22kΩ	±1%	¼W	ERO-25CKF 2202	
R42	A9166RL	Res: module				MRP1422	
R43	A9684RM	Res: fxd met film	2kΩ	±1%	¼W	ERO-25CKF 2001	
R44	A9695RM	Res: fxd met film	5.6kΩ	±1%	¼W	ERO-25CKF 5601	
(R45)	A9716RM	Res: fxd met film	43kΩ	±1%	¼W	ERO-25CKF 4302	for INCH specification
R46	A9711RM	Res: fxd met film	27kΩ	±1%	¼W	ERO-25CKF 2702	
R50	A9544RV	Res: var cermet	2kΩ	±20%	¼W	ET-6X 2kΩ	
R51	A9272RV	Res: var cermet	50kΩ	±20%	¼W	ET-6X 50kΩ	
R52, R53	A9348RV	Res: var cermet	10kΩ	±20%	¼W	ET-6X 10kΩ	
R54	A9724RM	Res: fxd met film	91kΩ	±1%	¼W	ERO-25CKF 9102	
R55, R56							not assigned
R57	A9544RV	Res: var cermet	2kΩ	±20%	¼W	ET-6X 2kΩ	
R60	A9732RM	Res: fxd met film	200kΩ	±1%	¼W	ERO-25CKF 2003	
R61	A9629RM	Res: fxd met film	10Ω	±1%	¼W	ERO-25CKF 10RO	
R62	A9870RM	Res: fxd met film	1MΩ	±1%	¼W	ERO-50CKF 1004	
R63	A9710RM	Res: fxd met film	24kΩ	±1%	¼W	ERO-25CKF 2402	
R64, R65	A9677RM	Res: fxd met film	1kΩ	±1%	¼W	ERO-25CKF 1001	

6-4. X-Axis Servo Amp PCB Ass'y: B9551WM (Cont'd).

Item	Part No.	Part Name and Description					Remarks
R66	A9725RM	Res: fxd met flm	100kΩ	±1%	¼W	ERO-25CKF 1003	
R67	A9712RM	Res: fxd met flm	30kΩ	±1%	¼W	ERO-25CKF 3002	
R68	A9684RM	Res: fxd met flm	2kΩ	±1%	¼W	ERO-25CKF 2001	
R69	A9671RM	Res: fxd met flm	560Ω	±1%	¼W	ERO-25CKF 5600	
R70	A9096RL	Res: module	100kΩ	±5%	1/8W	RK1/8B4S 100kΩJ	4 elements
R80	A9670RM	Res: fxd met flm	510Ω	±1%	¼W	ERO-25CKF 5100	
R81	A9712RM	Res: fxd met flm	30kΩ	±1%	¼W	ERO-25CKF 3002	
R82	A9701RM	Res: fxd met flm	10kΩ	±1%	¼W	ERO-25CKF 1002	
R83	A9670RM	Res: fxd met flm	510Ω	±1%	¼W	ERO-25CKF 5100	
R84	A9712RM	Res: fxd met flm	30kΩ	±1%	¼W	ERO-25CKF 3002	
R85	A9701RM	Res: fxd met flm	10kΩ	±1%	¼W	ERO-25CKF 1002	
R86, R87	A9329RK	Res: fxd met flm	100Ω	±5%	2W	ERG-2ANJ 101	
R88	A9506RA	Res: fxd ww	0.1Ω	±10%	2W	ERW-2PK R10	
R89	A9220RK	Res: fxd met flm	8.2Ω	±5%	½W	ERX-12AVJ 8.2Ω	
R201~R204							for Preampless (Optional)
C1	A9254CY	Cap: fxd polye flm	0.047μF	±10%	50V	MFL5002-473K	
C2	A9369CY	Cap: fxd polye flm	0.47μF	±10%	63V	553M6302-474K	
C3	A9370CY	Cap: fxd polye flm	0.68μF	±10%	50V	553M5002-684K	
C4	A9254CY	Cap: fxd polye flm	0.047μF	±10%	50V	MFL5002-473K	
C5	A9369CY	Cap: fxd polye flm	0.47μF	±10%	63V	553M6302-474K	
C6	A9370CY	Cap: fxd polye flm	0.68μF	±10%	50V	553M5002-684K	
C7~C9	A9114CC	Cap: fxd cer	0.1μF		50V	RPE112-127F104Z50	
C10	A9021CN	Cap: fxd mica	47pF	±10%	100V	DM05C 470K1	
C20	A9247CY	Cap: fxd polye flm	3300pF	±10%	50V	MFL5002-332K	
C21	A9256CY	Cap: fxd polye flm	0.068μF	±10%	50V	MFL5002-683K	
C30	A9250CY	Cap: fxd polye flm	0.01μF	±10%	50V	MFL5002-103K	
C31	A9232CY	Cap: fxd polye flm	0.33μF	±10%	100V	ECQ-E1334KZ	
C32	A9247CY	Cap: fxd polye flm	3300pF	±10%	50V	MFL5002-332K	
C40	A9114CC	Cap: fxd cer	0.1μF		50V	RPE112-127F104Z50	
C41	A9250CY	Cap: fxd polye flm	0.01μF	±10%	50V	MFL5002-103K	
C42	A9369CY	Cap: fxd polye flm	0.47μF	±10%	63V	553M6302-474K	
C60	A9360CA	Cap: fxd Al elect	47μF		35V	ECE-A1VS470R	
C61	A9025CN	Cap: fxd mica	100pF	±10%	100V	DM05C 101K1	
C81, C82	A9025CN	Cap: fxd mica	100pF	±10%	100V	DM05C 101K1	
C83	A9114CC	Cap: fxd cer	0.1μF		50V	RPE112-127F104Z50	
C84, C85	A9245CY	Cap: fxd polye flm	1500pF	±10%	50V	MFL5002-152K	
C86	A9128CC	Cap: fxd cer	1μF		50V	RPE113F105Z50	
C90, C91	A9407CA	Cap: fxd Al elect	10000μF		35V	ECE-SIVU103T	
C92, C93	A9336CA	Cap: fxd Al elect	100μF		35V	ECE-A1VS101R	

