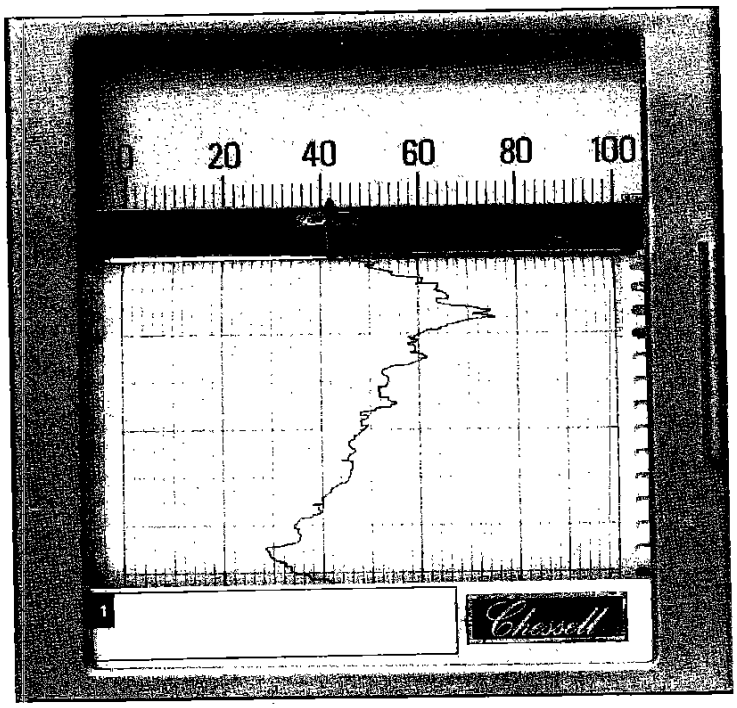
Chessell

Model 300

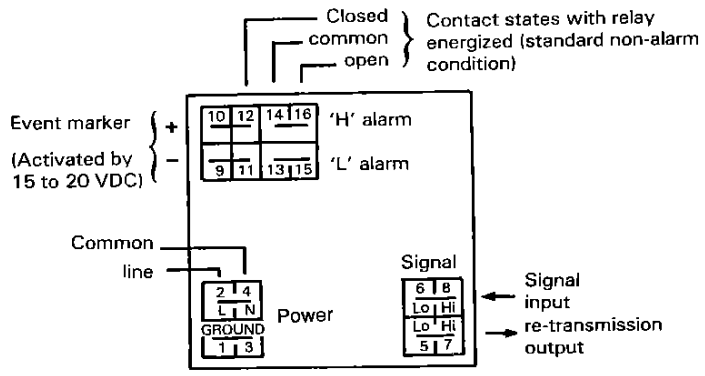
HA 233403/2 8/85

Model 300
Installation Operation & Maintenance Instructions

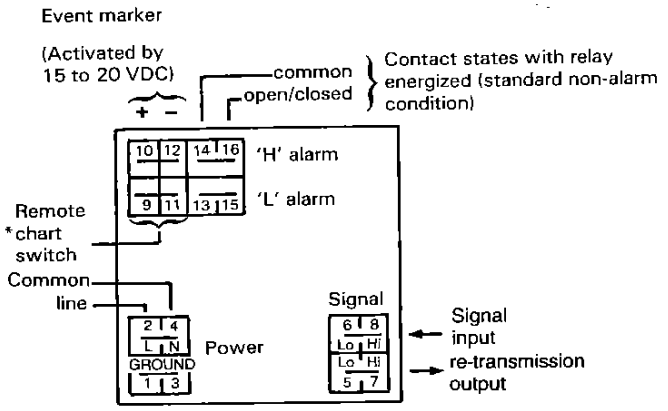


ADDENDUM

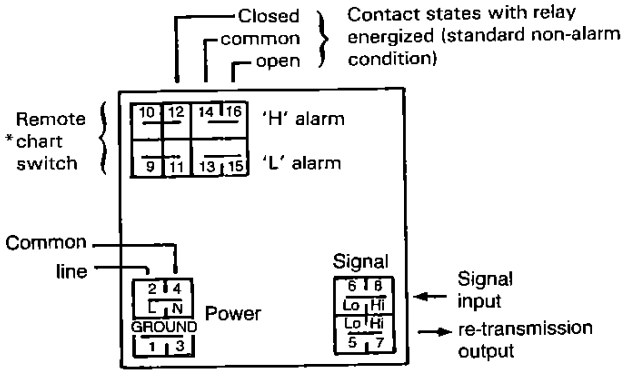
2.7 Electrical Connections



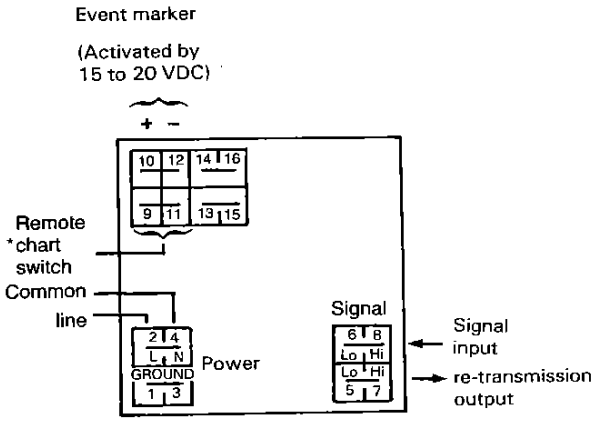
Change over alarm relay and event marker



Normally (open/closed) alarm relay with event marker and remote chart switch



Change over alarm relay with remote chart switch



Remote chart switch and event marker

* If remote chart switch only fitted, use terminals +9 and 10

WARNING! 220Vac present on remote chart switch terminals not isolated from line power

Model 300
Installation Operation & Maintenance Instructions

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Model 300
Installation Operation & Maintenance Instructions

1.0 General Information

1.1 Introduction

Model 300 is a single pen 100mm servo recorder housed in a lockable steel case with gasket-sealed door. The Model 300 provides a choice of roll or z-fold chart format, three writing systems (disposable ink cartridge, capillary ink or electric etch), plus a choice of over 4000 input conditioning modules and matching scales which can be supplied to order. Other options include: Hi/Lo alarms, event marker pen, retransmission outputs.

This manual contains installation, operating and basic maintenance instructions, with drawings and calibration procedures for selected input modules. Model 300 is similar in most respects to the Model 301.

1.2 Specifications

Available Writing Systems:
Disposable ink cartridge (version D) — writing duration typically two months with chart speeds of 2cm/hr and greater. Pen colour is blue.
Capillary ink (version C) — writing duration typically one month per 3ml ink capsule. Choice of red, green, blue or black pens.
Electric (version E) — spark erosion of aluminised paper. Unlimited writing length.

Chart Length:
Roll, 15m; Z-fold, ink writing only, 8m.
Chart speed (standard version): One speed chosen from—

Time/cm	5s/cm	10s/cm	15s/cm	20s/cm	30s/cm	60s/cm	2m/cm	2.5m/cm	5m/cm
Cm/time	12cm/m	6cm/m	4cm/m	3cm/m	2cm/m	1cm/m	5mm/m	4mm/m	12cm/h
Time/cm	10m/cm	12m/cm	15m/cm	20m/cm	24m/cm	30m/cm	60m/cm	2h/cm	2.5h/cm
Cm/time	6cm/h	5cm/h	4cm/h	3cm/h	2.5cm/h	2cm/h	1cm/h	5mm/h	4mm/h

s = second; m = minute; h = hour.

Over-range Protection:
Pen servo is electronically limited at −1.5mm and +1.5mm (−1.5% and +101.5% full scale).

Pen Response Time:
Zero to 90% full scale in less than 0.5 seconds.

Servo Linearity:
Linearity, from servo amplifier to recording pen, excluding input conditioner, ±0.25% full scale.

Pen Repeatability:
±0.1% full scale.

Input Conditioning Modules:
Table of specifications in 1.4.

Environment:
Ambient temperature range — zero to +50°C.
Humidity (non-condensing) — zero to 90%.

Power Requirement (standard version):
115, 220 or 240V AC, +5%, −10%, 50 or 60 Hz, 15 VA typical.

Dimensions:
Diagrams, figures 1.1 & 1.2. Net weight — 6kg.

Finish:
Matt paint. Standard colours — Dark Grey; Blue; Black; Cream.

Connectors:
Rear panel connectors are screw-type terminals, stud diameter 3.5mm, for No. 6 or 8 spade lugs and ¼" (6mm) Faston lugs. Terminal rating: maximum voltage 500V; maximum current 2A.

1.3 Options

Retransmission (Option RSO):
Linear zero to 10V retransmission output, with 0.25mA maximum current. This option is subject to the availability of rear panel terminals. Minimum load resistance 40K ohms; maximum load capacitance 0.2 uF.

Alarms (Option HLL):
This option is a pair of independent Hi and Lo alarms. each controlling a relay.

Relay contact specification (for resistive load)

Max voltage: 100V AC/DC
Max current: 1A AC/DC
Max power: 60VA AC, 30W DC.

Event Marker (Option EVP):
Available in disposable cartridge, capillary ink or electric writing versions. A solenoid operated pen mechanism traces a continuous line just to the right of the chart grid. When energised by an external contact closure, the solenoid deflects the pen 3mm to the left.

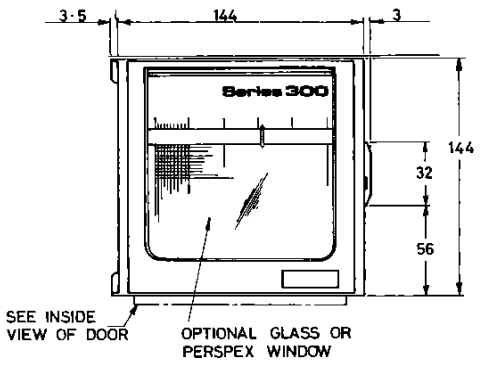
Perspex (Option P):
Acrylic window in place of glass, mostly for pharmaceutical and food processing application.

Chart Run-Out (Option CRO):

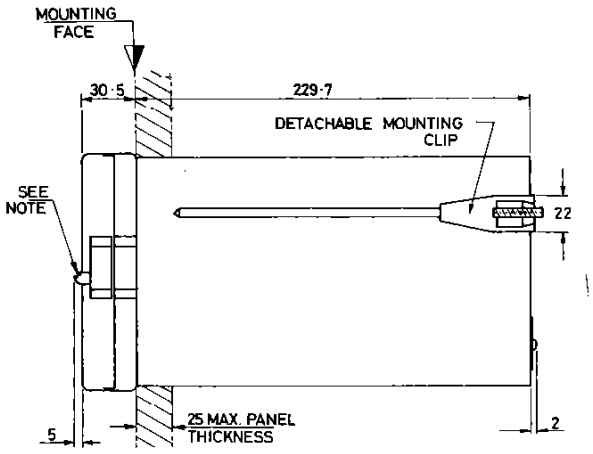
For roll chart only. Hold-down fingers are added to the cassette and a tear-off plate is fitted to the lower edge of the door. Not available with electric writing or DIN door.

Colour:
Case is blue unless otherwise specified. Dark Grey, Black and Cream are alternative colours.

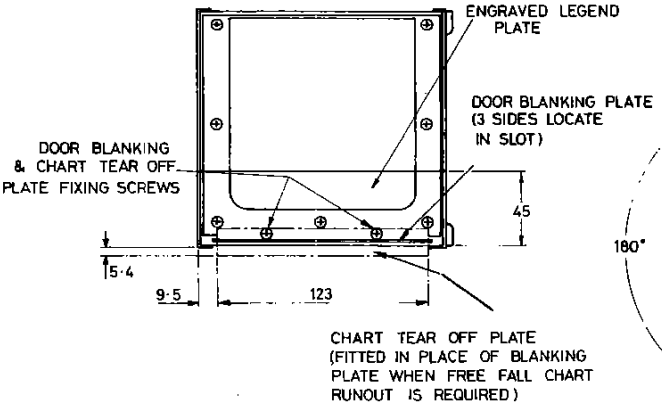
Case:
DIN style case, figure 1.2 is alternative to the industrial case, style HD, figure 1.1.



