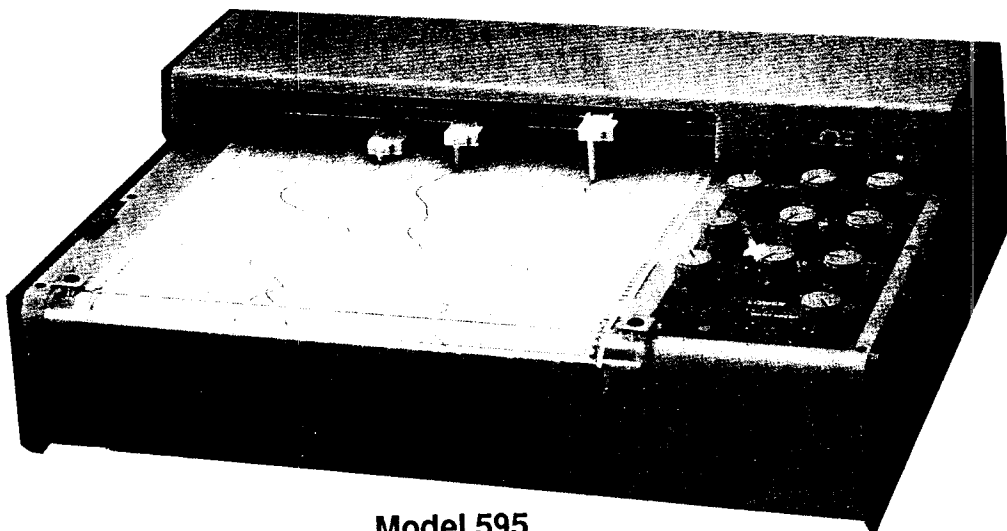


®  555, 585, 595

®  One-, Two- and Three-Pen
Deluxe Laboratory Chart Recorders



Model 595



Operator's Manual
M95/0692

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INTRODUCTION

The DC analog recorder is an application of advanced electronic techniques. Its solid state modular circuitry yields high performance and reliability.

This graphic recorder may be used in many different applications in the medical, teaching and industrial fields where a precision instrument is of utmost importance.

Measurement of DC voltage, current, temperature, and a variety of other variables are made possible with the use of the recorder.

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 in the event reshipment is necessary.

SPECIFICATIONS

GENERAL

1. Power: 115/230VAC $\pm 10\%$, 50/60Hz, 1
2. Wattage:

Single Channel	21W nominal
Dual Channel	29W nominal
Triple Channel	38W nominal
3. Fuse: 3AG Slo-Blo 0.5A @ 115v
For all Models 0.25A @ 230v
4. Writing Method: Pens are disposable fiber tipped units with self-contained ink supply
5. Chart: 250mm width; 30 meter length
6. Dimensions: 14.3cm (5.625") H x 45.7cm (18") W x 35cm (13.75") D
7. Weight: 5.7Kg (12.5lbs.) to 7.25Kg (16lbs)
8. Auxiliary Power Supply: I out > than 1/4A @ 24VDC (low line condition)
- V out < than 40VDC, no load (high line condition)

SERVO SYSTEM

1. Span-Full Scale: 1mV, 2mV, 5mV, 10mV, 20mV, 50mV, 100mV, 500mV, 1V, 2V and 5V (10.mV through 50V with uncalibrated 10:1 attenuator) Model 555, 585, 595
2. Input Type: Floating ($\pm 100V$ single ended)
3. Input Impedance: 20 Megohms through 100mV, 2.5 Megohms through 5 volts
4. Pen Response <0.5 sec full scale
5. Damping: Critically damped on all ranged (requires no adjustment)
6. Accuracy:

Linearity	$\pm 0.5\%$
Deadband	$\pm 0.1\%$
Repeatability	$\pm 0.1\%$

- 7. Zero Adjust: Continuously adjustable from -100% to +100% (full scale + 100% suppression) on each range. Right hand zero is standard
- 8. Normal Mode: 35db Typical @ 50/60Hz
Rejection: Begins Filtering @ 3Hz, 100 Volts maximum

CHART DRIVE SYSTEM

- 1. Chart Drive: Stepper Motor
- 2. Chart Speeds: 1, 2, 3, 4, 5, 6, 10, 12, 15, 20 and 30 cm - Per Minute and Per Hour, Switch Selectable
- 3. Chart Speed Accuracy: Less than 0.03% Error - Typical 0.02%
- 4. Control: Internal Crystal Oscillator
External Remote Pulse Train, TTL/CMOS or Contact Closure for Start/Stop