6-4. X-Axis Servo Amp PCB Ass'y: B9551WM (Cont'd).

Item	Part No.	Part Name and Description				Remarks
C201						for Preampless (Optional)
D1	A9337HD	Diode: zener			1SZ51	
D2~D6	A9248HD	Diode: Si			1S953	
D7						not assigned
D8	A9248HD	Diode: Si			1S953	
D9, D10	A9236HD	Diode: Si			F14A	
D11	A9133HL	Diode: array			6B4841	
D20, D21	A9248HD	Diode: Si			1S953	
D201, D202						for Preampless (Optional)
Q1	A9465HQ	TSTR: Si PNP			2SA1015-GR	
Q2	A9464HQ	TSTR: Si NPN			2SC1815-GR	
Q3	A9287HQ	TSTR: Si NPN			2SD1268-P, Q	
Q4	A9334HQ	TSTR: Si PNP			2SB943-P, Q	
Q5	A9400HQ	TSTR: Si PNP			2SA1106-0	
Q6	A9408HQ	TSTR: Si NPN			2SC2581	
Q7	A9413HQ	TSTR: FET			2SK1178L	
U1~U7	A9082LA	IC: dual OP amp			μPC4558C	
U8	A9104LA	IC: +12V voltage regulator			μPC14312H	
U9	A9105LA	IC: −12V voltage regulator			μPC16312H	
R101, R102	A9203RK	Res: fxd met flm	27MΩ	±5% ¼W	RG08V2F 27MΩJ	
R103, R104	A9684RM	Res: fxd met flm	2kΩ	±1% ¼W	ERO-25CKF 2001	
R105	A9701RM	Res: fxd met flm	10kΩ	±1% ¼W	ERO-25CKF 1002	
R106	A9677RM	Res: fxd met flm	1kΩ	±1% ¼W	ERO-25CKF 1001	
R107, R108						not assigned
R109	A9701RM	Res: fxd met flm	10kΩ	±1% ¼W	ERO-25CKF 1002	
R110	A9670RM	Res: fxd met flm	510Ω	±1% ¼W	ERO-25CKF 5100	
C101, C102	A9360CY	Cap: fxd polye flm	0.01μF	±10% 1250V	ECQ-E12103KZ	
C103	A9364CA	Cap: fxd Al elect	1000μF	35V	ECE-A1VS102R	
C104	A9373CA	Cap: fxd Al elect	220μF	35V	ECE-A1VS221R	
D101, D102	A9235HD	Diode: Si			RM-1F	1500V, 0.5A
D103~D108	A9248HD	Diode: Si			1S953	
D109	A9236HD	Diode: Si			F14A	
D110	A9093HL	Diode: array			1G4B1	
Q101	A9340HQ	TSTR: Si NPN			2SC1815-Y	
Q102	A9287HQ	TSTR: Si NPN			2SD1268-P, Q	
Q103	A9442HQ	TSTR: Si NPN			2SC2720	
Q104	A9340HQ	TSTR: Si NPN			2SC1815-Y	
CN1	A9398KP	Conn			5046-04A	4P
CN3	A9598KP	Conn			5274-02A	2P

6-4. X-Axis Servo Amp PCB Ass'y: B9551WM (Cont'd).

Item	Part No.	Part Name and Description		Remarks
CN5	A9599KP	Conn	5274-04A	4P
CN7	A9237KP	Conn	225J-20621-487(115)	for Preamp
CN8	A9322KP	Conn	225J-21021-487(115)	for Time Base
CN9	A9400KP	Conn	5046-07A	7P
CN11	A9500KP	Conn	5046-06A	6P
CN13	A9397KP	Conn	5046-03A	3P
CN15	A9397KP	Conn	5046-03A	3P
CN17	A9399KP	Conn	5046-05A	5P
CN19	A9599KP	Conn	5274-04A	4P
	B9551GL	Heat sink (1 pc)		for Q3~Q6
	A9177KH	Heat sink (2 pcs)		for U8, U9
	Y9306LB	Screw: M3 x 6 (8 pcs)		
	Y9305TT	Tapping screw: M3 x 5 (2 pcs)		
	B9551WN	Printed board		