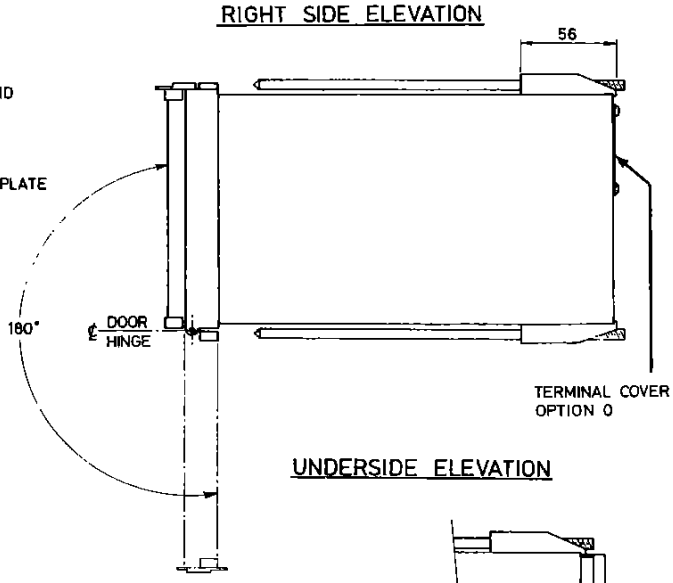
FRONT ELEVATION



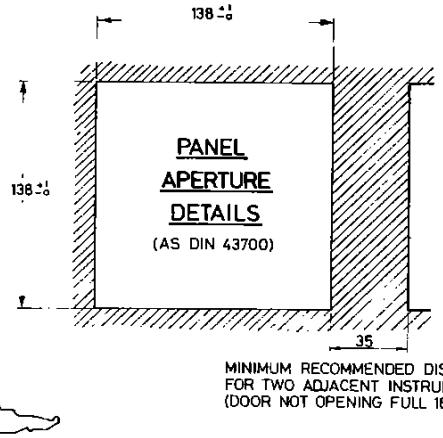
RIGHT SIDE ELEVATION

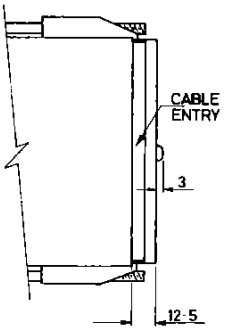


INSIDE VIEW OF DOOR



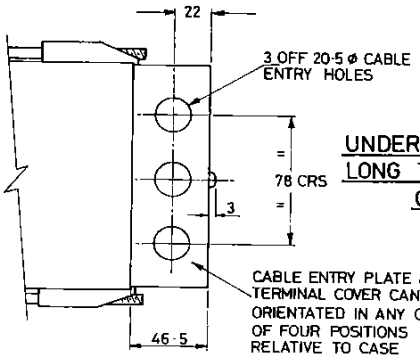
UNDERSIDE ELEVATION





UNDERSIDE ELEVATION
SHORT TERMINAL COVER
OPTION 1

(CANNOT BE USED IF SHUNT RESISTORS ARE FITTED)



UNDERSIDE ELEVATION
LONG TERMINAL COVER
OPTION 2

DOOR LOCK KEY - FOR USE ON A KEY RING

DOOR LOCK KEY FOR CONTINUAL USE ON RECORDER (i.e. WHEN IT IS NOT NECESSARY TO LOCK THE DOOR)

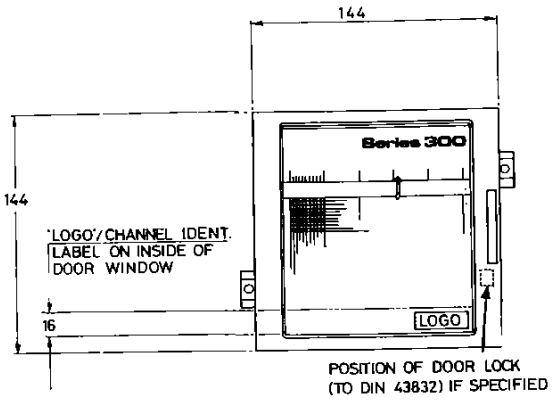
NOTE. 1. TO UNLOCK DOOR PRESS KEY DOWNWARDS
2. KEY IS REMOVABLE IN THE UP POSITION
3. WHEN KEY IS REMOVED DOOR IS LOCKED

WEIGHT 6kg UNPACKED
WEIGHT 9·5 kg PACKED

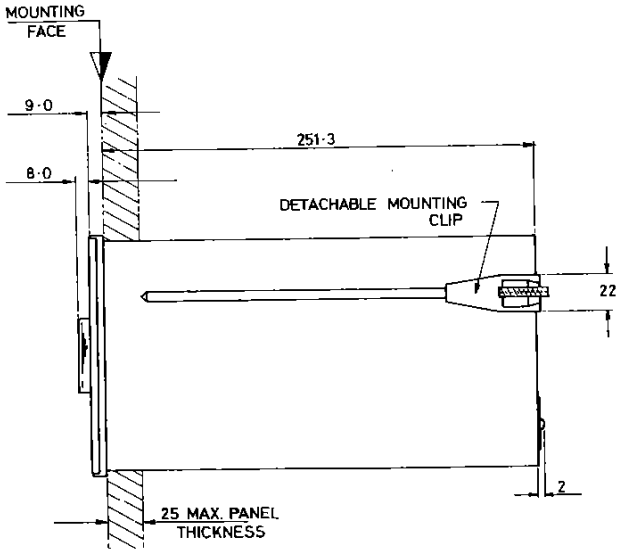
Drg. No. HG230331
Issue 2

Figure 1.1 Model 300 dimensions (HD case)

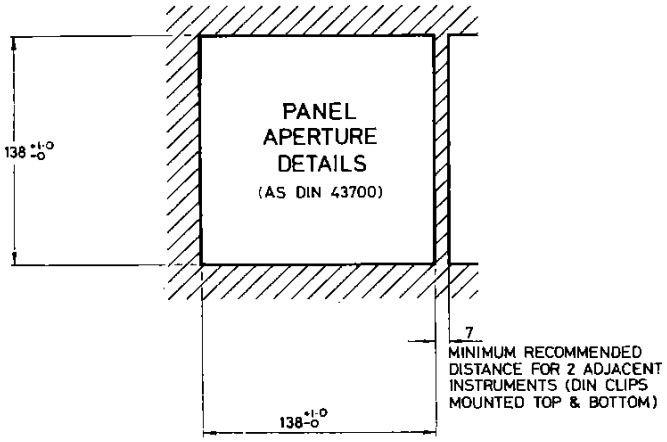
Dimensions in mm.

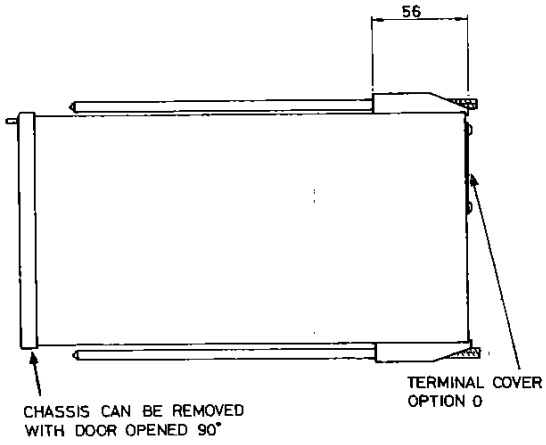


FRONT ELEVATION SHOWING HORIZONTAL SCALE ARRANGEMENT

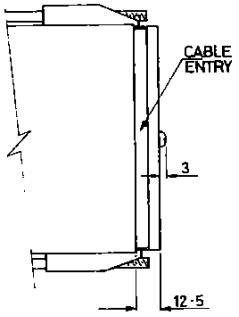


RIGHT SIDE ELEVATION





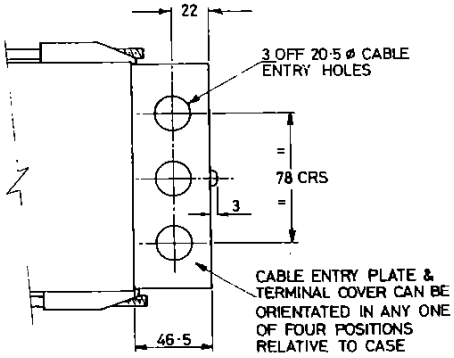
UNDERSIDE ELEVATION



UNDERSIDE ELEVATION SHORT TERMINAL COVER OPTION 1

(CANNOT BE USED IF SHUNT RESISTORS ARE FITTED)

Dimensions in mm.



UNDERSIDE ELEVATION LONG TERMINAL COVER OPTION 2

Drg. No. HG230330
Issue 2

Figure 1.2 Model 300 dimensions (DIN case)

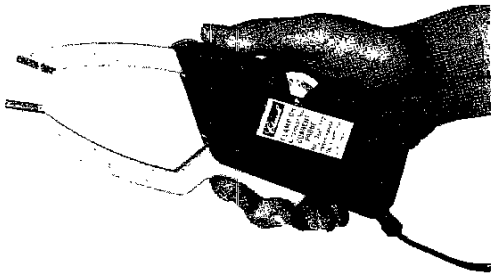
1.4 Input Signal Conditioning Performance specifications for dedicated single-range modules (100mm recorders)

TYPE NO.	1016 98	1017 05	1017 05	1017 00	1017 00	1017 01	1017 01	1017 05	1016 86	1017 03	1017 05	1017 05
INPUT	DIRECT VOLTAGE AND CURRENT			ALTERNATING CURRENTS TO 1 AMP VOLTS TO 30 V	ALTERNATING VOLTS 30 V to 250 V	FREQUENCY		THERMO-COUPLE[k] SPANS ≥ 4 mV	RTD		POT-TYPE TRANSDUCER	SQUARE ROOT
	SPANS UP TO 4 mV & 100 μA	SPANS 4 mV to 2 V 100 μA to 1 AMP	SPANS 2 V to 50 V			SIGNAL UP TO 500 kHz	LINE 50/60 Hz NOMINAL		4 or 2 WIRE	3 WIRE		
Accuracy (including linearity): % of span	±0.25% ±5 μV	±0.25% ±5 μV	±0.25%	±1%[g]	±1.5%[g]	±0.3%[h]	Better than ±0.2 Hz	±0.5% ±5 μV typical[f]			±0.25%	±1.5%
Input Impedance	>10MΩ	>1 MΩ	100 kΩ/V	1 MΩ/V but ≥ 10 MΩ	>10MΩ	>10 kΩ	>100 kΩ	>1 MΩ	—	—	>1 MΩ[j]	c
Bias Current	<10 nA	<150 nA	<150 nA	AC Coupled	Transformer Coupled (50:1)	AC or DC Coupled	Transformer Coupled (50:1)	<150 nA[a]	Current through RTD <2 mA		<100 nA	c
Minimum Span	1 mV 1 μA[e]	4 mV 100 μA[e]	2 V	75 mVrms 1 mArms[e]	30 Vrms	Note 'd'	2 Hz	4 mV[b]	25°C 50°F	25°C 50°F	3 V	c
Maximum Input	100 mV	20 V	50 V	50 Vrms	350 Vrms	100 V p-p	250 Vrms	20 V	20 V	20 V	50 V	c
Gain/Temp Coefficient	100 ppm/°C	100 ppm/°C	200 ppm/°C	200 ppm/°C	200 ppm/°C	—	—	100 ppm/°C	100 ppm/°C	100 ppm/°C	200 ppm/°C	200 ppm/°C
Offset Voltage Drift	<0.5 μV/°C	<4 μV/°C	—	—	—	—	—	<4 μV/°C	<4 μV/°C	<4 μV/°C	—	—
Bias Current Drift	<50p A/°C	<5n A/°C	—	—	—	—	—	<5n A/°C[a]	—	—	—	—
Common Mode Rejection 1kΩ unbalance	120 dB			—	—	—	—	120 dB				
Normal Mode Rejection	55 dB up to ½ span			—	—	—	—	55 dB up to ½ span				

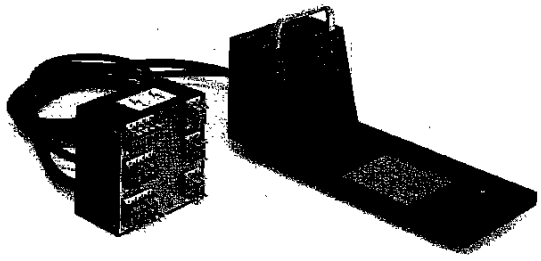
nA = 10^{-9}A pA = 10^{-12}A

a Unless break protection fitted when bias current 1uA.
b Approximately 100°C for a base metal thermocouple.
c Generally supplied for 4-20mA loop use with a 250 ohm shunt.
d Ratio of zero offset to span must not exceed 15:1, also low end frequency must be at least 20Hz if full-scale frequency is 1KHz or less.
e Current is converted to voltage, usually 75mV span, by shunt resistor. 4V span (1 to 5V) is usual for 4-20mA and 10-50mA inputs.
f Plus intrinsic errors in the temperature sensor.
g Accuracy is as stated provided input exceeds 5% of span.
h Accuracy is ±3% of full scale frequency, not span.
j Full scale resistance of transducer must be between 480 ohms and 5k ohms input signal is nominally 10V full scale.
k Thermocouple inputs usually include automatic cold junction compensation for changes in ambient temperature. Error in the measured temperature can be up to 1° for each 10° change in ambient temperature normally, or 1° for each 20° change for the high grade version.

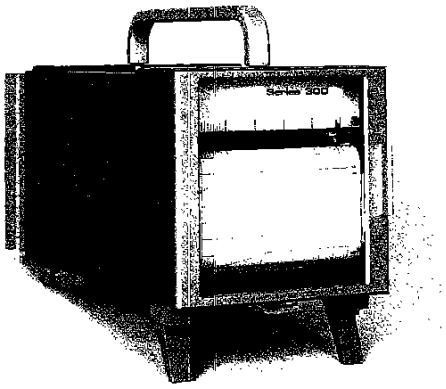
1.5 Accessories



Multirange Clip-on Transformer:
For alternating current measurements without breaking the circuit. The jaws open to hook around either insulated or non-insulated conductors up to 32mm diameter, rectangular sections up to 9.7sq. cm and foils up to 2.5mm × 7.6cm. Six current ranges: 10, 20, 50, 100, 200, and 500A rms. For use with line voltages up to 600V rms. Output: 5V rms full scale. Recorders can be supplied pre-calibrated for use with this device.

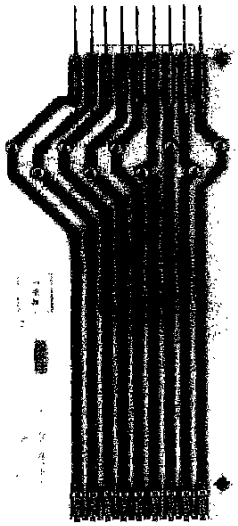


Service Connector Assembly:
Code LA125444. Allows recorder to be withdrawn from case for bench operation. For model 300, 301 or 305.

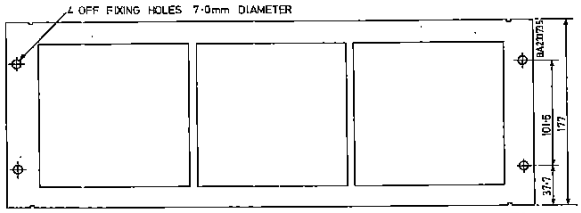


Instrument Carrying Cradle (Option ICC):
Carrying handle and feet for either style of case.
Also available is option 154 terminal cover fitted with an ac supply connector conforming to IEC320/CEE22 and a single hole, grommeted, for the signal lead.

Service Extender Board, *AH122310: For input conditioning modules.*



Service Extender Board, *AH122320: For servo amplifier (pen drive) modules.*



19 INCH WIDE RACK MOUNTING FRAME FOR ACCOMODATING UP TO 3 DIN CASED STYLE RECORDERS.
138mm x 138mm CUTOUTS CENTRALLY DISPLACED. Part number BA129951E
UNUSED CUTOUTS MAY BE BLANKED OFF WITH BLANKING PANEL . Part number LA124670.
THE TWO PART NUMBERS ABOVE ARE PAINT FINISH COLOUR DEPENDENT PLEASE STATE COLOUR REQUIRED.