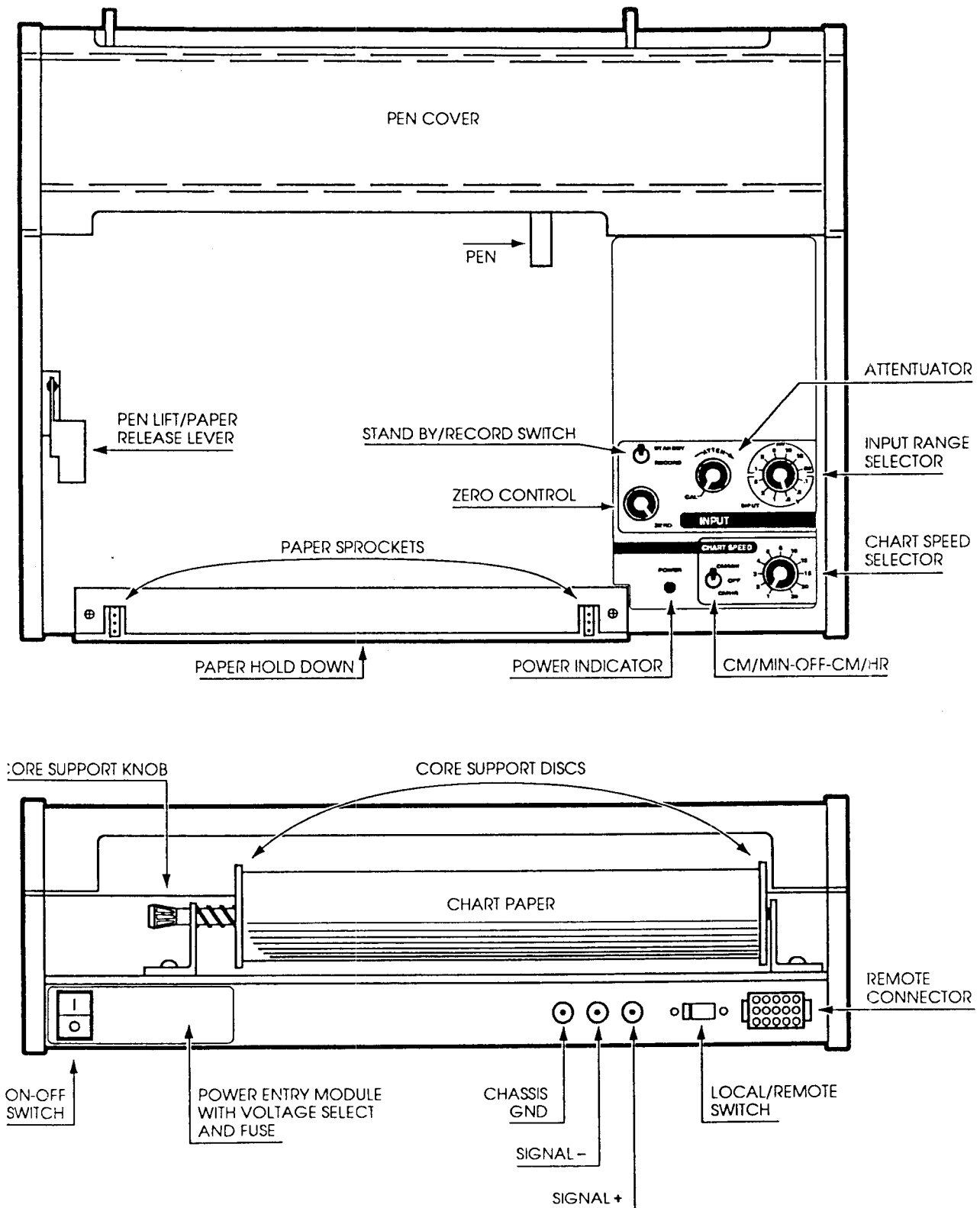


FIGURE 1 - SINGLE CHANNEL INPUT/CONTROL LOCATION

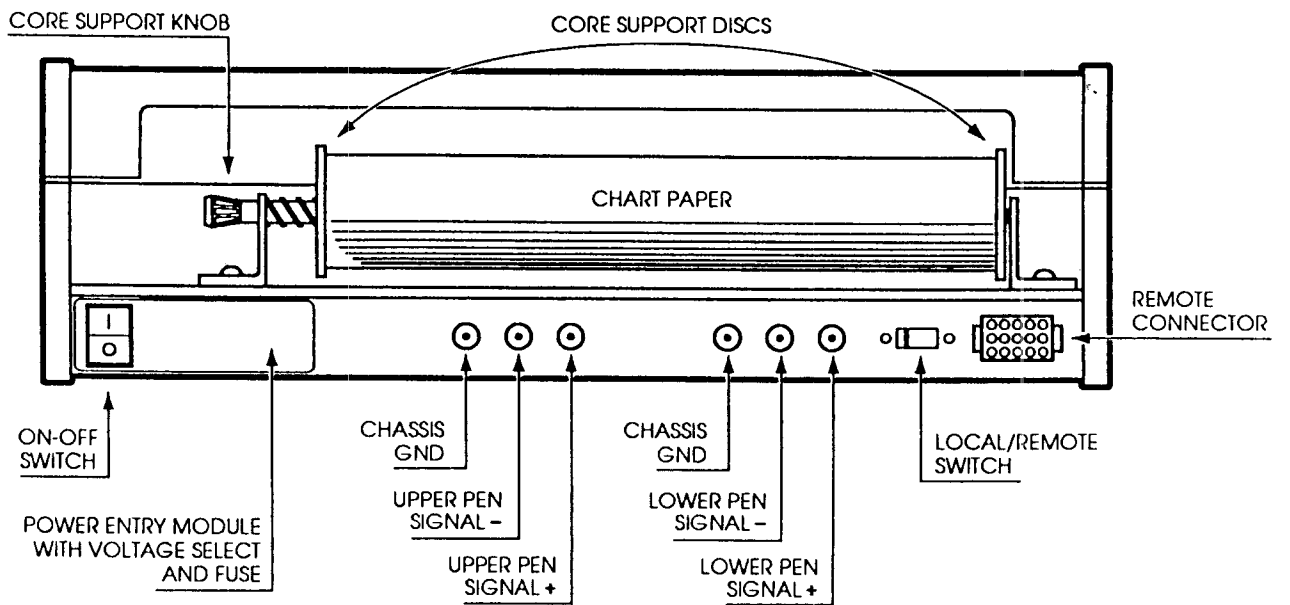
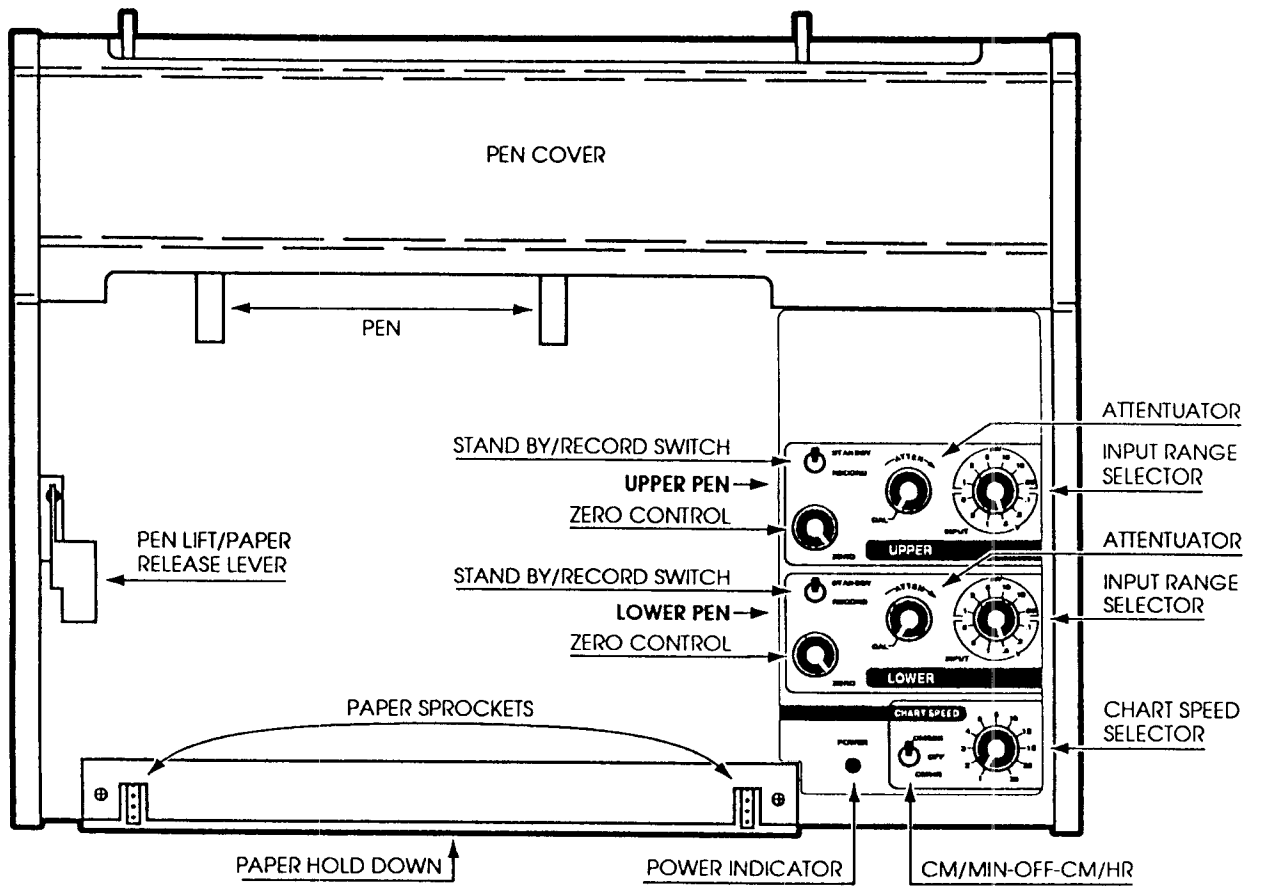