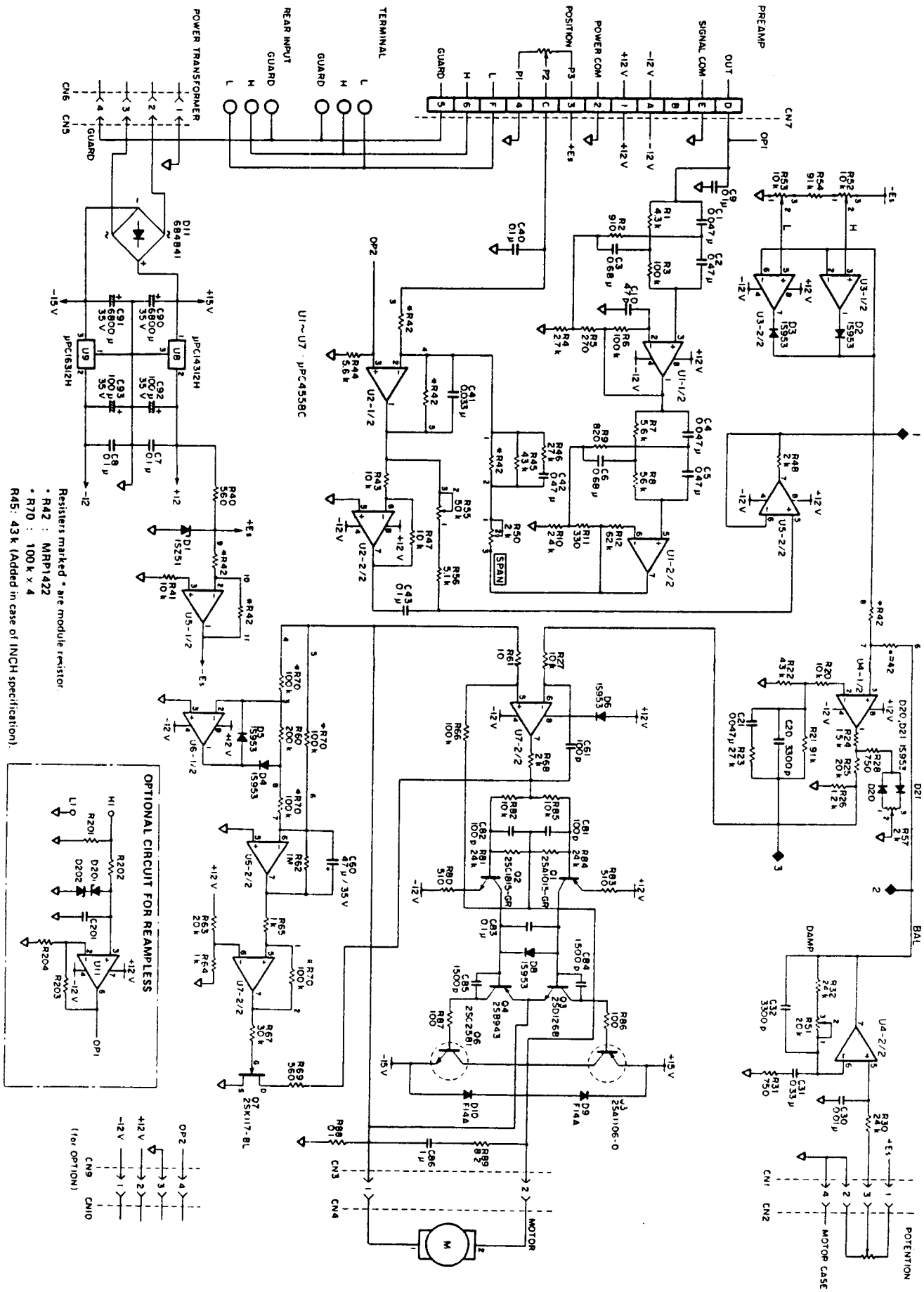
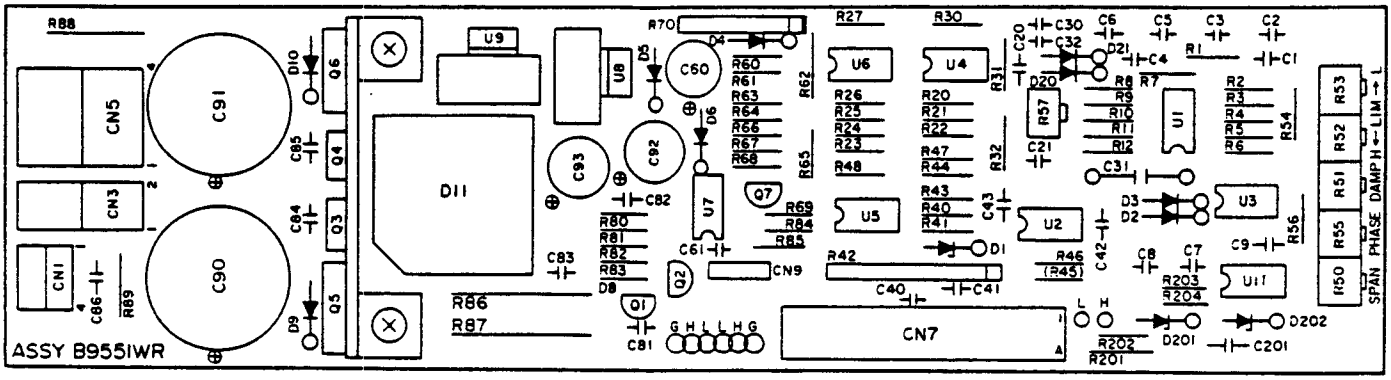


Figure 6-5a. Y-Axis Servo Amp PCB Ass'y: B9551WR Schematic Diagram.