Rack Mounting Frames:
Code 19F for 19" rack; 5mm alloy plate. Colour optional.

The following are not illustrated:—

Capillary Flushing Bulb: Service accessory, LA127163, for cleaning capillary ink systems. Rubber bulb and 1 metre length of flexible capillary tubing.

Capillary Pen Tool: Service accessory, BD123218, facilitates removal and replacement of capillary pen tips.

Wall Mounting Case: HG230660F, for model 300 only. Casting with four-point bulkhead mounting. Dimensions — 308mm high × 194mm wide × 315.5mm projection.

2.0 Installation Instructions

2.1 Unpacking

This instrument was shipped in a special pack designed to ensure adequate protection in transit. If the outer box shows signs of excessive damage, the pack should be opened and the instrument examined. If there is evidence of damage, do ***not*** operate the instrument. Call your local representative. Before discarding the packing materials, check that all accessories have been removed.

2.2 Storage

This instrument is packed in a polythene bag which should be left intact if the instrument is to be stored.

2.3 Transit Bolt

As shipped, the recorder chassis is secured to the rear of the case by a M5 screw which should be removed when installation is complete. For access to the screw, remove the red rear terminal cover.

2.4 Door Lock

Two types of panel mounting case are available for the 300. The industrial case, style HD, has a protruding door with a locking latch operated by a detachable key; to open the door insert one of the keys supplied, then press down on the key head. The compact case, style DIN, has a flush fitting door secured by ball catches at top and bottom. The door can be provided with an optional security lock.

2.5 Visual Inspection

Before installation the transit bolt should be removed and the recorder chassis withdrawn from the case. Inspect for mechanical integrity. For access to the chassis, first remove the chart cassette as shown in section 3, figures 3.1 and 3.2.

2.6 Panel Installation

The recorder is intended for installation in a panel, and may be tilted at any elevation when fitted with an electric writing or disposable cartridge writing system. Panel tilt should not exceed 30°, forward or back, if the instrument is fitted with a capillary pen. The instrument is secured to the panel by mounting brackets (figure 2.1), which are clipped into either side of the case and tightened with a screwdriver.

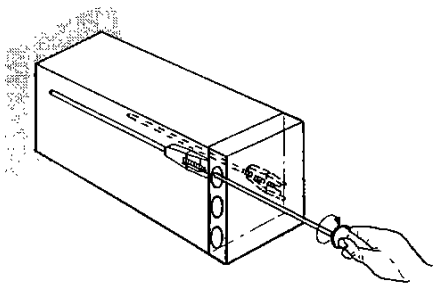


Figure 2.1 Clamps for case style HD and DIN. *Clamp locations are provided on all four sides of the case. To install, lay the clamp flat on the case; push rearward to engage the tongue in the rectangular slot, then hook the clamp shoulder over the edge of the case.*

2.7 Electrical Connections

All electrical connections to the model 300 (Figure 2.2) are made at the rear of the case. Before making any connections, be sure that the supply voltage and input range shown on the rear label match the requirements of the installation.

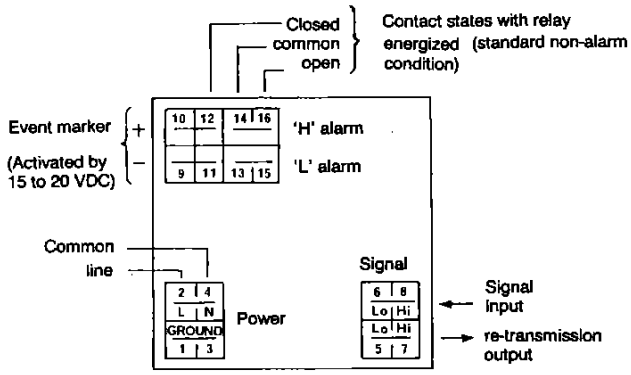


Figure 2.2 Model 300 rear terminal layout.

2.8 Supply Connections

Follow this procedure carefully:—

1) Check the supply voltage on the rear panel label.
2) Open the recorder case door, remove the chart cassette and withdraw the chassis from the case (Section 3, figure 3.1).
3) Remove, check and replace the fuse (holder at the rear of the chassis).
   Fuse type — metric 5mm diameter, 20mm long.
   For 115/220/240V AC, use 1 Amp Type T (slow-blow) No. CH050013.
4) Remove the insulating cover from the power terminals, figure 2.2, and connect wiring for the AC supply:
   Line Terminal No. 2.
   Common/Neutral (N) Terminal No. 4.
   Ground (earth) Separate grounding terminal on case.
5) Replace the insulating cover over the power terminals.
6) Visually check the chassis for secure installation of printed circuit boards, etc.
7) Replace the chassis in the recorder case.

2.9 Signal Connections General

Signal input and retransmission output terminals are contained in a four-way block at the right of the rear panel. The insulating cover over this block ***must*** be installed if the signal voltage is high.

Use terminal numbers 6 and 8 for most applications, 6 is LOW and 8 is HIGH. The input is floating i.e. terminal 6 is not grounded.

2.10 Small Signals

Check that gold-plated input terminals have been installed if the input is a thermocouple, RTD or DC less than 4mV.

2.11 High Current Signals

DC spans up to 500mA and AC spans up to 1.25A are accommodated by an external current shunt. For DC spans greater than 500mA a 4-terminal external shunt can be supplied, to give 75mV at the rated value of the shunt. For AC spans of 1A and greater where the recorder is intended to be used with line current transformers, a double-wound isolating current transformer is supplied.

2.12 High Voltage AC Signals

AC inputs greater than 30V rms (e.g. for line voltage or frequency monitoring) require a 50:1 step-down transformer which is factory-installed at the rear of the case. The signal is

connected to the terminals on the transformer panel, NOT to the four-way block. The insulating cover over the transformer must be replaced.

2.13 Resistance Thermometers

For optimum accuracy without rebalancing, a four-wire connection to the recorder is recommended as shown in figures 2.3, 2.4 and 2.5. Which shows the connection to the terminal block.

For full rated accuracy without on-site adjustment, the resistance of any one lead should not exceed six ohms or approximately 100 metres of 16/0.2mm copper wire. With adjustment, this may be increased to 50 ohms, or about 1km of 16/0.2mm.

Where the lead lengths from the resistance thermometer are short, the current and voltage terminals may be shorted out and two leads taken to the resistance thermometer. Under this condition, the error introduced by the two-wire connection will be 1°C offset per 0.385 ohms (approximately 5 metres of lead length for 16/0.2mm copper). To avoid this error, particularly with long lengths between R/T and recorder, it is necessary to use 4-wire or 3-wire connections.

Where three-wire cable runs are installed, this may be catered for by 3-wire R/T input amplifier (please specify when ordering). Automatic lead compensation removes the error produced by lead resistance provided that the two leads V+ and V− have the same total resistance. (0.385 ohm difference between lead resistance producing 1°C error). Maximum lead resistance should not exceed 50 ohms.

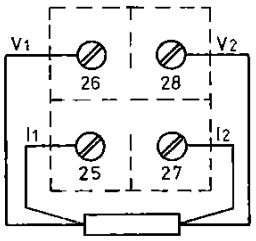


Figure 2.3 Four wire RTD

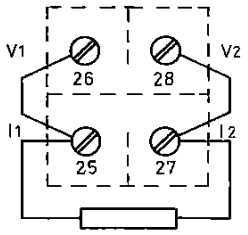


Figure 2.4 Two wire RTD

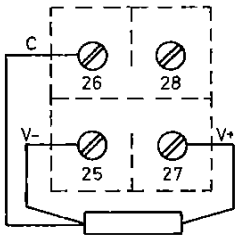


Figure 2.5 Three wire RTD

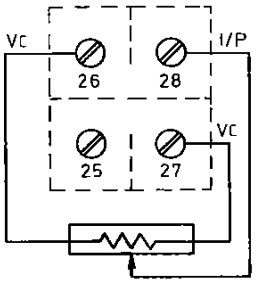


Figure 2.6 Potentiometric transducer

2.14 Potentiometric Transducers

Potentiometer inputs from pressure or displacement transducers are connected as shown in Figure 2.6, **common – ve negative — *terminal No. 6, + 12 volt 25mA max supply O/P from recorder No. 7.* Variable voltage output from transducer — *terminal No. 8.*** The resistance R of the transducer connected between terminals 6 and 7 should NOT be less than 480 ohms, the highest value should not exceed 5K ohms, determined by the maximum permissible source resistance which the recorder can accept for this type of input.

Note: Not all potentiometric transducers are calibrated 0—100% of measured variable. If this is so ***please supply input signal range or resistance range when ordering.***

2.15 Retransmission Output (Option RSO)

Option RSO provides a zero to 10V full scale retransmission of the input signal, as modified (e.g. linearised) by the input conditioning module. Maximum current 0.25mA. RSO is available at the pair of terminals immediately below the input terminals. The left hand terminal (e.g. 5) is the neg. rail, right hand (e.g. 7) pos.

2.16 Remote Chart Switching (Option RCS)

Closing of an external contact switches the chart drive on.

WARNING
FOR RECORDERS MANUFACTURED IN 1981 AND EARLIER

IN A SINGLE SPEED SYNCHRONOUS MOTOR INSTALLATION WITH OPTION RCS, 220V AC IS PRESENT ACROSS THE SWITCHED TERMINALS. TAKE CARE TO ENSURE THAT THE REAR COVER IS ALWAYS IN PLACE, AND THAT THE EXTERNAL COMPONENTS ARE ADEQUATELY SPECIFIED AND PROTECTED.

2.17 Event Marker (Option EVP)

Available in disposable ink cartridge, capillary ink or electric writing versions, the event marker is a solenoid operated pen which writes a continuous trace at the right hand-edge of the chart grid, marking each event by a 3mm shift to the left. The solenoid is energised by an external contact closure across terminals 10 (+ 18V DC nominal) and 9 (zero volts).

2.18 On-Site Modifications

Qualified service personnel can perform the following modifications on site:

- Retrofit the following options: alarms (HLL), event marker (EVP), retransmission (RSO); for industrial case, chart tear-off (CRO).
- Exchange and adjust input modules.
- Exchange scales.
- Change supply transformer tappings.
- Exchange cassettes, e.g. roll to z-fold.
- Change chart speed by exchanging cassette gear sets and/or motor assemblies.

2.19 Adding Options To The Model 300

Component kits including instructions are available for all retrofittable options listed above. Refer to section 7.0 Spares List for details.

2.20 Input Module Exchange

1) Withdraw the chassis from the case.
2) Remove the retaining fixture from the top of the vertical printed circuit assemblies.
3) Remove the blank white retaining strips from the appropriate four-way plug at right of the chassis rear panel.
4) Remove the selected input module assembly (PCB, loom and four-way plug).
5) When installing the exchange module, be sure that orientation of the four-way plug is correct (input leads at top; red and black RSO leads, if fitted, at bottom) and that the retaining strips are installed firmly.

2.21 Input Module Adjustments

Calibration procedures are together with the input module drawings in Section 4.

2.22 Scale Exchange

HANDLE SCALES GENTLY — AVOID FINGERMARKS AND OTHER MECHANICAL DAMAGE

1) With power switched off, remove one of the 2.5mm scale retaining screws; loosen the other.
2) Install the exchange scale, leaving the screws part tightened.
3) By rotating the plastic capstan on the pen servo assembly, align the pen with the chart zero (left or right limit of the chart grid, depending on the scale direction).
4) Slide the scale to left or right to set the scale servo under the pen position indicator. Gently tighten the two retaining screws.

2.23 Supply Transformer Tappings

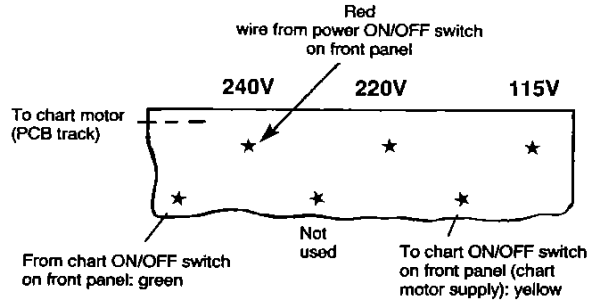


Figure 2.7 Supply transformer tappings *The asterisks indicate holes on the Motherboard.*

To change the supply transformer tapping, remove the chassis from the recorder case, then follow this procedure carefully:—

1) Unsolder and transfer the red wire to the PCB hole matching the available supply voltage.
2) Modify ***both*** labels on the recorder to indicate the supply voltage for which the instrument is now wired.

> **CAUTION**
> Check the line frequency also. It may be necessary to exchange the motor/gearbox assembly to suit the new supply. Procedure, paragraph 2.26.

2.24 Exchanging Cassettes

If changing from one cassette to another — as opposed to re-loading the cassette originally installed — the following procedure applies:—

1) Depress the cassette retaining latch at the bottom right corner of the chassis, allowing the cassette to swing upward.
2) Swing the cassette upward to the point where it can be removed from the chassis forks.
3) Withdraw the chassis from the case.
4) Install the exchange cassette by the exact reverse of the above procedure. ***do not force*** the pivot studs into the forks; the cassette slips easily into place provided the front plate is tilted slightly upward from the horizontal.
5) Check the security of the cassette; the latch, when hooked over the cassette tab, should permit a very small (but detectable) movement of the cassette. The latch can be adjusted by bending the tab with smooth-jaw pliers.
6) With the cassette latched in place, check the mesh between the chart motor/gearbox and the first cassette gear. The ideal mesh is 75%, i.e. a gap equal to one quarter the tooth depth should be visible between the gears. A tighter mesh would cause the drive to seize; a looser mesh could cause excessive wear.
   Adjust the mesh very slightly loosening the upper and lower screws holding the motor/gearbox assembly forward or back to correct the mesh. Re-tighten both screws.

2.25 Chart Run-Out (Option CRO)

This option is available for roll chart, ink writing only. Hold-down fingers are added to the cassette, and a tear-off plate is fitted to the lower edge of the door. A retrofit kit is available, but users are recommended to return their cassettes to the factory for exchange or modification. The tear-off plate can be installed on site.