FIGURE 2 - DUAL CHANNEL INPUT/CONTROL LOCATION

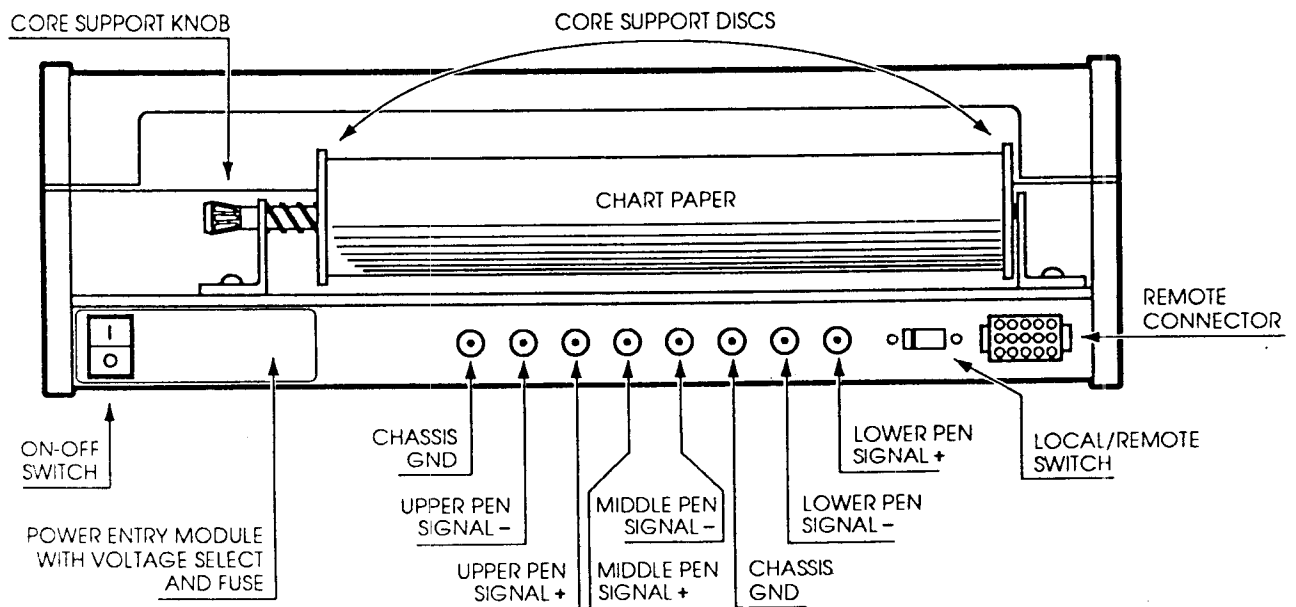
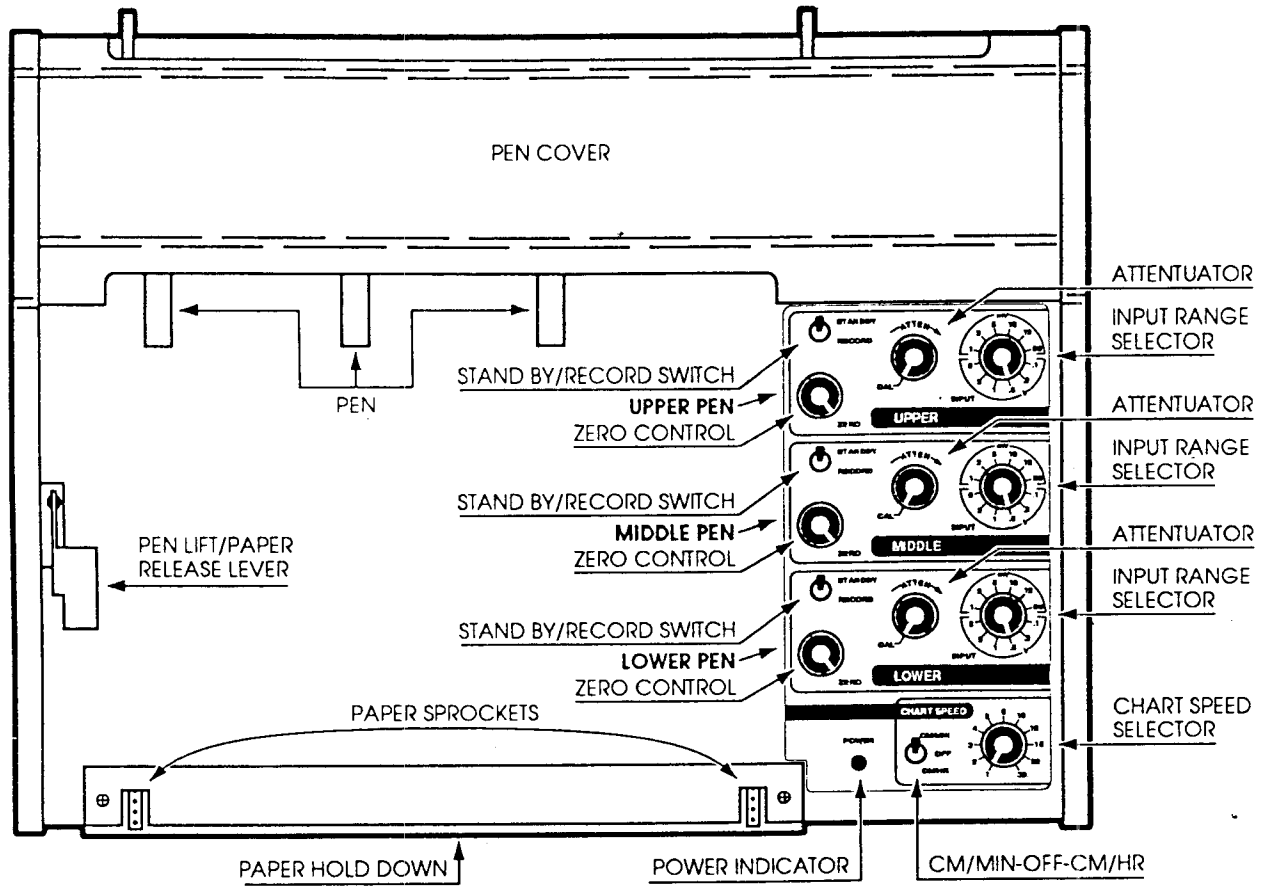
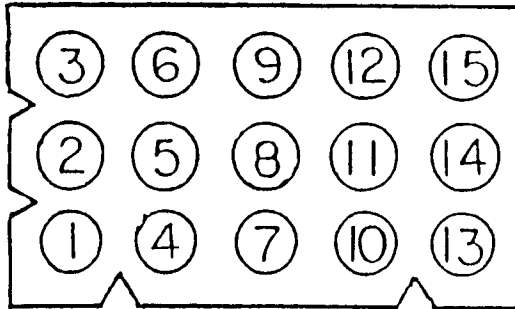