Notes: 1. R45 is equipped with INCH specifications.
2. Parts with Item nos. of 200 order and CN9, U11 are used only in PREAMPLESS (OPTION) version.

Figure 6-5b. Y-Axis Servo Amp PCB Ass'y: B9551WR Components Location Diagram.

6-5. Y-Axis Servo Amp PCB Ass'y: B9551WR.

Item	Part No.	Part Name and Description					Remarks
R1	A9692RM	Res: fxd met flm	4.3kΩ	±1%	¼W	ERO-25CKF 4301	
R2	A9676RM	Res: fxd met flm	910Ω	±1%	¼W	ERO-25CKF 9100	
R3	A9725RM	Res: fxd met flm	100kΩ	±1%	¼W	ERO-25CKF 1003	
R4	A9687RM	Res: fxd met flm	2.7kΩ	±1%	¼W	ERO-25CKF 2701	
R5	A9663RM	Res: fxd met flm	270Ω	±1%	¼W	ERO-25CKF 2700	
R6	A9725RM	Res: fxd met flm	100kΩ	±1%	¼W	ERO-25CKF 1003	
R7	A9695RM	Res: fxd met flm	5.6kΩ	±1%	¼W	ERO-25CKF 5601	
R8	A9719RM	Res: fxd met flm	56kΩ	±1%	¼W	ERO-25CKF 5602	
R9	A9675RM	Res: fxd met flm	820Ω	±1%	¼W	ERO-25CKF 8200	
R10	A9686RM	Res: fxd met flm	2.4kΩ	±1%	¼W	ERO-25CKF 2401	
R11	A9665RM	Res: fxd met flm	330Ω	±1%	¼W	ERO-25CKF 3300	
R12	A9720RM	Res: fxd met flm	62kΩ	±1%	¼W	ERO-25CKF 6202	
R20	A9701RM	Res: fxd met flm	10kΩ	±1%	¼W	ERO-25CKF 1002	
R21	A9724RM	Res: fxd met flm	91kΩ	±1%	¼W	ERO-25CKF 9102	
R22	A9692RM	Res: fxd met flm	4.3kΩ	±1%	¼W	ERO-25CKF 4301	
R23	A9711RM	Res: fxd met flm	27kΩ	±1%	¼W	ERO-25CKF 2702	
R24	A9681RM	Res: fxd met flm	1.5kΩ	±1%	¼W	ERO-25CKF 1501	
R25	A9708RM	Res: fxd met flm	20kΩ	±1%	¼W	ERO-25CKF 2002	
R26	A9679RM	Res: fxd met flm	1.2kΩ	±1%	¼W	ERO-25CKF 1201	
R27	A9701RM	Res: fxd met flm	10kΩ	±1%	¼W	ERO-25CKF 1002	
R28	A9674RM	Res: fxd met flm	750Ω	±1%	¼W	ERO-25CKF 7500	

6-5. Y-Axis Servo Amp PCB Ass'y: B9551WR (Cont'd).

Item	Part No.	Part Name and Description					Remarks
R30	A9710RM	Res: fxd met flm	24kΩ	±1%	¼W	ERO-25CKF 2402	
R31	A9674RM	Res: fxd met flm	750Ω	±1%	¼W	ERO-25CKF 7500	
R32	A9710RM	Res: fxd met flm	24kΩ	±1%	¼W	ERO-25CKF 2402	
R40	A9671RM	Res: fxd met flm	560	±1%	¼W	ERO-25CKF 5600	
R41	A9701RM	Res: fxd met flm	10kΩ	±1%	¼W	ERO-25CKF 1002	
R42	A9166RL	Res: module				MRP1422	
R43	A9701RM	Res: fxd met flm	10kΩ	±1%	¼W	ERO-25CKF 1002	
R44	A9695RM	Res: fxd met flm	5.6kΩ	±1%	¼W	ERO-25CKF 5601	
(R45)	A9716RM	Res: fxd met flm	43kΩ	±1%	¼W	ERO-25CKF 4302	for INCH specification
R46	A9711RM	Res: fxd met flm	27kΩ	±1%	¼W	ERO-25CKF 2702	
R47	A9701RM	Res: fxd met flm	10kΩ	±1%	¼W	ERO-25CKF 1002	
R48	A9684RM	Res: fxd met flm	2kΩ	±1%	¼W	ERO-25CKF 2001	
R50	A9544RV	Res: var cermet	2kΩ	±20%	¼W	ET-6X 2kΩ	
R51	A9271RV	Res: var cermet	20kΩ	±20%	¼W	ET-6X 20kΩ	
R52, R53	A9348RV	Res: var cermet	10kΩ	±20%	¼W	ET-6X 10kΩ	
R54	A9724RM	Res: fxd met flm	91kΩ	±1%	¼W	ERO-25CKF 9102	
R55	A9272RV	Res: var cermet	50kΩ	±20%	¼W	ET-6X 50kΩ	
R56	A9694RM	Res: fxd met flm	5.1kΩ	±1%	¼W	ERO-25CKF 5101	
R57	A9544RV	Res: var cermet	2kΩ	±20%	¼W	ET-6X 2kΩ	
R60	A9732RM	Res: fxd met flm	200kΩ	±1%	¼W	ERO-25CKF 2003	
R61	A9629RM	Res: fxd met flm	10Ω	±1%	¼W	ERO-25CKF 10R0	
R62	A9870RM	Res: fxd met flm	1MΩ	±1%	½W	ERO-50CKF 1004	
R63	A9708RM	Res: fxd met flm	20kΩ	±1%	¼W	ERO-25CKF 2002	