2.26 Changing Chart Speed

Detail information of the chart drive system is contained in the following pages. Following any modifications to the chart drive system, the mesh between the motor and the first cassette gear must be checked as outlined in paragraph 2.24 above.
To remove a synchronous-type (single-speed) chart motor, detach the two-wire motor supply loom and socket from the two-pin plug on the mother PCB, adjacent to the supply transformer. Then remove the two 2.5mm countersunk screws securing the motor/gearbox plate to the chassis. (An anchor nut is installed in the chassis for the upper screw; the lower screw is secured by a lock washer and nut).
To exchange the cassette gears, remove the screw and lock washer securing the gear cover plate to the right side of the cassette (2mm screw for roll cassette, 2.5mm for z-fold). Detach the cover plate and install the exchange gear set as diagrammed on Figures 2.8 and 2.9. Do not lubricate the gear teeth. Check that the gears rotate freely, and are not buckled. Replace the cover plate. Secure the retaining screw with Loctite 222. Check the inspection procedures in Section 3.

2.27 Chart Drive System

Chart speed in the model 300 recorder is established by (i) the type of motor/gearbox installed on the chassis, and (ii) the set of gears installed on the chart cassette.
The following single-speed synchronous motor/gearbox assemblies are available:—

125:2	220V 50Hz	LA124650
75:1	220V 60Hz	LA124651
3750:1	220V 50Hz	LA124654
4500:1	220V 60Hz	LA124655

Gears assembled as shown in Figure 2.9. (i.e. lower gear to be against plate).

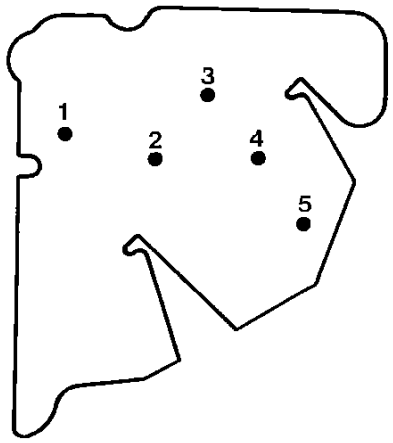


Figure 2.8 Cassette right-hand plate.

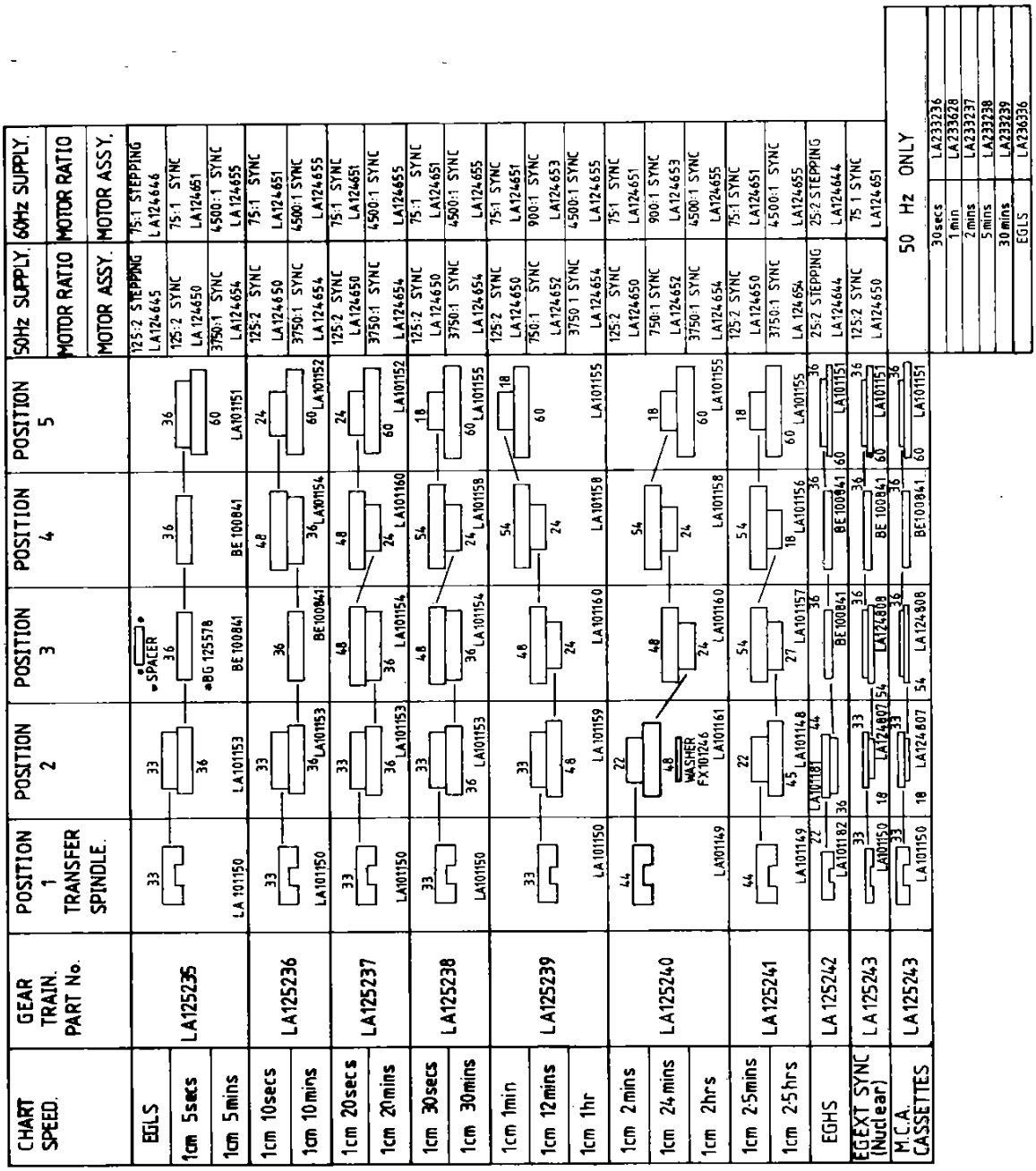


Figure 2.9 300 chart speed data

3.0 Operation and Maintenance

3.1 Cassette Removal

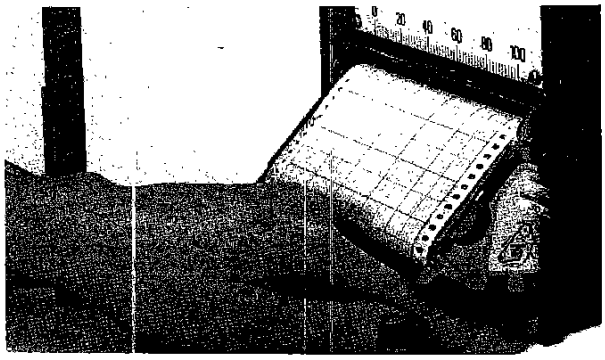


Figure 3.1 Free the cassette *Depress the latch at the bottom right corner of the recorder.*

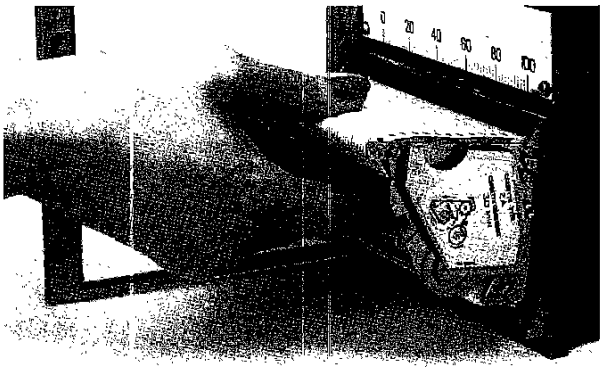


Figure 3.2 Remove the cassette *Swing the cassette upward until it can be freed from the chassis forks.*

3.2 Roll Cassette Loading

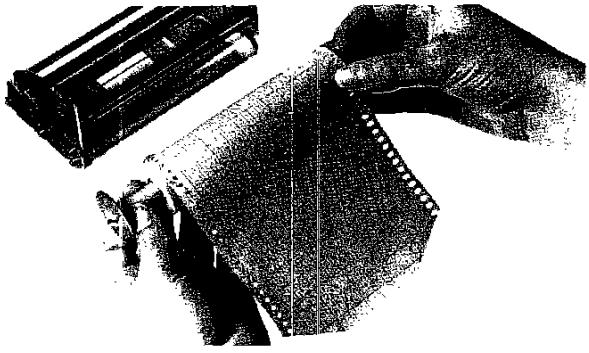


Figure 3.3 Load the feed roller. *Place the cassette on a flat surface with the front plate face down and the sprocket roller facing forward. Pull the feed roller forward against the springs, then lift the roller clear of the cassette. Insert the feed roller into the chart roll.*

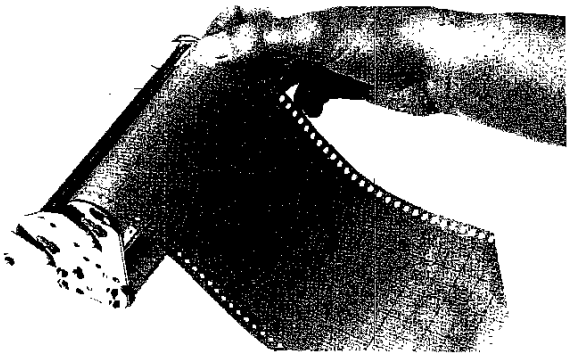


Figure 3.4 Install the feed roller. *Insert the feed roller into the cassette with the flange on the left. Be sure that both pins on both ends of the roller click into the bearing slots and are held firm by the springs.*

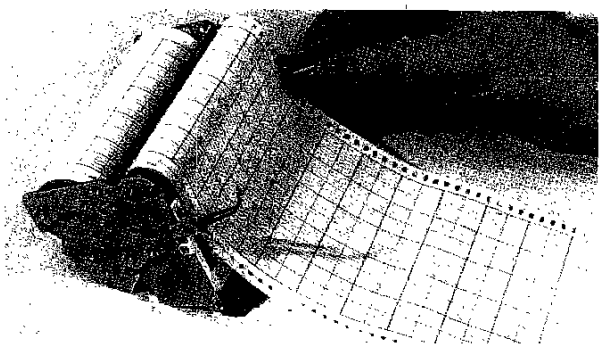


Figure 3.5 Under the bar, over the sprockets. *Re-position the cassette with platen facing forward and the sprocket roller at the top. Pull out approximately 375mm of chart, then pass it under the tie bar and over the sprocket roller; swing the chart "fingers" (if fitted) forward, engage chart squarely on the sprocket roller, then return the chart fingers to their normal position. (Recently manufactured cassettes have been modified to eliminate the need for chart fingers when the chart run-out feature is not required).*

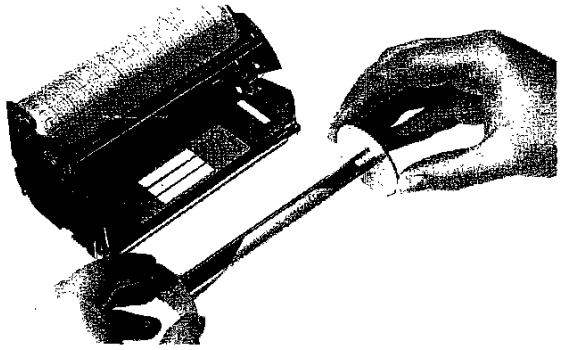


Figure 3.6 Prime the take-up roller. *Again re-position the cassette with the front plate face down and the take-up roller facing forward. By folding or cutting into a V-shape prepare the chart for insertion into the slotted roller* ***with the printed side up.*** *If desired, the take-up roller may be unclipped to facilitate threading. With the chart centralised between the take-up flanges, roll up surplus chart by rotating the knurled flange.*

3.3 Z-fold Cassette Loading

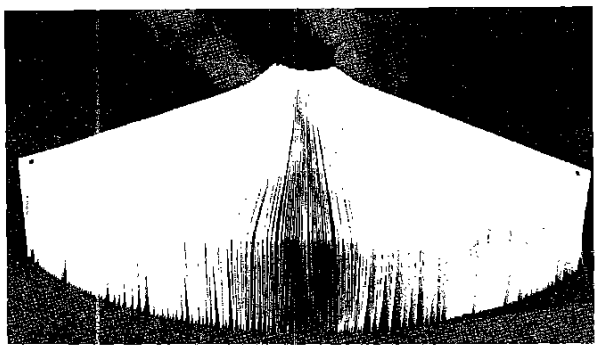


Figure 3.7 Prepare the z-fold chart. *Place the chart on a flat surface and check that the edges are square and smooth; if not, the chart should be rejected. To ensure that the chart leaves will separate freely when feeding through the cassette, hold the chart as shown and gently move the hand from side to side. Repeat, holding the other end of the chart; then repeat with the chart inverted. This process shakes out perforation dust and separates sprocket hole perforations in adjacent leaves.*

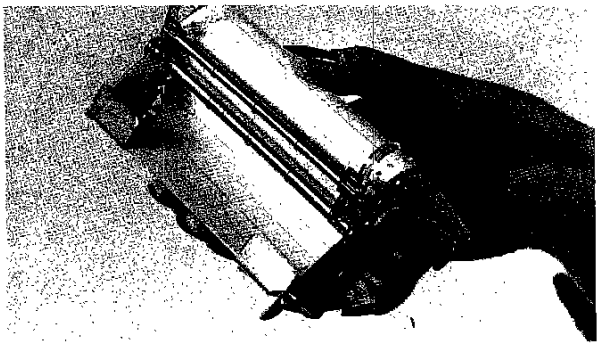


Figure 3.10 Over sprockets under bars. *Re-position the cassette with the guide bars facing forward. Swing the chart "finger" and guide bar assembly forward, engage the chart squarely on the sprocket and return the chart fingers to their normal operating position.* ***NOTE:*** *the chart shown here is for left-hand scale zero.*

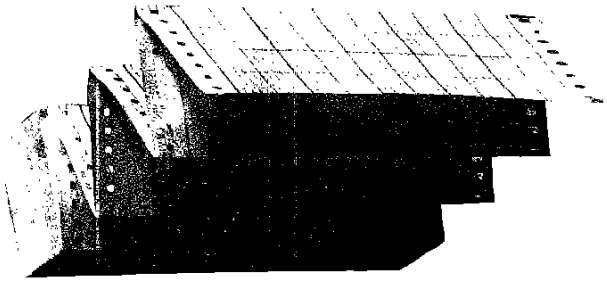


Figure 3.8 Check orientation of chart. *Position the chart with the red finishing line face down. The top leaf should be printed side upward; if not, remove the first 4cm leaf to expose the next printed surface. Unfold the first few leaves of the chart.* ***NOTE:*** *the chart shown here is intended for left-hand scale zero, with the datum (circular) sprocket holes at left.*