FIGURE 3 - 3 CHANNEL INPUT/CONTROL LOCATION



MOLEX - 15 PIN LEGEND	
PIN NO'S	DESCRIPTION
1 & 2	OPTION 16 - OVERRIDE EVENT
3 & 4 *	OPTION 11 - ELECTRIC EVENT MARK
5 & 6	OPTION 12 - REMOTE START / STOP
7	GROUND
8 & 9 *	OPTION 13 - ELECTRIC PEN LIFT
10, 11, 12 & 14	NOT USED
13 & 15	(+13) (-15) - AUX POWER SUPPLY
*	NOT AVAILABLE ON MODEL 595

FIGURE 4 — DIAGRAM — 15 PIN MOLEX CONNECTION

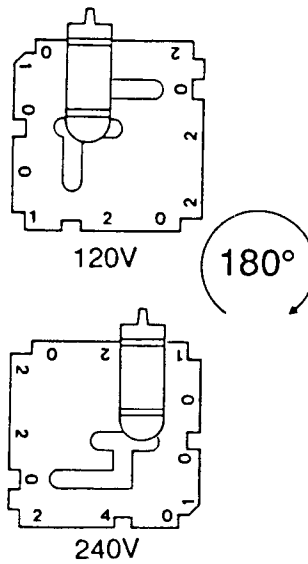
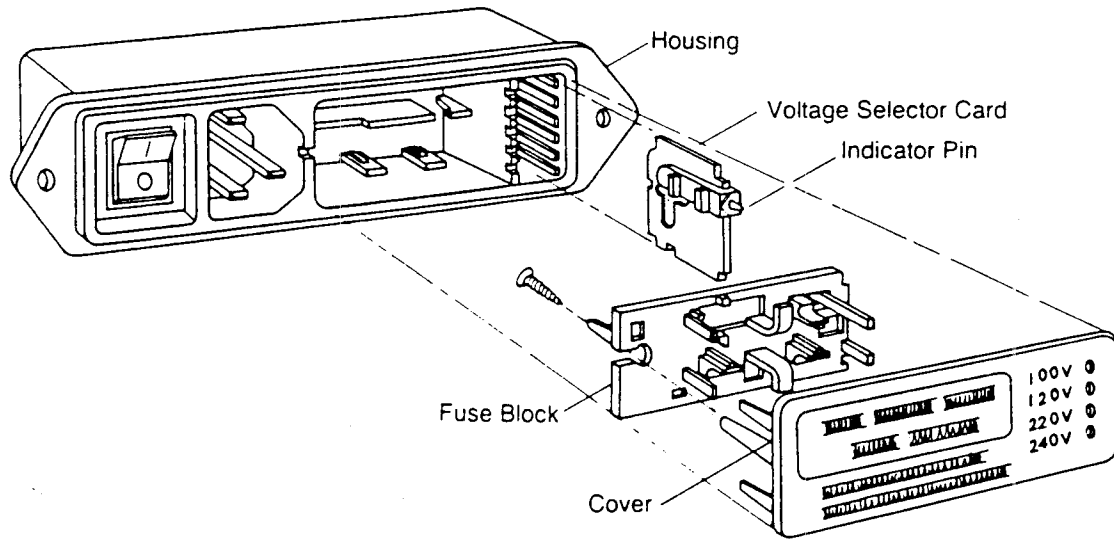


FIGURE 5 - DETECTOR VOLTAGE SELECTOR

SET UP PROCEDURES

The procedures, detailed in the following paragraphs, must be performed to prepare the recorder for operation

ELECTRICAL CONNECTIONS (See Figure 5)

Setting Voltage:

Check the voltage selector block located next to the power cord connector on the rear panel. The white plastic tab indicates the voltage for which the instrument has been configured. This has been factory set for the voltage appropriate to your country (120 or 240 VAC; 50 or 60 Hz). If the voltage is incorrectly set, you should reset it to the proper value before proceeding further. The recorder will not function in 100 and 220 VAC positions.

Insert the blade of a small screwdriver into the slot next to the connector and pry open the fuse block. Pull the fuse block straight out. Using tweezers or a pair of longnose pliers, pull the voltage selector card straight out. Orient the plastic indicator for the proper voltage as indicated in Figure 5, then press the selector card back into place. Insure that the proper fuse is inserted for the voltage selected as follows:

- .5A S.B. for 120 VAC and
- .25A S.B. for 240 VAC

Snap the fuse block cover back into place.

Power Cord:

Power to the detector is provided by a standard modular power cord assembly. Connect the power cord to the receptacle next to the fuse block.

CHART PAPER INSTALLATION

1. Remove masking tape from new roll of chart paper and cut or tear each side to form a blunt point at the center. (DO NOT FOLD.)
2. Pull the knob on the right side of the chart paper core support, located on the rear panel of the recorder. Install paper, making sure it seats evenly on the two core supports. Release knob.
3. Lift the pen lift lever (on the left side of the instrument) to the full upright position.
4. Manually feed the pointed paper under the pen cover and across the writing area.

5. Pull the paper under the paper hold down and across the paper sprockets, making sure the holes in the paper sit evenly on the sprockets.
6. The paper is now loaded for operation.

PAPER RELEASE SYSTEM

Your recorder is equipped with a sprocket release that enables you to advance or rewind the paper manually.

To advance or rewind the paper manually:

Lift the pen lift lever to the full UP position. The paper may now be moved forward or backward as desired

To re-engage chart drive:

Return pen lift lever to the full DOWN position.

NOTE: After manual advancement or rewind there may be a short delay, depending on chart speed selected, then the chart will run at the selected speed.

PEN INSTALLATION

1. Remove the pen cap and store it where it can easily be found. Pens can be left uncapped for long periods of time, but greater pen life results from capping when not in use.
2. Slide the pen into the pen carriage and gently push back until the nib is firmly seated against the carriage.
3. Return the pen lift lever to the original down position.

GROUNDING

For best performance, the green (or green and yellow) ground wire in the power cord for the recorder and the signal source should share a common water pipe ground. The green (green and yellow) wire in the power cord, is connected to the recorder ground (chassis), but not to the signal input. If the signal input does not have a third wire in its power cord, or if the instrument is not grounded, connect a wire between the recorder ground (green terminal) and the chassis of the signal source.

In case of large normal-mode signals, particularly 120Hz, connect the recorder ground (green terminal) to the source of the normal-mode signal, or to the negative recorder input (black terminal.)