6-5. Y-Axis Servo Amp PCB Ass'y: B9551WR (Cont'd).

Item	Part No.	Part Name and Description					Remarks
R64, R65	A9677RM	Res: fxd met film	1kΩ	±1%	¼W	ERO-25CKF 1001	
R66	A9725RM	Res: fxd met film	100kΩ	±1%	¼W	ERO-25CKF 1003	
R67	A9712RM	Res: fxd met film	30kΩ	±1%	¼W	ERO-25CKF 3002	
R68	A9684RM	Res: fxd met film	2kΩ	±1%	¼W	ERO-25CKF 2001	
R69	A9671RM	Res: fxd met film	560Ω	±1%	¼W	ERO-25CKF 5600	
R70	A9096RL	Res: module	100kΩ	±5%	1/8W	RK1/8 84S 100kΩJ	4 elements
R80	A9670RM	Res: fxd met film	510Ω	±1%	¼W	ERO-25CKF 5100	
R81	A9710RM	Res: fxd met film	24kΩ	±1%	¼W	ERO-25CKF 2402	
R82	A9701RM	Res: fxd met film	10kΩ	±1%	¼W	ERO-25CKF 1002	
R83	A9670RM	Res: fxd met film	510Ω	±1%	¼W	ERO-25CKF 5100	
R84	A9710RM	Res: fxd met film	24kΩ	±1%	¼W	ERO-25CKF 2402	
R85	A9701RM	Res: fxd met film	10kΩ	±1%	¼W	ERO-25CKF 1002	
R86, R87	A9329RK	Res: fxd met film	100Ω	±5%	2W	ERG-2ANJ 101	
R88	A9506RA	Res: fxd ww	0.1Ω	±10%	2W	ERW-2PK R10	
R89	A9220RK	Res: fxd met film	8.2Ω	±5%	½W	ERX-12AVJ 8.2Ω	
R201~R204							for Preampless (Optional)
C1	A9254CY	Cap: fxd polye film	0.047μF	±10%	50V	MFL5002-473K	
C2	A9369CY	Cap: fxd polye film	0.47μF	±10%	63V	553M6302-474K	
C3	A9370CY	Cap: fxd polye film	0.68μF	±10%	50V	553M5002-684K	
C4	A9254CY	Cap: fxd polye film	0.047μF	±10%	50V	MFL5002-473K	
C5	A9369CY	Cap: fxd polye film	0.47μF	±10%	63V	553M6302-474K	
C6	A9370CY	Cap: fxd polye film	0.68μF	±10%	50V	553M5002-684K	
C7~C9	A9114CC	Cap: fxd cer	0.1μF		50V	RPE112-127F104Z50	
C10	A9021CN	Cap: fxd mica	47pF	±10%	100V	DM05C 470K1	
C20	A9247CY	Cap: fxd polye film	3300pF	±10%	50V	MFL5002-332K	
C21	A9254CY	Cap: fxd polye film	0.047μF	±10%	50V	MFL5002-473K	
C30	A9250CY	Cap: fxd polye film	0.01μF	±10%	50V	MFL5002-103K	
C31	A9232CY	Cap: fxd polye film	0.33μF	±10%	100V	ECQ-E1334KZ	
C32	A9247CY	Cap: fxd polye film	3300pF	±10%	50V	MFL5002-332K	
C40	A9114CC	Cap: fxd cer	0.1μF		50V	RPE112-127F104Z50	
C41	A9253CY	Cap: fxd polye film	0.033μF	±10%	50V	MFL5002-333K	
C42	A9369CY	Cap: fxd polye film	0.47μF	±10%	63V	553M6302-474K	
C43	A9229CY	Cap: fxd polye film	0.1μF	±10%	100V	ECQ-E1104KZ	
C60	A9360CA	Cap: fxd Al elect	47μF		35V	ECE-A1VS470R	
C61	A9025CN	Cap: fxd mica	100pF	±10%	100V	DM05C 101K1	
C81, C82	A9025CN	Cap: fxd mica	100pF	±10%	100V	DM05C 101K1	
C83	A9114CC	Cap: fxd cer	0.1μF		50V	RPE112-127F104Z50	
C84, C85	A9245CY	Cap: fxd polye film	1500pF	±10%	50V	MFL5002-152K	
C86	A9128CC	Cap: fxd cer	1μF		50V	RPE113F105Z50	

6-5. Y-Axis Servo Amp PCB Ass'y: B9551WR (Cont'd).