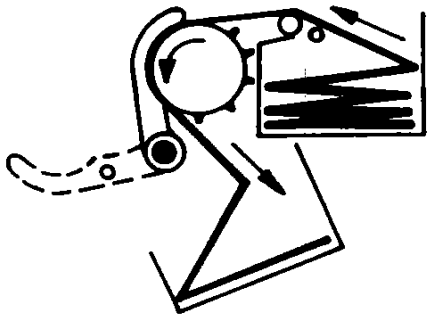


Figure 3.11 Check the paper feed. *Check for the correct operation by clockwise rotation of the first gear in the drive train, i.e. the gear which meshes with the chart drive motor. Be sure the paper folds are exactly as shown in this illustration; if they are reversed, the paper will not stack correctly in the receiving tray.*

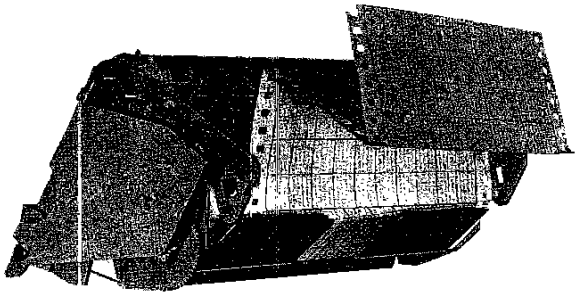


Figure 3.9 Load the feed tray. *Place the cassette on a flat surface with the platen face down and the sprocket roller facing forward. Load the chart into the feed tray with the printed side face up. Be sure the chart is seated squarely.* ***NOTE:*** *the chart shown here is for left-hand scale zero.*

3.4 Cassette Replacement

Re-install the cassette with the platen tilted slightly upward from the horizontal. ***do not force*** the cassette pivot studs into the chassis forks; the cassette slips easily into place provided the platen is at the correct angle.

3.5 Capillary Ink System

CAUTION

A capillary ink system is at its best in a stationary recorder installation. Prolonged vibration and mechanical shock, or operation with the recorder tilted by more than 30° from the horizontal can cause ink leakage. If the instrument is to be shipped, the ink capsule(s) should be removed, and the capillary system flushed with water (Figure 3.16).

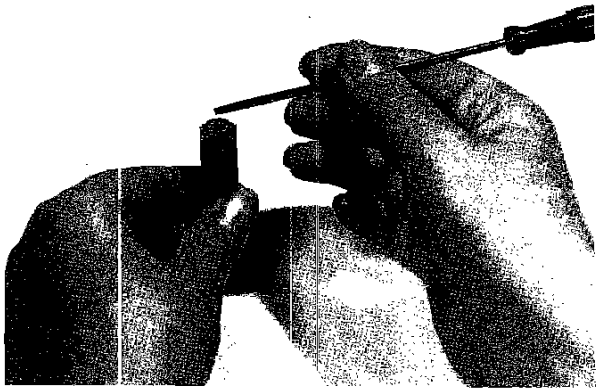


Figure 3.12 Prepare the ink capsule. *Before installing the ink capsule, gently press the steel sealing ball into the capsule. If the capsule is not fitted with a ball-seal use a safety pin or other pointed object to pierce the diaphragm in the 3mm cavity at one end of the capsule. Do* **not** *attempt to install the capsule on the dip tube without first perforating the diaphragm.*

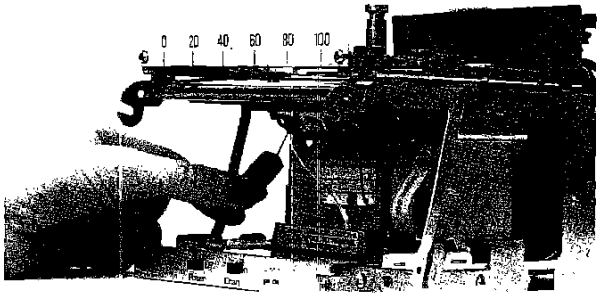


Figure 3.13 Install the ink capsule. *Remove the chart cassette. Pivot the ink carrier assembly forward, pass the ink capsule over the dip tube, then press the capsule firmly into place on the dip tube shoulder; a twisting motion helps ensure a leakproof fit.* **Do not squeeze** *the capsule, and do not allow ink into the priming tube. Return the ink carrier assembly to its original position. With the capsule installed, do not turn the recorder on its side — to do so would cause ink to enter the priming tube.*

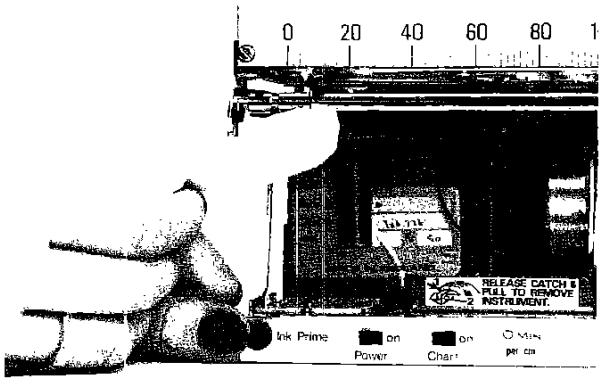


Figure 3.14 Priming the ink system. *While covering the air inlet with the finger, compress the priming bulb (push, do not squeeze); then release the bulb completely. Repeat this pumping action until ink appears at the pen tip. Remove surplus ink with tissue, then replace the chart cassette.*

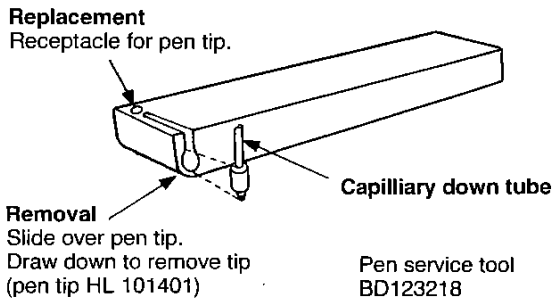


Figure 3.15 Pen tip replacement. *Line width increases with pen wear. If the line becomes unacceptably wide, remove the chart cassette and* **gently** *pull the pen tip away from the pen tube. Install a fresh tip, ensuring that the metal tube touches the tip fibres. Be sure not to distort the pen assembly during this operation. Installation of the pen tip is facilitated by the pen service tool No. BD123218.*

Figure 3.16 Cleaning the ink system. *Capillary systems allowed to dry out through intermittent use or storage may require flushing with water. Flushing bulb No. LA127163 is fitted with a capillary tube which may be attached to any part of the recorder ink system. Detach the nozzle from the bulb before filling. Complete the flushing operation so that, when the bulb is released for the last time, the flushing water is drawn out of the recorder capilliaries. When flushing is completed, reassemble the ink system, install a fresh ink capsule, then prime repeatedly until* **full strength** *ink appears at the pen tip.*

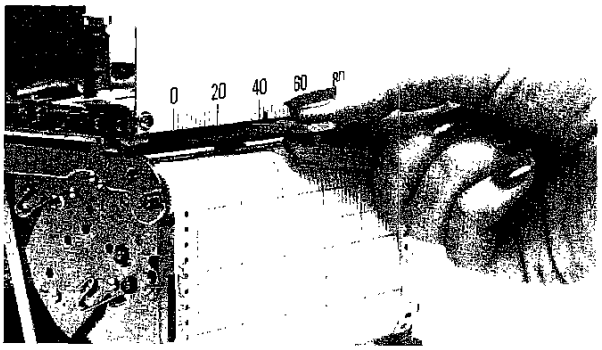


Figure 3.17 Installing the pen cartridge. *Remove the protective cap from the pen tip, and the sealing plug (if fitted) from the rear of the cartridge. If no sealing plug is fitted, and* **only** *if so directed in the instructions supplied with the cartridge, pierce a small hole at the rear of the cartridge. Carefully install the cartridge in the holder, avoiding sideways movement. Do not force the cartridge beyond the stop as this could disturb the pen pressure and damage the pen carriage.*

3.6 Disposable Ink/Pen Cartridge (FTD)

Disposable cartridges are available in sealed packs. Warranted shelf life of the pack with seal unbroken is 12 months. Colours available are:

Blue		LA125451
Purple	Event marker cartridge (sold singly)	LA230393

3.7 Conversion from Capillary Ink to Disposable Pen Cartridge

This conversion can be performed on site, if desired. Conversion kit and instructions are available. Refer to Section 7.0 Spares List for details.

3.8 Operation of the Recorder

Power On: With the input signal and power connected, set the ***power switch*** (on the lower front ledge of the chassis) to ***ON.*** The pen should drive to a position depending on the input amplitude. If not, remove the chassis from the case and check the security of the printed circuit assemblies, harnesses and fuse. If unsuccessful, check the fuse and replace if necessary. If the visual and fuse check fails to rectify the problem, ***qualified service personnel*** should perform detailed electrical checks with reference to the drawings in Section 4.0.

Chart On: Set the ***chart*** switch to ***on***. If the chart fails to move, remove the chassis from the case and check security of the two-wire harness and plug connecting the chart motor with the mother PCB. If the chart speed is incorrect, check the speed at the output shaft of the motor/gearbox assembly. For single speed (synchronous) motors, this should be 1 revolution in either 15 seconds or 15 minutes, depending on the choice of motor. If the motor speed is correct, check the gears installed on the cassette. Gear diagrams and corrective procedures are outlined in Section 2.0

Input Module Calibration: Zero and span adjustment procedures are together with the drawings in Section 4.0. To locate the appropriate schematic, check the type of input and the signal span for which the recorder was calibrated at the factory (label on rear panel of the recorder). Example: AH101703 for RTD 3-wire, AH101705 for thermo-couples (table, section 1.4).

3.9 Maintenance Procedures

Six Month Inspection:

1) Remove the chassis from the case. Check for cleanliness and security of sub-assemblies.
2) Check the ink capillary tubes, if fitted, for flexibility and replace any tube showing signs of hardening (Part Number BK127743).
3) Clean the viewing window.

Twelve Month Inspection:

1) Complete the six month inspection outlined above, then remove the pen servo tray and chart cassette for cleaning as follows:—

2) Pen servo tray:
   a) Unscrew the knurled nut from the post at the centre of the pen servo tray, remove the spacing collars, if any, then detach the tray from the chassis.
   b) Unplug the pen servo and alarms (if fitted) looms from the printed circuit boards.
   c) Remove ink spills and other deposits using non-linting cloth moistened with isopropyl alcohol only. (Other solvents may damage plastic components such as the conductive plastic feedback potentiometer). Using a soft brush and air line, remove all traces of dust. ***Do not lubricate*** any bearing surface on the pen servo tray.
   d) Inspect the drive cord for wear, then check cord tension (details later in this section). Replace or adjust the cord as required.
   e) Using a cotton swab and isopropyl alcohol ***only,*** clean the plastic feedback track and allow to dry. ***If reduced performance*** or sensitivity is apparent when the recorder is re-assembled and tested, this may be due to feedback contact wear. In that case, replace the contacts as outlined in paragraph 3.13.
   f) Re-assemble the pen servo tray to the chassis. Check that the pen travels parallel to the paper.
   g) Reconnect the servo wiring to the printed circuit boards; arrange harnesses carefully to give clearance from metal edges, circuit components, etc.

3) Chart cassette:
   a) Remove the chart cassette and unload any remaining paper.
   b) Remove the screw and lock washer securing the gear cover plate to the right side of the cassette. Lift off the gears, noting their positions carefully.
   c) Without disassembling the cassette, use a non-linting cloth moistened with isopropyl alcohol to remove old lubricant.
   d) Using a soft brush and air line, remove all dust.
   e) Lubricate all bearings with a ***minute*** quantity of Microtime Oil (Part Number EB127750) or other "non-migrating" lubricating oil, applied very carefully with an eye dropper or toothpick. ***Do not lubricate*** take-up roller clutch or gear teeth.
   f) Re-assemble the gears and replace the cover plate. Secure the retaining screw with Loctite 222.
   g) Re-install the cassette; check the mesh of the chart motor with the cassette as outlined in Section 2.
   h) If a capillary ink system is fitted, and the pen is showing signs of wear (wide line), replace the pen tip as shown in figure 3.15.
   i) For all writing systems, check the pen pressure as outlined later in this section.

3.10 Checking Pen Pressure

Pen pressure is checked with a force gauge calibrated from zero to 15 grams, such as Correx. Alternatively, a laboratory-type spring balance may be used, but this must first be calibrated by the user with weights (especially in the range 5 to 10 grams). Check and adjust pen pressure as follows:—

Place the tip of the force gauge under the leading edge of the cartridge holder, then raise the gauge gently until the pen tip is just lifted clear of the paper; note the force indication at that point.

The pressure MUST be between 7 grams ±2, and the pen tip should be vertical. If not, adjust the two 2mm set screws in the pen block, ***checking frequently that the upper surface of the cartridge holder blade bears on the points of the screws,*** and not on the lower surface of the pen block (Figure 3.18).

If the pressure remains too high throughout the range of adjustment, i.e. if the blade of the holder exerts too much downward force, this can be corrected by screwing down the two sets of screws to the limit, then returning the screws to the point where they hold the blade just clear of the pen block. Be sure not to strip the threads from the triangular cavities in the pen block.

3.11 Electric Writing — Grounding Block Pressure

Remove the chart cassette and pen tray. "Weigh" the grounding block with a Correx force gauge; raise the gauge to the point where the front edge of the block, hooked onto the gauge, is exactly 63mm above the chassis. The reading should be 100 ±10 grams for American paper, or 145 ±15 grams for European paper.