INPUT SIGNAL CONNECTIONS

This instrument requires a DC voltage input. Signal sources with current outputs will require a shunt resistor across the + (red) and - (black) inputs. Ohms law may be used to compute the proper value for a given input range. The formula is:

$$R = \frac{E}{I}$$

Where E is the recorder span range selected in volts.
I is the maximum current signal to be recorded in amps.
R is the resistance of the shunt resistor in Ohms.

Electrical connections are made as follows:

Signal source positive to recorder Red (+) terminal.
Signal source negative to recorder Black (-) terminal.

Right hand chart zero is standard on the recorder. Positive going signals drive pen to the left. If an opposite presentation is desired, reverse the input leads and use the zero adjust control to position the pen to the opposite side of the chart. Negative signals will now drive the pen to the right.

NOTE: This unit is calibrated for right hand zero. Reversal of the input leads may yield a $\pm 3\%$ full scale error.

RECORDING PROCEDURE

With chart paper and pen(s) installed and recorder plugged into proper AC source (corresponding to the conversion slide switch on the back of the recorder) perform the following steps for routine recording.

1. Turn power switch on and chart switch off
2. Set input span to desired range and attenuator to Cal position.
3. Set record/stand-by switch to stand-by position.
4. Zero pen to right side of chart using zero control knob.
5. Set record/stand-by switch to "REC" position.

6. Adjust input span and attenuator for desired full scale range to best display input signal.
7. Turn chart drive on and set chart speed as desired. Make sure the chart paper holes are properly aligned with sprocket teeth.

8. REMOTE CHART CONTROL

Place the Remote-Local slide switch in the "Remote" position. To start the chart drive from a remote location, apply a contact closure between pins 5 and 6 of the remote control connector located on rear panel of recorder. The chart will stop when the contact is opened.

NOTE 1: When switching from one sensitivity range to another, it may be necessary to rezero the pen. To do so, place REC/STBY switch in "STBY" readjust the zero knob. (The zero control has no stops at the end of mechanical travel) Return REC/STBY switch to "REC".

NOTE 2: In most models, the input resistance is so high that the pen may drift when no connections are present at the input.

NOTE 3: If the pen is physically stalled on the chart for a few seconds, the servo system will shut down to protect the motor. The best way to reset the system is to turn the recorder off for about 5 seconds, and then back on. Pen should reactivate and continue to record normally.

If the shutdown resulted from an overrange, the recorder will operate normally as soon as the input signal decreases to a level which is within the selected span range.

GENERAL THEORY

The DC input signal to the recorder is first filtered, then amplified by the preamp to a level which is less susceptible to noise and interference. This conditioned signal is then applied to the servo amplifier which continuously compares it to the feedback signal developed by the servo potentiometer.

The difference between these two signals is a positive or negative error signal that is amplified and used to drive the servo motor, which is coupled to the servo potentiometer, in a direction as to reduce the error signal to zero. Since the recorder pen is mechanically coupled to the servo motor and servo potentiometer, its position on the chart represents an accurate and continuous permanent graphic record of the input signal (See Figure 6).

CHART RECORDER POWER SUPPLY

AC line voltage is reduced by stepdown transformers and converted to DC by solid state rectifiers and regulators. A stable DC voltage, generated by a temperature compensated zener diode, is used as a reference for the servo pot.

PEN DRIVE SYSTEM

A DC servo motor is used to control the servo pot and recorder pen by means of a gear driven servo drum assembly. The pen is attached to a drive cable which is wrapped around and secured to the drum. As the drum rotates, the pen is moved across the chart proportionate to the amount of drum rotation.

CHART DRIVE SYSTEM

In this simple, reliable system an internal crystal oscillator generates pulses which are divided down by integrated circuit logic. The chart speed switch selects the appropriate pulse rate to drive the stepper motor at the desired speed. (The crystal frequency is not a function of line frequency, therefore chart speeds are completely independent.)