Item	Part No.	Part Name and Description	Remarks
C90, C91	A9406CA	Cap: fxd Al elect 6800μF 35V ECE-S1VU682M	
C92, C93	A9336CA	Cap: fxd Al elect 100μF 35V ECE-A1VS101R	
C201			for Preampless (Optional)
D1	A9337HD	Diode: zener 1SZ51	
D2~D6	A9248HD	Diode: Si 1S953	
D7			not assigned
D8	A9248HD	Diode: Si 1S953	
D9 D10	A9236HD	Diode: Si F14A	
D11	A9133HL	Diode: array 6B4B41	
D20, D21	A9248HD	Diode: Si 1S953	
D201, D202			for Preampless (Optional)
Q1	A9465HQ	TSTR: Si PNP 2SA1015-GR	
Q2	A9464HQ	TSTR: Si NPN 2SC1815-GR	
Q3	A9287HQ	TSTR: Si NPN 2SD1268-P, Q	
Q4	A9334HQ	TSTR: Si PNP 2SB943-P, Q	
Q5	A9400HQ	TSTR: Si PNP 2SA1106-O	
Q6	A9408HQ	TSTR: Si NPN 2SC2581	
Q7	A9413HQ	TSTR: FET 2SK117BL	
U1~U7	A9082LA	IC: dual OP amp μPC4558C	
U8	A9104LA	IC: +12V voltage regulator μPC14312H	
U9	A9105LA	IC: −12V voltage regulator μPC16312H	
U11			for Preampless (Optional)
CN1	A9398KP	Conn 5046-04A	4P
CN3	A9598KP	Conn 5274-02A	2P
CN5	A9599KP	Conn 5274-04A	4P
CN7	A9237KP	Conn 225J-20621-487(115)	for Preamp
	B9551GM	Heat Shink (1 pc)	for Q3~Q6
	A9177KH	Heat shink (2 pcs)	for U8, U9
	Y9306LB	Screw: M3 x 6 (8 pcs)	
	Y9305TT	Tapping screw: M3 x 5 (2 pcs)	
	B9551WS	Printed board	