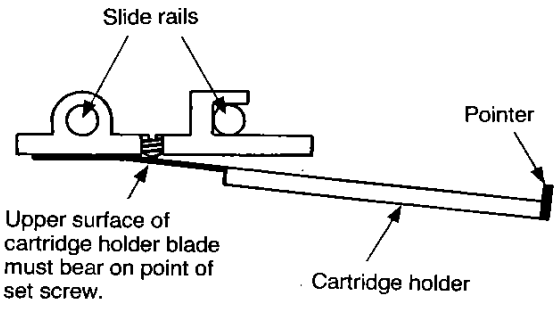


Figure 3.18 Cartridge pressure adjustment.

On electric writing recorders using paper purchased in the USA, the stylus pressure must be between 6 and 7 grams. For European paper, set the pressure between 4 and 5 grams.

3.12 Replacing Servo Drive Cord

The servo drive cord is very durable and has a practically infinite life; the most likely cause of failure is accidental damage by burning or cutting. In the event of failure, the entire pen servo tray should be returned to the nearest service facility for repair. If that is impracticable, emergency repair can be successful if the procedure given below is followed carefully:—

The drive cord is a 0.5mm diameter woven polyester suture, factory treated to prevent stretch. For emergency purposes, any non-stretching cord of similar thickness can be used.

1) Slacken the two pen motor securing screws so that the motor can be moved back and forth.
2) Slacken the cord retaining screw on the white moulded pen block; remove the cord from the block.
3) Remove the grip ring No. 1, Figure 3.19, from vertical shaft No. 2, then remove the circlip No. 3 from the phosphor bronze outer shaft No. 4.
4) Construct a measuring jig by tapping two panel pins 210mm apart into a wooden bench top. Loop the replacement cord round one pin; then knot very firmly the two ends round the other pin to give a continuous loop of 420mm total length. Cut off the surplus cord and seal the knot with quick drying varnish.
5) Using a length of fine-gauge wire as a threader, feed the cord loop with the knot to the inside through the hole in the side of the grey plastic capstan; pull the cord tight against the knot.
6) Re-assemble the capstan components exactly as originally installed; the number and location of the acetate washers is critical in determining the slipping torque of the clutch.
7) Hold the pen tray with scale plate forward. With the hole in the capstan facing the scale plate, wind the left-hand half of the cord loop ***three times clockwise*** round the capstan, and then round left-hand pulley, Figure 3.19. Run the other half of the cord loop round the right-hand pulley.
8) Position the pen block to the left side of the pen servo tray; then run the cord round and under the clamp bush on the pen block. Lightly tighten the clamp screw.
9) Slide the pen block to the right side of the tray to ensure that full traverse of the block is not impeded and the cord winds evenly on the capstan. If necessary adjust the position of the pen block in relation to the cord. Tighten the cord clamp screw.
10) Cord tension is checked with a force gauge calibrated from zero to 15 grams, such as Correx. Position the force gauge so that blade deflects the cord when the gauge is moved toward the front of the pen tray. The force indication should be between 9 and 11 grams with the cord deflected 3mm. Move the pen motor forward or back as necessary, then tighten the motor securing screws.

3.13 Replacing the Feedback Potentiometer (Slidefilm) & Contacts

1) Slide the white moulded pen block to the right side of the tray, then remove the countersunk zero adjust screw from the chassis tab at the left-hand end of the slidefilm assembly.
2) Remove the leafspring located between the tray sidewall and the left-hand end of the slidefilm assembly. Lift out the slidefilm assembly.
3) If the slidefilm assembly is to be replaced, unsolder the feedback and alarm setpoint wires, noting their positions for re-assembly. Use low melting point solder, taking care ***not to overheat*** the printed circuit pads. New contacts should be fitted if the slidefilm assembly is replaced.
4) Remove the screw securing the contact set to the pen block; remove the contact set.
5) Install the replacement contact set, taking care ***not to distort*** the contacts (the contacts are jigged to give the correct pressure when installed and do not require adjustment).
6) Replace the slidefilm assembly, leaf spring and zero adjust screw.
7) Refit the pen servo tray to the chassis.
8) Install a loaded chart cassette. Apply power to the recorder; then with the zero level input signal, adjust the slidefilm zero screw to set the pen tip to the zero line on the chart. Adjust the scale position if necessary to set the pen pointer at scale zero.

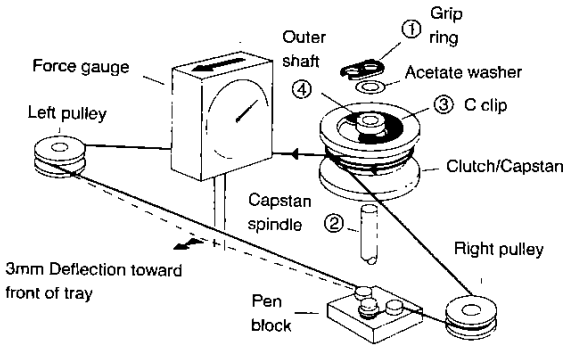


Figure 3.19 Servo drive cord installation

3.14 Alarm Contacts

The alarm contact securing screws are accessible only with the slidefilm assembly removed. When replacing alarm contacts, be sure that the ***assymetrical*** contact pair is fitted to the ***right*** block.

4.0 Calibration Procedures for Input & Pen Drive Modules

Input Conditioning Modules:
AH101698 High Impedance DC Amplifier.
AH101705 General Purpose DC and Thermocouples.
AH101700 General Purpose AC.
AH101686 Two and Four Wire RTD's.
AH101703 Three Wire RTD.

Pen Drive:
AH101682 Pen Drive Module.

4.1 Calibration Procedures

Re-Calibration of a model 300 recorder should always be checked in the following sequence:—

1) Input module.
2) Pen drive module.
3) Alignment of feedback element.
4) Scale alignment.

Model 300 input conditioning modules are characterised at the factory to match the user's original specifications.
ESSENTIAL for input modules . . . Before starting any calibration procedure ***always*** check the 12V DC reference supply at the input module. The permissible range is ±10mV. Allow a few minutes warm-up period before calibrating.

4.2 Service Aids.

Service connector No. LA125444 is a cable harness assembly which brings all power and signal lines from the case rear panel connectors out to a duplicate set of connectors mounted on a bench stand. This allows the exposed recorder chassis to be checked with the regular input signals (usually hard-wired to the case) or with locally injected test signals. Service extender boards are available for both input conditioning modules, No. AH122310 and servo amplifier (pen drive) modules, No. AH122320.

> **CAUTION**
> Dangerous voltages may be present at accessible points within the recorder ***whether or not*** AC power is connected; this is because there is no isolation between the input signal and internal circuit components, including the potentiometric feedback element.

4.3 Calibration Procedure for Module AH101698.

Linear direct voltages up to 4mV and currents up to 100uA.
These instructions apply to standard ranges only. Special features provided at customer request may require a different procedure to be followed.
Current inputs usually incorporate a shunt resistor on the rear terminals of the case, which allows the instrument to be withdrawn without breaking the current loop. Ensure this component is in place before attempting to pass current through the input module. If an additional error of 0.15% can be tolerated, the current input module can be calibrated to the nominal (i.e. theoretical) shunt voltage without using the actual shunt resistor intended for the particular input.

Equipment Required:—
1) Signal source covering the desired range, with overall accuracy of ±0.02%.
2) DVM covering the range zero to 10V DC, with overall accuracy of ±0.2%.

Procedure:—
1) Check the seal on P4 (offset null); if broken, centre the potentiometer. No further adjustment is necessary.
2) Adjust ***input bias current*** as follows—
With the module input terminals otherwise open-circuit, connect a 10k ohms 1% 50ppm metal film resistor across the terminals, then measure the voltage across the resistor. Adjust P1 for less than ±10uV. Remove the resistor.
3) Adjust electrical ***zero*** as follows—
Apply the low scale (most negative, smallest) input voltage to the input terminals and adjust P2 (zero) for 0.0V ±10mV between connector pins 6 (0V) and 2 (output).
4) Adjust ***span*** as follows—
Apply the high scale (most positive, largest) input voltage to the input terminals and adjust P3 (span) for 10.0V ±10mV between connector pins 6 (0V) and 2 (output).
5) Apply low and high scale inputs once more checking that the respective outputs are 0 and 10V ±10mV. If not, slight re-adjustment of P2 and P3 will correct.
6) Check the mechanical zero, i.e. pen position in relation to the zero grid line on the chart, with the input signal at low scale value. Adjust the slide film position screw if necessary. Tapping the pen tray lightly during this operation will assist in overcoming drag between paper and pen tip.
7) Check the pointer position at low scale taking care to avoid parallax errors. If necessary, slacken the scale retaining screws and slide the scale to achieve an acceptable reading.
8) At low and high scale settings, check pen and pointer positions on scale and chart, again avoiding parallax errors. The position should be within ±0.25% (0.25mm) of true. At extreme humidities, ignore the chart and refer only to the scale.
9) Other factors such as pen pressure, pen/holder alignment, servo board calibration, and so on can affect calibration. If the above does not produce acceptable results, or if the instrument has been disassembled, these factors must be corrected before starting the calibration procedure.

4.4 Calibration Procedure for Module AH101705.

Equipment Required:—
1) Signal source covering the desired range, with overall accuracy of ±0.02%.
2) DVM covering the range zero to 10V DC with overall accuracy of ±0.02%.

NOTE: For thermocouple inputs, gold-plated contacts should be fitted to the male and female grey moulded connectors at rear of the recorder chassis and case. If the input requires cold junction compensation, then the appropriate compensating cable and temperature reference chamber accurate to ±0.1°C (or ±0.02% whichever is greater) are necessary.

3) Eurotherm Thermocouple & Resistance Thermometer Tables TT2-1.

Linear direct voltages and currents:
These instructions apply to standard ranges only. Special features provided at customer request may require a different procedure to be followed.
In recorders, a current input is converted into a voltage signal, which is then treated conventionally by the Module AH101705. The shunt resistor is selected (typically) to give a span of 75mV full scale; for 4-20mA signals, the option of 4V span (i.e. range of 1-5V) is offered. Commonly specified shunt resistor values

are listed below.
For most applications, the shunt resistor is fitted to the input terminals on the rear panel of the recorder case; the current circuit thus remains intact if the recorder chassis is withdrawn from the case.

Signal Range in mA	Shunt Value in ohms	Voltage Range
0 to 1.0	75	0 to 75mV
0 to 10.0	7.5	0 to 75mV
0 to 20.0	3.75	0 to 75mV
−1.0 to +1.0	37.5	−37.5 to +37.5mV
−0.5 to +0.5	75	−37.5 to +37.5mV
4 to 20	4.688	18.75 to 93.75mV
4 to 20	250	1.0 to 5.0V
10 to 50	1.875	18.75 to 93.75mV

Ensure the shunt resistor is in place before attempting to pass the input current through the input module. If an additional error of 0.15% can be tolerated, the current input module can be calibrated to the nominal (i.e. theoretical) shunt voltage without using the actual shunt resistor intended for the particular input.
Exceptionally, R13B may be fitted as an internal shunt resistor on current inputs. When this is the case, unplugging the instrument will break the input current loop.

Procedure:—

1) Adjust the ***offset null*** as follows:
Apply to the input terminals a voltage within the range for which the module is calibrated. Adjust the input to give 1.0V ±10mV between pins 6 (0V) and 2 (output). Adjust P5B for 0V ±20uV between ICl inputs, accessible at R4B (−) and R20B(+).
2) Adjust electrical ***zero*** as follows:
Apply the low scale (most negative) input value to the input terminals and adjust P3B (zero) for 0.0V ±10mV between connector pins 6 (0V) and 2 (output). If P4B (coarse zero) is fitted, centre P3B, adjust P4B for 0.0V ±100mV, then set P3B as above.
3) Adjust ***span*** as follows:
Apply the high scale (most positive) input to the input terminals and adjust P2B (span) for 10.0V ±mV between connector pins 6(0V) and 2 (output).
4) Apply low and high scale inputs once more checking that the respective outputs are 0 and 10V ±10mV. If not, slight re-adjustment of P3B and P2B will correct.
5) Check the mechanical zero, i.e. the pen position in relation to the zero grid line on the chart, with the input signal at low scale value. Adjust the slide film position screw if necessary; tapping the pen tray lightly during this operation will assist in overcoming drag between paper and pen tip.
6) Check the pointer position at low scale taking care to avoid parallax errors. If necessary slacken the scale retaining screws and slide the scale to adjust.
7) At low and high scale settings, check pen and pointer positions on scale and chart, again avoiding parallax errors. The positions should be within ±0.25% (0.25mm or 0.01in) of true. In high humidities ignore the chart and refer only to the scale.
8) Other factors such as pen pressure, pen/holder alignment, servo board calibration, and so on can affect calibration. If the above does not produce acceptable results, or if the instrument has been dis-assembled, these factors must be first corrected.

Electronically linearised thermocouple inputs:
Thermocouple curves are linearised by a "straight line approximation", with four segments corresponding to four different amplifier gains (section "D" of the schematic). All component values in the linearising section are calculated in manufacture for the temperature range and thermocouple type specified by the user. To check calibration of a particular module, essential data are the input voltages corresponding to 10% and 90% scale indications. These values (available on request) differ from the thermocouple reference tables by a specific amount, i.e. the linearising offset voltage. The ***signal source*** used for calibration must be specifically intended for thermocouple work, with built-in cold junction compensation (e.g. Eurotherm Model 239), and must be connected to the recorder by an extension wire matching the thermocouple for which the input module is calibrated.

Procedure:—

1) Adjust the ***offset null*** as in 1) above for linear versions of the AH101705 module.
2) Adjust electrical ***zero*** as follows:
Apply to the input terminals the voltage corresponding to 10% of the temperature span for which the module is calibrated. Adjust P3B for 1.0V ±10mV between connector pins 6 (0V) and 2 (output). If P4B (coarse zero) is fitted, centre P3B, adjust P4B for 0.0V ±100mV, then set P3B as above.
3) Adjust ***span*** as follows:
Apply the voltage corresponding to 90% of the temperature span. Adjust P2B (span) for 9.0V ±10mV between connector pins 6 (0V) and 2 (output).
4) Re-apply the 10% and 90% inputs, checking once more that the respective outputs are 1 and 9V ±10mV. If not, slight re-adjustment of P3B and P2B will correct.
5) Adjust the input voltage for 0V ±10mV output. (This should correspond closely, but not precisely, to the low-scale voltage given in the thermocouple table for the particular temperature span in question, e.g. a module ranged for 200° to 400°C Type K, should give 0.0V output with 8.137mV input).