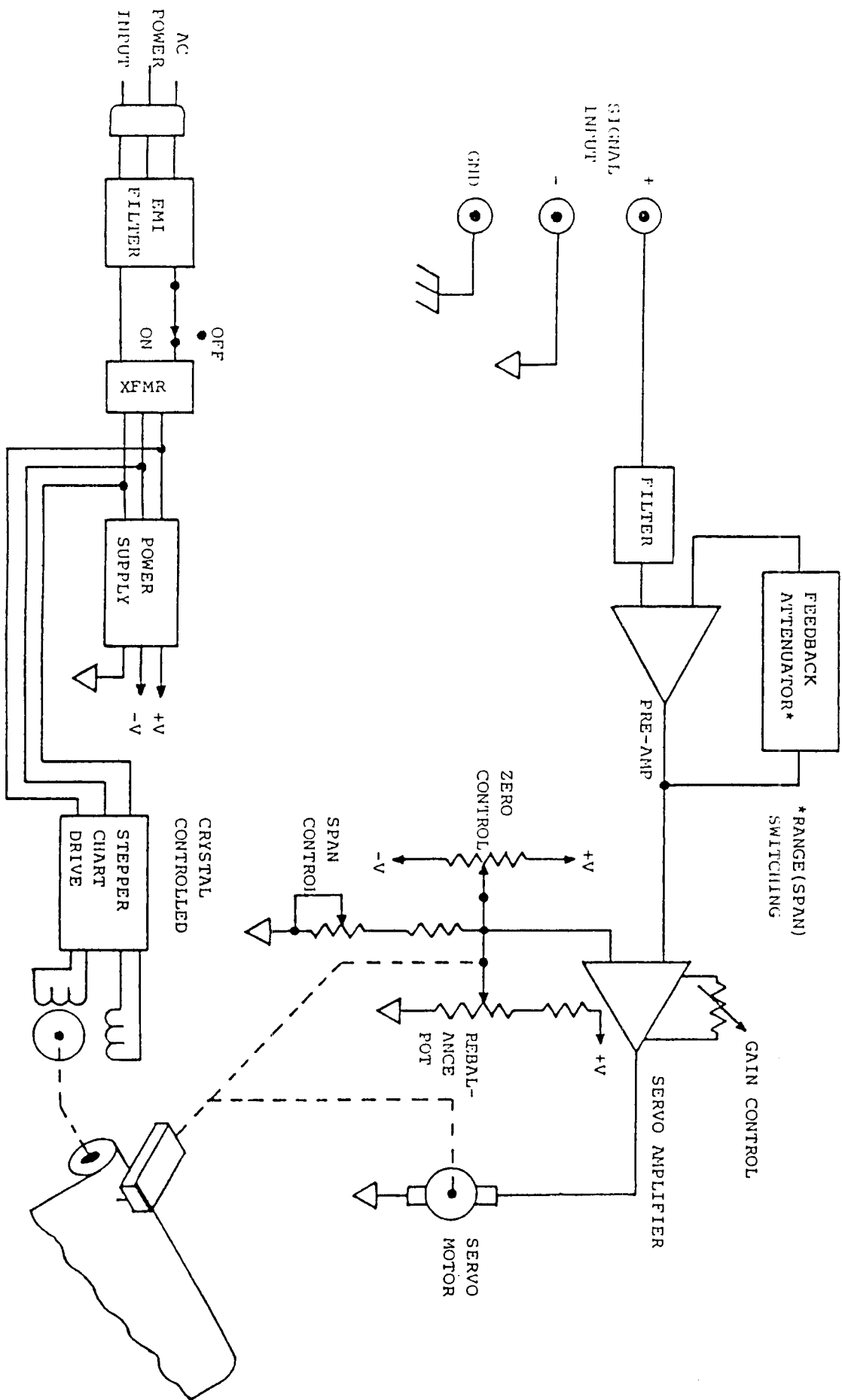


FIGURE 6 - BASIC RECORDER BLOCK DIAGRAM

CALIBRATION

This recorder is designed to be simple, reliable, easy to maintain and repair. Therefore, the procedures presented here will be as simple, clear and brief as possible. For special problems, we recommend that you contact the factory.

CHART RECORDER POWER SUPPLY

There are no calibration adjustments in the power supply. Barring failure, the reference voltages will remain constant and stable.

CHART DRIVE SYSTEM

The stepper drive printed circuit board has no calibration adjustments. Barring failure or gear binding, the stepper drive printed circuit board and stepper motor should give many years of reliable service. If a problem should arise, consult your factory service department.

PEN DRIVE SYSTEM

The calibrations covered in this section should be performed by a qualified technician. The technician must have knowledge of working around voltages which may cause an electrical shock.

NOTE: Gain, offset and span must be adjusted for each channel in multi-pen units.

1. Gain (See Figure 7)

The gain adjustment controls the servo loop gain or "dead band" of the recorder. This can be reached through a hole in the bottom of the recorder marked GAIN. If set too high, the pen will "buzz". If set too low, the pen will be sluggish.

To Calibrate:

- A. Short (+) and (-) inputs, (red and black connectors on back of recorder) and set pen to center scale by turning the zero control.
- B. Adjust gain control clockwise until pen "buzzes", then back off counterclockwise until buzzing stops.
- C. Recheck the adjustment by moving the pen cover full scale using the zero control. If pen "buzzes" at any point, turn gain control counterclockwise until the

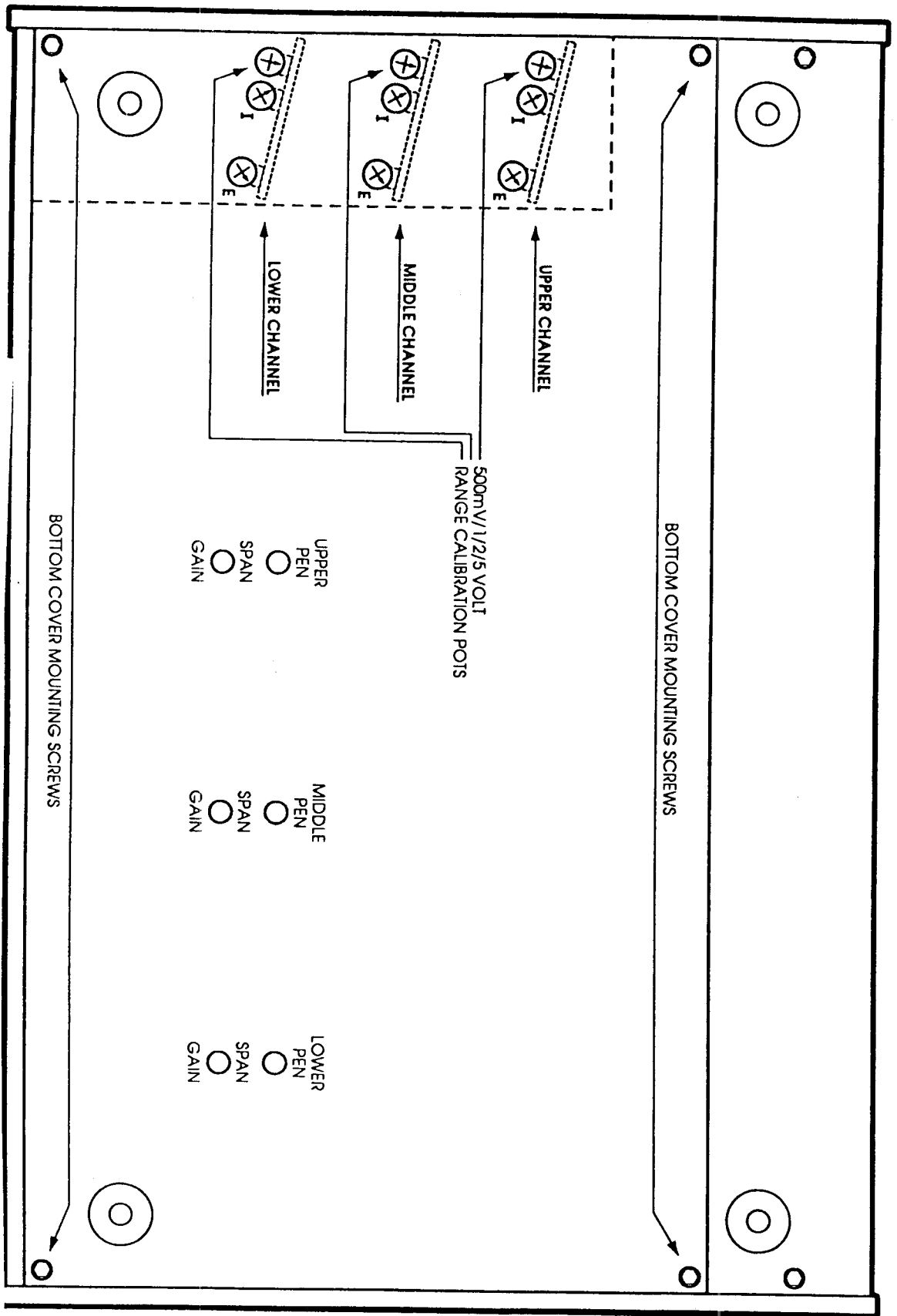


FIGURE 7 - BOTTOM COVER MOUNTING SCREW AND GAIN/SPAN/OFFSET CONTROL ACCESS LOCATION

2. Offset

This adjustment reduces the zero shift between input spans to a minimum value. Performance of this adjustment requires the recorder input to be switched between a short circuit and a 50K ohm resistor. Connect a 50K resistor across the recorder's input binding posts (+ and -).