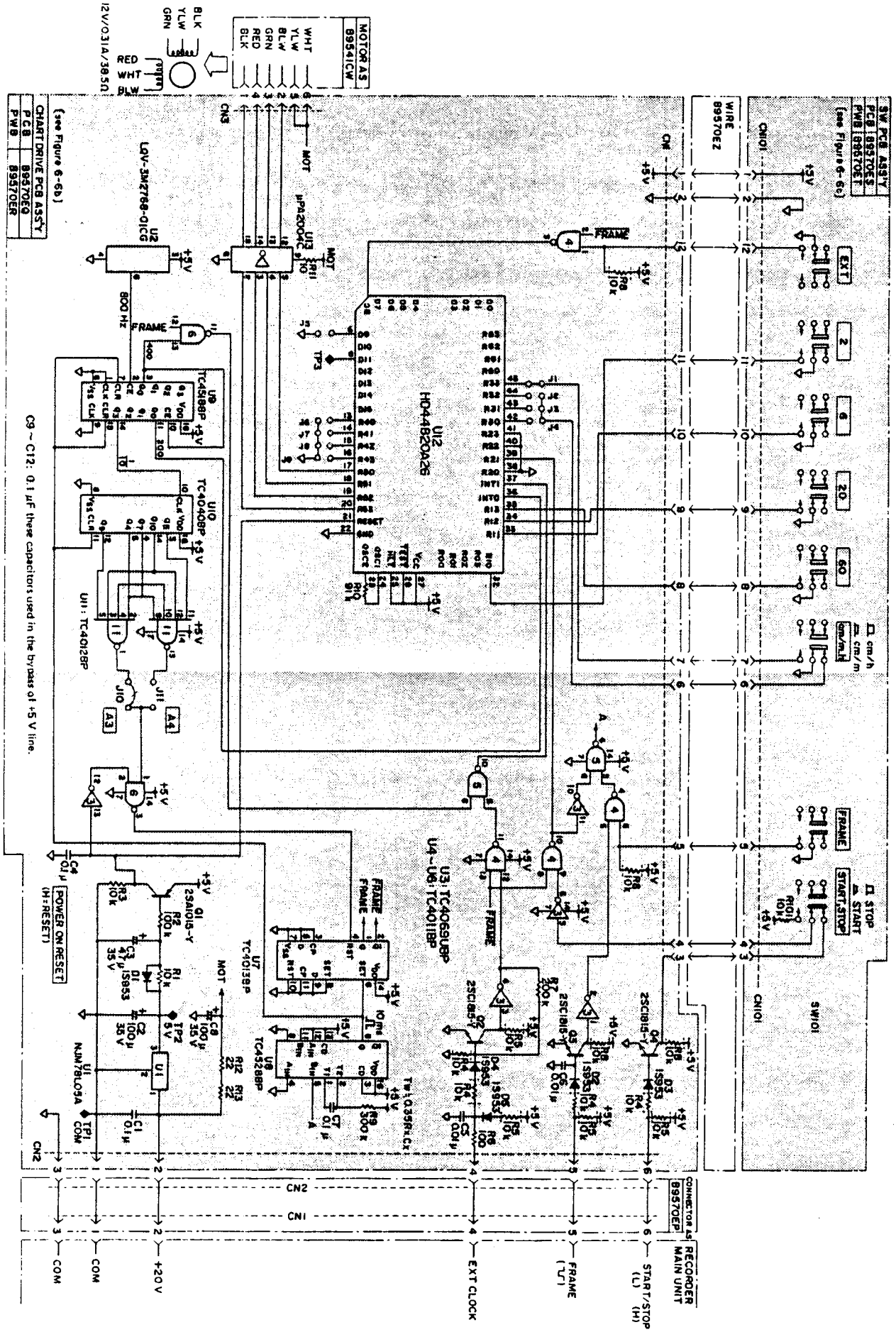


Figure 6-6a. Chart Drive Unit (Optional) Overall Wiring.

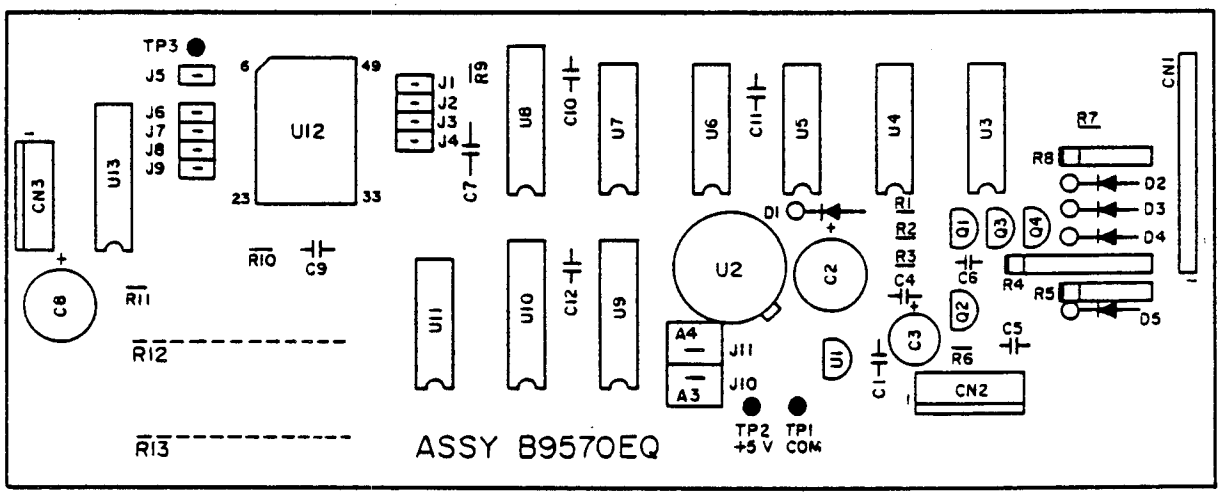


Figure 6-6b. Chart Drive PCB Ass'y: B9570EQ Components Location Diagram.

6-6b. Chart Drive PCB Ass'y: B9570EQ.