The remaining mechanical procedure is as 5) through 8) for linear AH101705 modules.

Internal cold junction compensation (CJC):
The internal cold junction is set at 40°C (104°F), that being the average temperature within a working cased recorder. When checking CJC calibration as outlined below, the input module should be protected from large temperature variations.

1) Remove link LK3, if fitted, then solder a 10K ohms 1% 50ppm metal film resistor between post "P" and the right-hand pad for LK3. (The 10K ohms resistor in effect sets the junction temperature at 40°C).
2) Turn P1B fully clockwise, viewed from the right-hand side of the PCB, component side up.
3) With a reference voltage source connected to the input terminals, vary the input voltage to give an output of 8V ±10mV. Note the exact ***input*** voltage.
4) Reduce the input voltage by the exact amount ***shown in mV*** in the following table for the value of R6B installed and the type of thermocouple in question, e.g. for R6B 12K ohms and Type K thermocouple, lower the input voltage by 1.933mV.

Value of R6B	Type of Thermocouple				
	J	K	T	E	R/S
1.2K ohms	2.439	1.904	1.951	2.897	—
4.7K ohms	2.465	1.925	1.972	2.928	—
12K ohms	2.476	1.933	1.980	2.941	—
27K ohms	2.481	1.937	1.984	2.947	0.299
56K ohms	—	—	—	—	0.299
120K ohms	—	—	—	—	0.299

5) Turn P1B counter-clockwise to restore the output to 8V ±10mV.
6) Remove the 10K ohms resistor and re-install link LK3. Allow the PCB to cool for at least 15 minutes before checking 10% and 90% calibration, as in electronically linearised thermocouple inputs.

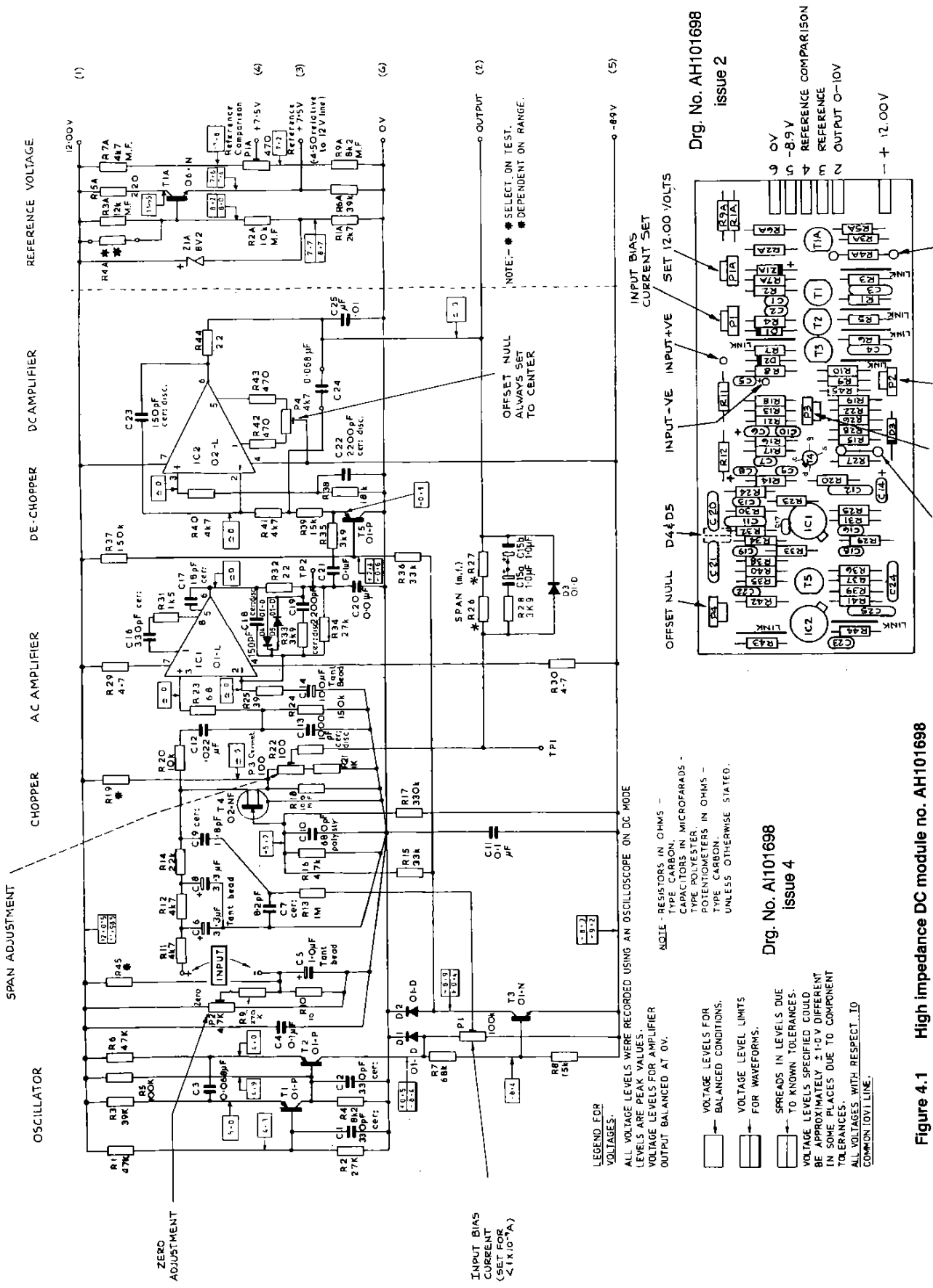
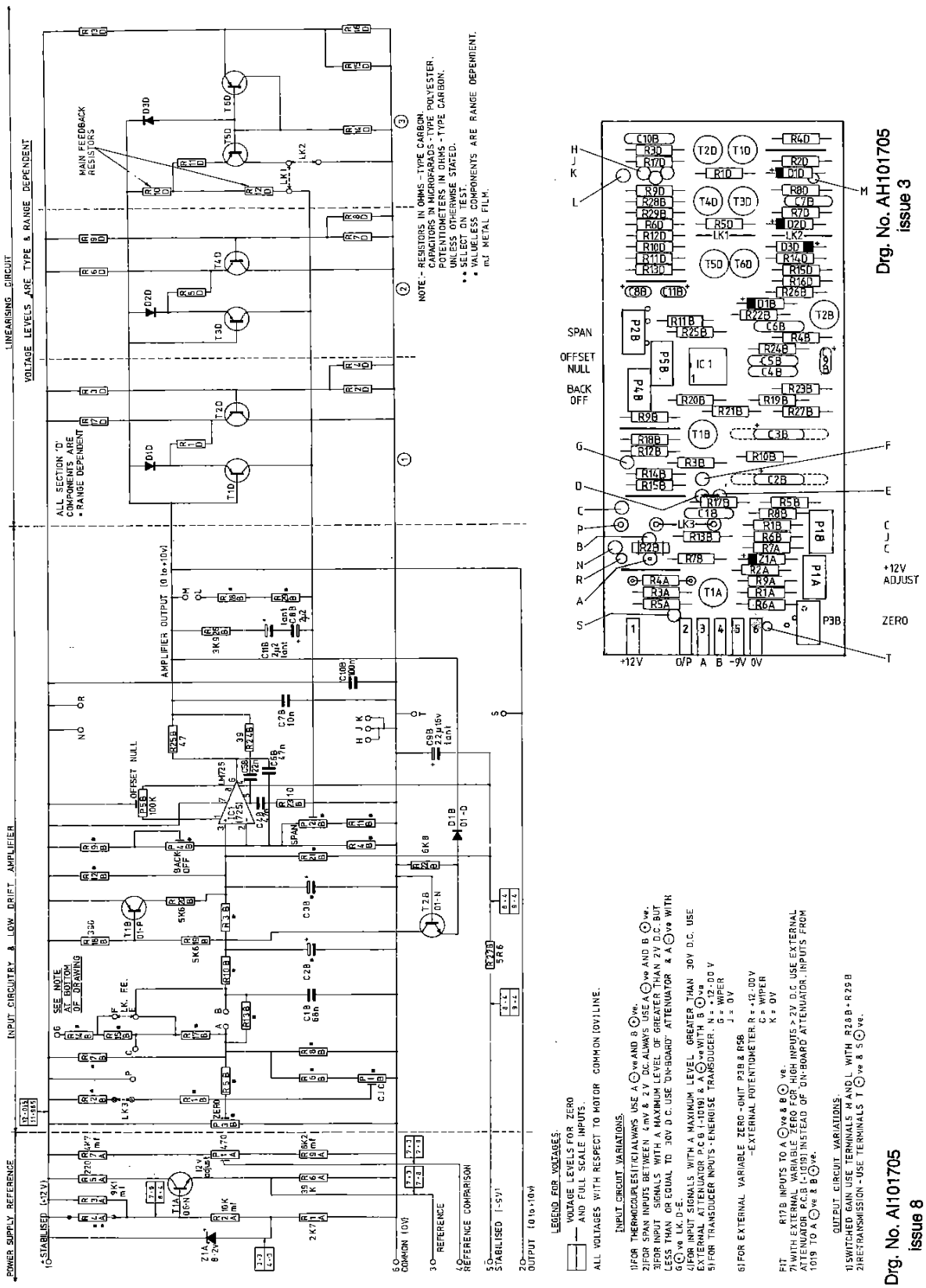


Figure 4.1 High impedance DC module no. AH101698



Drg. No. AH101705
issue 8

Drg. No. AH101705
issue 3

Figure 4.2 mA, mV, V and thermocouples module no. AH101705

4.5 Calibration Procedure for Module AH101700

Linear AC voltage and current.

These instructions apply to standard ranges only. Special features provided at customer request may require a different procedure to be followed.

Current inputs usually incorporate a shunt resistor on the rear terminals of the case, which allows the instrument to be withdrawn without breaking the current loop. Ensure this component is in place before attempting to pass current through the input module. If an additional error of 0.15% can be tolerated, the current input module can be calibrated to the nominal (i.e theoretical) shunt voltage without using the actual shunt resistor intended for the particular input.

For inputs greater than 30V AC, a 50:1 (nominal) isolating transformer is installed on the rear panel of the recorder case. For calibration purposes, the transformer must be included in the signal loop; either detach the transformer from the case or use a service connector assembly, No. LA125444.

Equipment Required:—

1) Signal source covering the desired range, with overall accuracy of ±0.2%.
2) DVM covering the range zero to 10V DC, with overall accuracy of ±0.02%.

Procedure:—

1) Adjust ***zero*** as follows:
   Apply the low scale (smallest) input voltage to the input terminals and adjust P2 (zero) for 0.0V ±10mV between connector pins 6 (0V) and 2 (output). If P1 (coarse zero) is fitted, first centre P2 and adjust P1 for 0.0V ±100mV; then set P2 as above.
2) Adjust ***span*** as follows:
   Apply the high scale (largest) input voltage to the input terminals and adjust P3 (span) for 10.0V ±10mV between connector pins 6 (0V) and 2 (output).
3) Apply low and high scale inputs once more checking that the respective outputs are 0 and 10V ±10mV. If not, slight re-adjustment of P2 and P3 will correct.
4) Check the mechanical zero, i.e. pen position in relation to the zero grid line on the chart, with the input signal at low scale value. Adjust the slide film position screw if necessary. Tapping the pen tray lightly during this operation will assist in overcoming drag between paper and pen tip.
5) Check the pointer position at low scale taking care to avoid parallax errors. If necessary, slacken the scale retaining screws and slide the scale to achieve an acceptable reading.
6) At low and high scale settings, check pen and pointer position on scale and chart, again avoiding parallax errors. The positions should be within ±0.25% (0.25mm) of true. At extreme humidities, ignore the chart and refer only to the scale.
7) Other factors such as pen pressure, pen/holder alignment, servo board calibration, and so on can affect calibration. If the above does not produce acceptable results, or if the instrument has been dis-assembled, these factors must be corrected before starting the calibration procedure.

4.6 Two & Four Wire RTD Module AH101686

Range component selection:

The range dependent components marked with an asterisk on the drawings are selected to match the RTD specified at the time of ordering. We do not recommend range changes to be carried out in the field. Factory re-calibration or exchange schemes should be used if required.

Calibration procedure:

Equipment Required:—

1) Resistance box, ±0.01% accuracy, e.g. Cropico Type RBB5.
2) Eurotherm Bulletin TT2-1, Thermocouple & Resistance Thermometer Tables.
3) Digital voltmeter (DVM) covering the range zero to 20V DC with overall accuracy of ±0.02%.
4) 1K ohm metal film resistor.

Procedure:—

1) Connect the resistance box to the recorder by a 4-wire connection.
2) Switch on the instrument and allow 5 minutes for the instrument to warm up. Check the presence of the power supplies, and that the 12.00V reference line is 12.00V ±15mV (11.985 to 12.015V) relative to 0V. Adjust P1A if necessary.
3) Short together the inverting (pin 2) and non-inverting (pin 3) inputs of IC1. Adjust P4B for an amplifier output of around 0V. Note that this adjustment is very sensitive, but not very critical. Remove the short circuit.