2.1 Recorders with REC/STBY switch

- A. Allow the recorder to warm up to operating temperature (30 minutes is suggested).
- B. Remove the bottom panel of the recorder.
- C. Place the REC/STBY switch in STBY.
- D. Place the range (span) switch in the 100mV setting (10mV setting on 2 range instruments).
- E. Use the Zero adjust knob to set the pen to mid-scale.
- F. Switch the range switch to the 1mV position.
- G. Return the pen to the setting in step "E" with the E potentiometer in the pre-amp circuit.
- H. Place the REC/STBY switch in REC.
- I. Return the pen to the setting in step "E" with the I potentiometer in the pre-amp circuit.
- J. These adjustments are interactive so it will be necessary to repeat steps "C" through "I" until minimum pen movement is achieved.
- K. Remove the 50K resistor.

3. Span (See Figure 7)

This enables the technician to adjust the recorder so that a calibrated full scale input signal will move the pen up to the full width of the chart. The first span adjustment can be reached through a hole in the bottom of the recorder marked SPAN. The second span adjustment is normally not necessary and the bottom panel must be removed to gain access to this adjustment.

To Calibrate:

- A. Allow recorder to warm up to operating temperature (30 minutes is suggested.)
- B. Set recorder in 1mV position and signal source to zero output.
- C. Carefully set pen to zero by turning zero control

- D. Apply a 0.1% accuracy 1mV DC signal to the input
 - E. Insert a screwdriver in the hole in bottom of recorder marked SPAN. Move adjustment until pen is at 100% position.
 - F. Check all input spans with proper inputs for 100% \pm 0.5% deflection. Check zero all ranges and reset as necessary.
- NOTE:** If spans for ranges from 200mV through 5V DO NOT deflect 100% \pm 0.5%, continue with the following steps:
- G. Remove the bottom panel and set the range (span) switch to the 1V position. Check zero and reset as necessary.
 - H. Apply a 1V 0.1% accuracy DC signal to the input.
 - I. Adjust the 500 mV/1/2/5V range calibration potentiometer located on PreAmp PCB (See Figure 7) for 100% \pm 0.5% pen deflection.
 - J. Check all inputs from 200mV to 5V with proper inputs for 100% \pm 0.5% pen deflection.

There are no additional calibration points on the recorder.

PAPER RELEASE CLUTCH (**)

Your recorder is equipped with a sprocket release that enables you to advance or rewind the paper manually.

To operate the sprocket release:

Lift pen lever to the full UP position. The paper may now be moved forward or backward as desired.

To re-engage the chart drive:

Return the pen lift lever to the full DOWN position.

NOTE: After manual advancement or rewind there may be some delay, depending on the chart speed selected, until the gears re-engage, then the chart will run at the selected speed.

REMOTE CHART PROGRAMMING/TTL (**)

The recorder chart drive system is designed to operate from an external frequency source (including TTL levels). The chart can be run at time rate other than those built into the recorder. This mode is obtained by placing the Remote-Local slide switch, on the rear panel of the recorder, in the "REMOTE" position, and applying a pulse train, with the following characteristics, to pins 6 and 7 of the remote control connector, pin 7 being common.

PULSE TRAIN SPECIFICATIONS:

0/LOW state voltage +0.5V or less

1/HIGH state voltage +3V to 10V maximum

Minimum pulse width: 100 microseconds

Pulse frequencies up to 10KHz may be used, providing the chart speed selector is set to limit actual chart movement to 50 cm/min or less. A 50 cm/min paper speed can be obtained by applying a 500Hz external frequency and setting the chart selector switch in the 30 cm/min position.

The formula is Chart Speed = $\frac{F \text{ Hz} \times S}{300}$

Where: F = external frequency in Hz
S = Selected chart speed

When the external frequency is set to 300Hz, the chart drive will run at the speeds marked on the top panel selector switch.

EXAMPLE: The selector switch is set at 30 cm/min and the external frequency changed to 330Hz (a 10% increase). The chart will now run at 33 cm/min.

**Standard on all model 500 recorders.

NOTE: Changes of external frequency affects all selector speeds by the same factor.

The recommended maximum chart speed for start-stop operation is 50 cm/min. If the frequency is "swept" (no start-stop), it is possible to run faster than 50 cm/min; however, sweep rates must be gradual enough to assure accurate mechanical tracking.

(**) Standard on all Model 500 Recorders.

OPERATIONAL TIPS AND MAINTENANCE

Chart paper and pens have been carefully matched for optimum writing and minimum "bleed". Substitutions could cause improper writing. Keep pen tips covered when not in use to prolong writing life.

NOTE: If the pen is left uncapped for long periods and dries out, it may be revitalized by dipping in water for a few seconds.

Do not press down or otherwise manually force the paper hold down bracket. This could cause pinching of the paper as it feeds over the sprockets. Firm tension on paper roll and correct alignment of paper hold down bracket are required for proper chart paper feed.

Allow recorder to warm up for about 30 minutes if high accuracy/stability recording is desired.

The exterior surfaces of the recorder should be cleaned periodically by wiping with a soft damp cloth. Water may be used to remove ink, etc.; however, solvents should not be used as they may damage or destroy the finish.

TROUBLESHOOTING

The modularity and simplicity of this recorder make it possible to isolate the problem area in many cases. Once you have done this, a quick call to the service representative will bring you needed advice or a replacement part.

While it is impossible to think of every problem possibility, the following chart will give you suggestions on how to solve the most common recorder problems.

SYMPTOM	ANALOG SECTION	
	PROBABLE CAUSE	REMEDY
Pilot light does not light, and recorder is inactive	1. AC power source disconnected	1. Connect AC power source
	2. Fuse blown	2. Replace fuse
	3. Conversion slide switch in wrong position	3. Check slide switch on rear panel
Pilot light on, but recorder inactive	1. Signal input leads disconnected	1. Check input board installation
	2. Preamp/servo driver circuit board loose in connector	2. Check circuit board installation
	3. Gain set too low	3. Adjust gain control through hole in bottom of recorder
	4. Defective preamp/servo driver circuit board	4. Replace preamp/servo driver circuit board
	5. Defective servo motor	5. Contact service representative
Excessive deadband	1. Gain set too low	1. Adjust gain control hole in bottom of recorder
	2. Excessive normal mode signal	2. Connect ground terminal to source of normal mode signal

	3. Recorder ground not connected to signal source ground	3. Provide a common ground for third wire (green or green and yellow) in power cord
	4. Pen drive cable too loose	4. Contact service representative
	5. Pen carriage dragging on slide rod	5. Contact service representative
Noise on pen trace	1. Noisy input signal from signal source	1. Check signal source
	2. Extremely noisy powerline	2. Check powerline
	3. Gain set too high	3. Adjust gain control through hole in bottom of recorder
	4. Recorder ground not connected	4. Provide a common ground for third wire (green or green and yellow) in power cord
	5. Defective bearing in servo motor	5. Contact service representative
Pen trace has isolated	1. Pen carriage slide rod dirty	1. Contact service representative
	2. Servo driver gain set too low	2. Adjust gain control through hole in bottom of recorder
	3. Defective servo motor	3. Contact service representative
	4. Defective servo pot	4. Contact service representative
Pens will stop moving but will catch up if physically pushed	1. Defective bearing in servo motor	1. Replace pen
Pen writes poorly	1. Ink supply depleted	1. Replace pen
	2. Pen tip dried out	2. Revitalize by dipping in water for a few seconds