Item	Part No.	Part Name and Description					Remarks
R1	A9073RG	Res: fxd met film	10kΩ	±1%	¼W	LF¼ 10kΩF	radial
R2	A9097RG	Res: fxd met film	100kΩ	±1%	¼W	LF¼ 100kΩF	radial
R3	A9073RG	Res: fxd met film	10kΩ	±1%	¼W	LF¼ 10kΩF	radial
R4	A9115RL	Res: module	10kΩ	±5%	1/8W	RK1/8B4S 10kΩJ	4 elements
R5	A9029RL	Res: module	10kΩ	±5%	1/8W	RK1/8B4 10kΩJ	4 elements
R6	A9025RG	Res: fxd met film	100Ω	±1%	¼W	LF¼ 100ΩF	radial
R7	A9104RG	Res: fxd met film	200kΩ	±1%	¼W	LF¼ 200kΩF	radial
R8	A9029RL	Res: module	10kΩ	±5%	1/8W	RK1/8B4 10kΩJ	4 elements
R9	A9108RG	Res: fxd met film	300kΩ	±1%	¼W	LF¼ 300kΩF	radial
R10	A9096RG	Res: fxd met film	91kΩ	±1%	¼W	LF¼ 91kΩF	radial
R11	A9001RG	Res: fxd met film	10Ω	±1%	¼W	LF¼ 10ΩF	radial
R12, R13	A9464RA	Res: fxd ww	22Ω	±5%	5W	ERF-5AJ-220	
C1	A9114CC	Cap: fxd cer	0.1μF		50V	RPE112-127F104Z50	
C2	A9336CA	Cap: fxd Al elect	100μF		35V	ECE-A1VS101R	
C3	A9290CA	Cap: fxd Al elect	4.7μF		35V	ECE-A1VS4R7R	
C4	A9114CC	Cap: fxd cer	0.1μF		50V	RPE112-127F104Z50	
C5, C6	A9250CY	Cap: fxd polye film	0.01μF	±10%	50V	MFL5002-103K	
C7	A9229CY	Cap: fxd polye film	0.1μF	±10%	100V	ECQ-E1104KZ	
C8	A9336CA	Cap: fxd Al elect	100μF		35V	ECE-A1VS101R	
C9, C10	A9114CC	Cap: fxd cer	0.1μF		50V	RPE112-127F104Z50	
C11, C12	A9114CC	Cap: fxd cer	0.1μF		50V	RPE112-127F104Z50	
D1~D5	A9248HD	Diode: Si				1S953	
Q1	A9338HQ	TSTR: Si PNP				2SA1015-Y	
Q2~Q4	A9340HQ	TSTR: Si NPN				2SC1815-Y	
U1	A9205LA	IC: +5V voltage regulator				NJM78L05A	+5V, 100 mA
U2	A9113EX	IC: oscillator/freq. divider				LQV-3M2768-01CG	MOS
U3	A9075LM	IC: digital				TC4069UBP	MOS
U4~U6	A9030LM	IC: digital				TC4011BP	MOS
U7	A9013LM	IC: digital				TC4013BP	MOS
U8	A9166LM	IC: digital				TC4528BP	MOS
U9	A9129LM	IC: digital				TC4518BP	MOS
U10	A9052LM	IC: digital				TC4040BP	MOS
U11	A9006LM	IC: digital				TC4012BP	MOS
U12	B9522ZZ	LSI: 1 chip μP				HD44820A26	MOS
U13	A9096HL	IC: NPN Derlington TSTR array				μPA2004C	
CN1	B9570EZ	Wire					see Fig. 6-6a
CN2 CN3	A9303KP	Conn				5045-06A	6P
TP1~TP3	A9574KP	Test point				VTC-1-1	
J10 or J11	A9025RG	Res: fxd met film	100Ω	±1%	¼W	LF¼ 100ΩF	Jumper for A3/A4 selection
	B9570ER	Printed board					

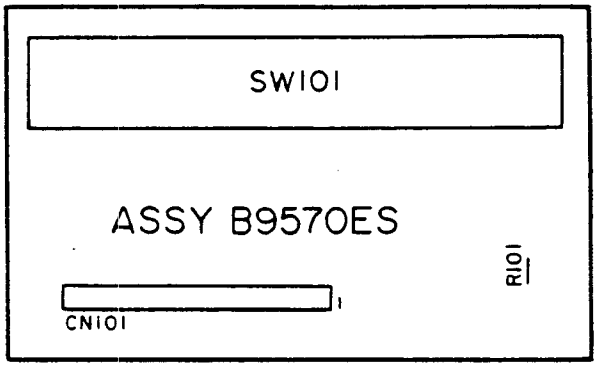


Figure 6-6c. Switch PCB Ass'y: B9570ES Components Location Diagram.

6-6c. Switch PCB Ass'y: B9570ES.

Item	Part No.	Part Name and Description	Remarks
R101	A9073RG	Res: fxd met flm 10kΩ ±1% ¼W LF¼ 10kΩF	radial
SW101	B9570EN	Sw: push	
	B9570ET	Printed board	

OMEGA® ...Your Source for Process Measurement and Control

TEMPERATURE

- ☑ Thermocouple, RTD & Thermistor Probes, Connectors, Panels & Assemblies
- ☑ Wire: Thermocouple, RTD & Thermistor
- ☑ Calibrators & Ice Point References
- ☑ Recorders, Controllers & Process Monitors
- ☑ Infrared Pyrometers

PRESSURE/STRAIN/FORCE

- ☑ Transducers & Strain Gauges
- ☑ Load Cells & Pressure Gauges
- ☑ Displacement Transducers
- ☑ Instrumentation & Accessories

FLOW/LEVEL

- ☑ Rotameters, Gas Mass Flowmeters & Flow Computers
- ☑ Air Velocity Indicators
- ☑ Turbine/Paddlewheel Systems
- ☑ Totalizers & Batch Controllers

pH/CONDUCTIVITY

- ☑ pH Electrodes, Testers & Accessories
- ☑ Benchtop/Laboratory Meters
- ☑ Controllers, Calibrators, Simulators & Pumps
- ☑ Industrial pH & Conductivity Equipment

DATA ACQUISITION

- ☑ Data Acquisition and Engineering Software
- ☑ Communications-Based Acquisition Systems
- ☑ Plug-in Cards for Apple, IBM & Compatibles
- ☑ Datalogging Systems
- ☑ Recorders, Printers & Plotters

HEATERS

- ☑ Heating Cable
- ☑ Cartridge & Strip Heaters
- ☑ Immersion & Band Heaters
- ☑ Flexible Heaters
- ☑ Laboratory Heaters