CHART DRIVE SECTION

SYMPTOM	PROBABLE CAUSE	REMEDY
Chart drive inoperative	<ol style="list-style-type: none">1. Loose or defective power connections2. Defective chart drive motor3. Defective chart drive4. Gear train binding	<ol style="list-style-type: none">1. Check power connections to stepper transformer2. Contact service representative3. a) Check AC power connections to circuit board b) Check DC voltages on circuit board4. Contact service representative
No chart drive in particular chart speed	<ol style="list-style-type: none">1. Loose or defective connections at chart speed selector and/or circuit board connector2. Defective component on circuit board	<ol style="list-style-type: none">1. Check and repair connections2. Replace defective circuit board
Fuse blows	<ol style="list-style-type: none">1. Auxiliary power supply shorted2. Internal fault	<ol style="list-style-type: none">1. Check wiring to connector pins 13 and 152. Contact service representative

PARTS AND SUB-ASSEMBLIES

Servo PCB Assembly	9816-0045 (S/N 55301 and Later)
Servo PCB Assembly	9816-0016 (S/N 43599 to 55300)
Servo PCB Assembly	9816-0011 (S/N 43598 and Before) (Interchangeable with 9816-0006)
Pre-Amp PCB Assembly	9800-0073
Cord, Power, Plug-in (Domestic)	6040-0005
Fuse, 3AG, 0.5A Slo-Blo	5120-0003
Fuse, 3AG, 0.25A Slo-Blo	5120-0023
Servo Potentiometer (Rebalance)	4750-0037
Motor, Chart Drive	3535-0020
Pinion Gear – Chart Motor	9050-0259
Motor, Servo	3510-0009
Pin, Remote Connector (Male)	2150-0063
Pin, Remote Connector (Female)	2150-0064
Feet, Rubber, Adhesive	2850-0005
Rectifier/Filter Assembly (Aux. Power)	9500-0125
Knob, .25" Shaft	2405-0033
Knob, .125" Shaft	2405-0032
Knob Cap	2405-0035
Backplane 555 PCB Assembly	9800-0078
Backplane 585 PCB Assembly	9800-0079
Backplane 595 PCB Assembly	9800-0074
Signal Input PCB Assembly	9800-0076
Step Speed Select PCB Assembly	9800-0075

IMPORTANT

Always specify model number, options, and serial number when ordering replacement parts and sub-assemblies

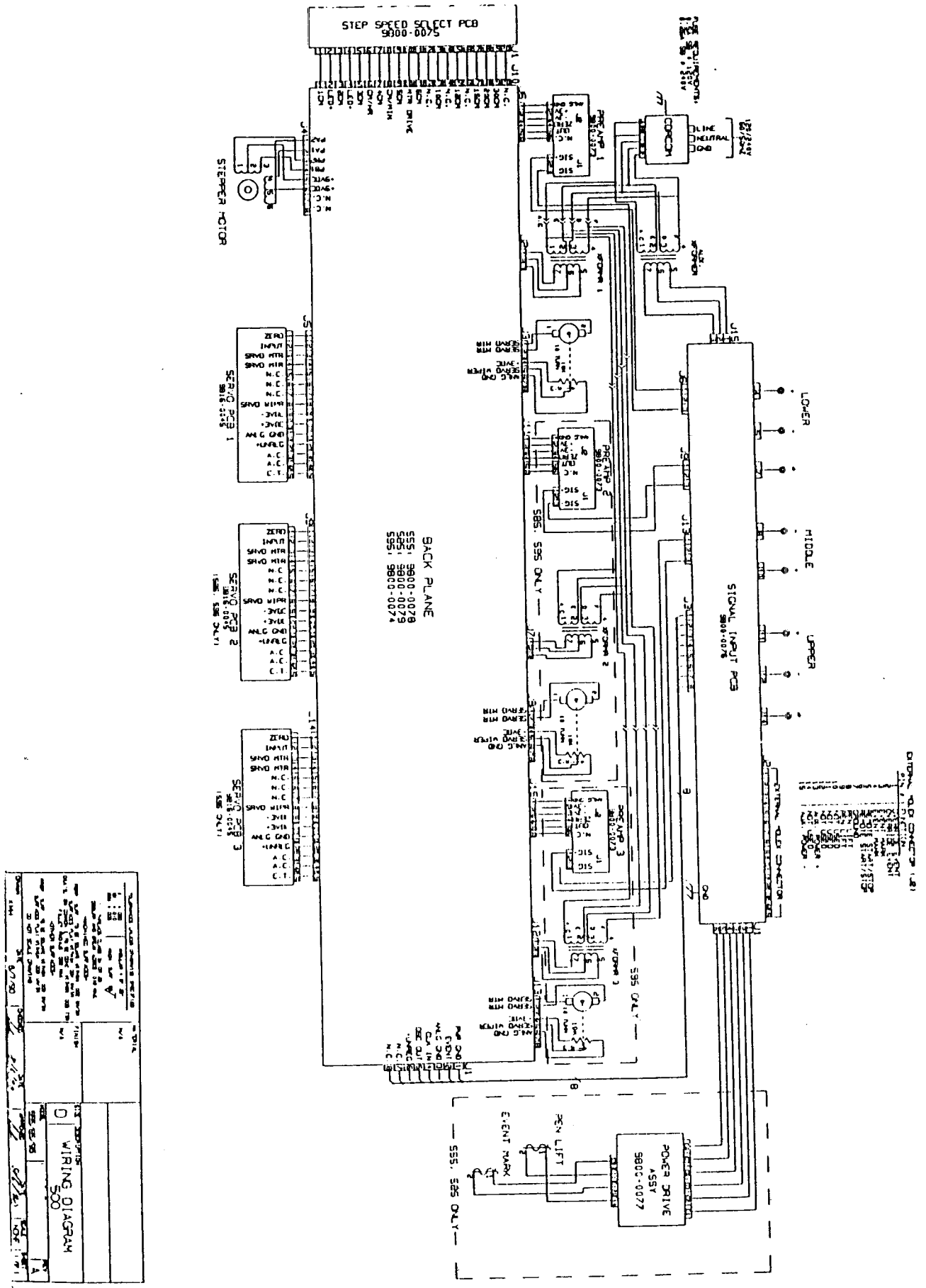


CHART PAPER

250 MM (10")

PART NUMBER

0100-0025

PENS

For Single Pen Models

Blue short nib	0100-0105
Red short nib	0100-0106
Black short nib	0100-0107
Green short nib	0100-0108

For Dual Overlap Models)

Blue short nib	0100-0105
Red short nib	0100-0106
Black short nib	0100-0107
Green short nib	0100-0108
Blue long nib	0100-0109
Red long nib	0100-0110
Black long nib	0100-0111
Green long nib	0100-0112

For Three Pen Models Only

Blue short nib	0100-0105
Red short nib	0100-0106
Black medium nib	0100-0131
Green long nib	0100-0132

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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.

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