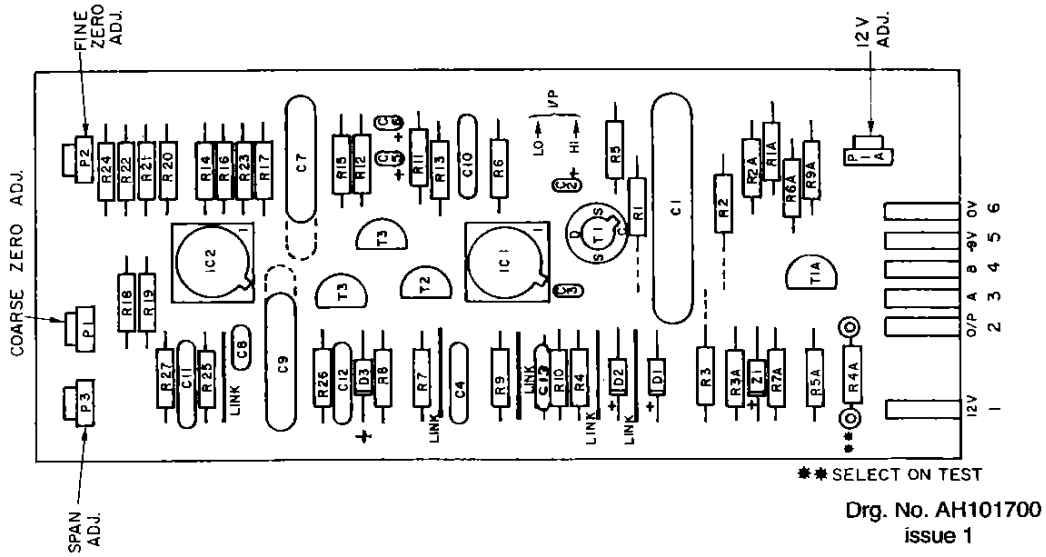
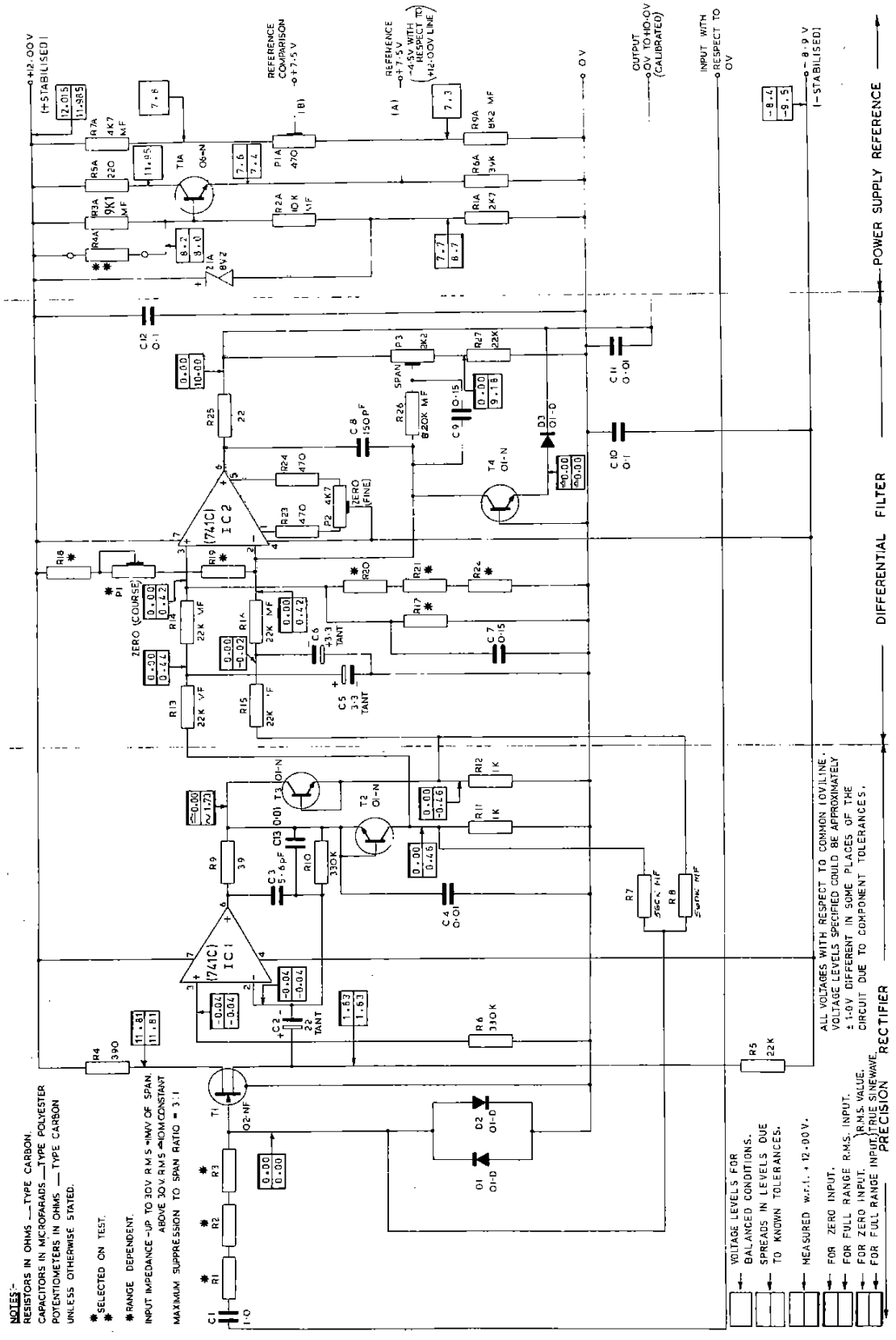


Figure 4.3 AC input module AH101700



Drg. No. AH101700 issue 2

Figure 4.4 AC input module no. AH101700

4) The scale of the input, for example 0—1000°C, is divided by 10, since the output of board is 0—10V. The board is then calibrated at low, high and mid-point; in this example 1V, 9V and 5V corresponding to 100°C, 900°C and 500°C.
5) Set up the low scale calibration resistance on the resistance box using the thermometer tables, and adjust P3B for an output at pin 2 of 1V ±15mV relative to pin 6 (0V).
6) Set up the high scale calibration resistance on the box and adjust P1B for 9V ±15mV output. Remove link 3 and replace with 1K ohm metal film resistor. Set up the mid-scale resistance on the box and adjust P2B for less than ±10mV across the 1K resistor.
7) Refit link 3 and repeat paragraphs 4) and 5) until no further improvement is obtained. Note that not more than two repeats should be necessary.
8) Check the pen position on the chart at low scale and adjust the slide film position screw if necessary. Tapping the pen tray lightly during this operation will assist in obtaining a satisfactory setting.
9) Check the pointer position at low scale taking care to avoid parallax errors. If necessary, slacken the scale retaining screws and slide the scale to achieve an acceptable reading.
10) Check pen and pointer positions on scale and chart, again avoiding parallax errors. The positions should be within ±0.25% (0.25mm) of true. At extreme humidities, ignore the chart and refer only to the scale.
11) Other factors such as pen pressure, pen/holder alignment, servo board calibration, and so on can affect calibration. If the above does not produce acceptable results, or if the instrument has beeen dis-assembled, these factors must be corrected before starting the calibration procedure.

4.7 Three Wire RTD Module AH101703

Range component selection:
The range dependent components marked with an asterisk on the drawings are selected to match the RTD specified at the time of ordering. We do not recommend range changes to be carried out in the field. Factory re-calibration or exchange schemes should be used if required.

Calibration procedure:
Equipment Required:—
1) Resistance box ±0.01% accuracy, e.g. Cropico Type RBB5.
2) Eurotherm Bulletin TT2-1, Thermocouple & Resistance Thermometer Tables.
3) Digital voltmeter (DVM) covering the range zero to 20V DC with overall accuracy of ±0.02%.

Procedure:—
1) Connect the resistance box to the recorder by a 3-wire connection ensuring that the lead resistance of the wires connected to terminals V + and V − are exactly equal.
2) Switch on the instrument and allow 5 minutes for the instrument to warm up. Check the presence of the power supplies, and that the 12.00V reference line is 12.00V ±15mV (11.985 to 12.015V) relative to 0V. Adjust P1A if necessary.
3) Short together the inverting (pin 2) and non-inverting (pin 3) inputs of IC2. Adjust P4B for an amplifier output of around 0V. Note that this adjustment is very sensitive but not very critical. Remove the short circuit.
4) Short out link 3. Adjust P6B for an amplifier output on IC1 of around 0V. Note that this adjustment is very sensitive but not very critical. Remove the short circuit.
5) The scale of the input, for example 0—1000°C, is divided by 10, since the output of the board is 0—10V. The board is then calibrated at low, high and mid-point; in this example 1V, 9V and 5V corresponding to 100°C, 900°C and 500°C.
6) Set up the low scale calibration resistance on the resistance box using the thermometer tables, and adjust P3B for an output at pin 2 of 1V ±15mV relative to pin 6 (0V).
7) Set up the high scale calibration resistance on the box and adjust P5B for 9V ±15mV output.
8) Repeat paragraphs 5) and 6) until no further improvement is obtained. Note that not more than two repeats should be necessary.
9) Check the pen position on the chart at low scale and adjust the slide film position screw if necessary. Tapping the pen tray lightly during this operation will assist in obtaining a satisfactory setting.
10) Check the pointer position at low scale taking care to avoid parallax errors. If necessary, slacken the scale retaining screws and slide the scale to achieve an acceptable reading.
11) Check pen and pointer positions on scale and chart, again avoiding parallax errors. The positions should be within ±0.25% (0.25mm) of true. At extreme humidities ignore the chart and refer only to the scale.
12) Other factors such as pen pressure, pen/holder alignment, servo board calibration, and so on can affect calibration. If the above does not produce acceptable results, or if the instrument has been dis-assembled, these factors must be corrected before starting the calibration procedure.

4.8 Pen Drive Module AH101682

Setting Up Procedure:—
1) Check the DC voltage between pins 4 and 9; this should be 12.0V ±10mV. If in error, adjust ***P1A*** on the ***input*** module.
2) Ensure the high-end electronic limit is well off-scale by applying a full scale signal to the input module, and adjusting P2B to bring the pointer downscale; then turn P2B fully in the opposite direction.
3) Repeat 2) for the low-end limit, adjusting P3B, with the input signal corresponding to scale zero.
4) Adjust the input signal to give 10V ±5mV between pins 4 and 8. Measure the voltage between pen tray connector pins L3 and L2 (red and orange wires for left-hand zero recorder). Adjust P4B (span) for 11.556V ±10mV. Be sure the pen assumes its true position by frequent gentle tapping of the pen tray throughout this procedure.
5) Adjust the input signal to give 0V ±5mV between pins 4 and 8. Measure the voltage between pen tray connector pins L3 and L2. Adjust P1B (zero) for 0.444V ±10mV. Be sure the pen assumes its true position by frequent gentle tapping of the pen tray throughout this procedure.
6) Repeat 4) and 5) until acceptable results are achieved.
7) Adjust the input signal to give > 10.5V between pins 4 and 8. Measure the voltage between pen tray connector pins L3 and L2. Adjust P2B (limit) for 11.722V ±10mV, tapping the pen tray as before.

With some input modules, for example AC ranges without zero offset, it may not be possible to adjust the input in accordance with 8). In these instances either adjust the input module zero potentiometer to simulate a negative input, or substitute another module of suitable type.

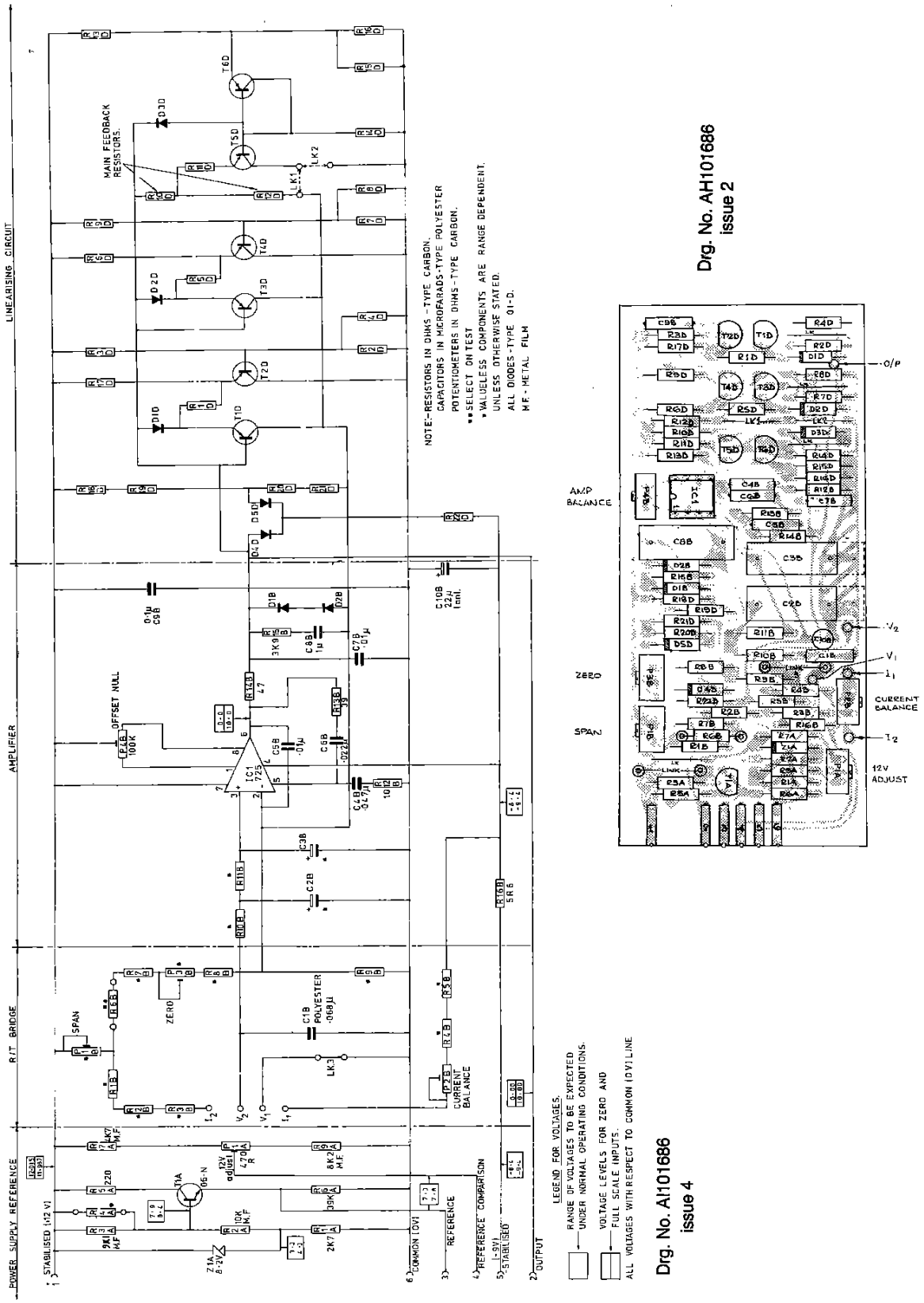


Figure 4.5 Resistance thermometer (2 and 4 wire) module no. AH101686

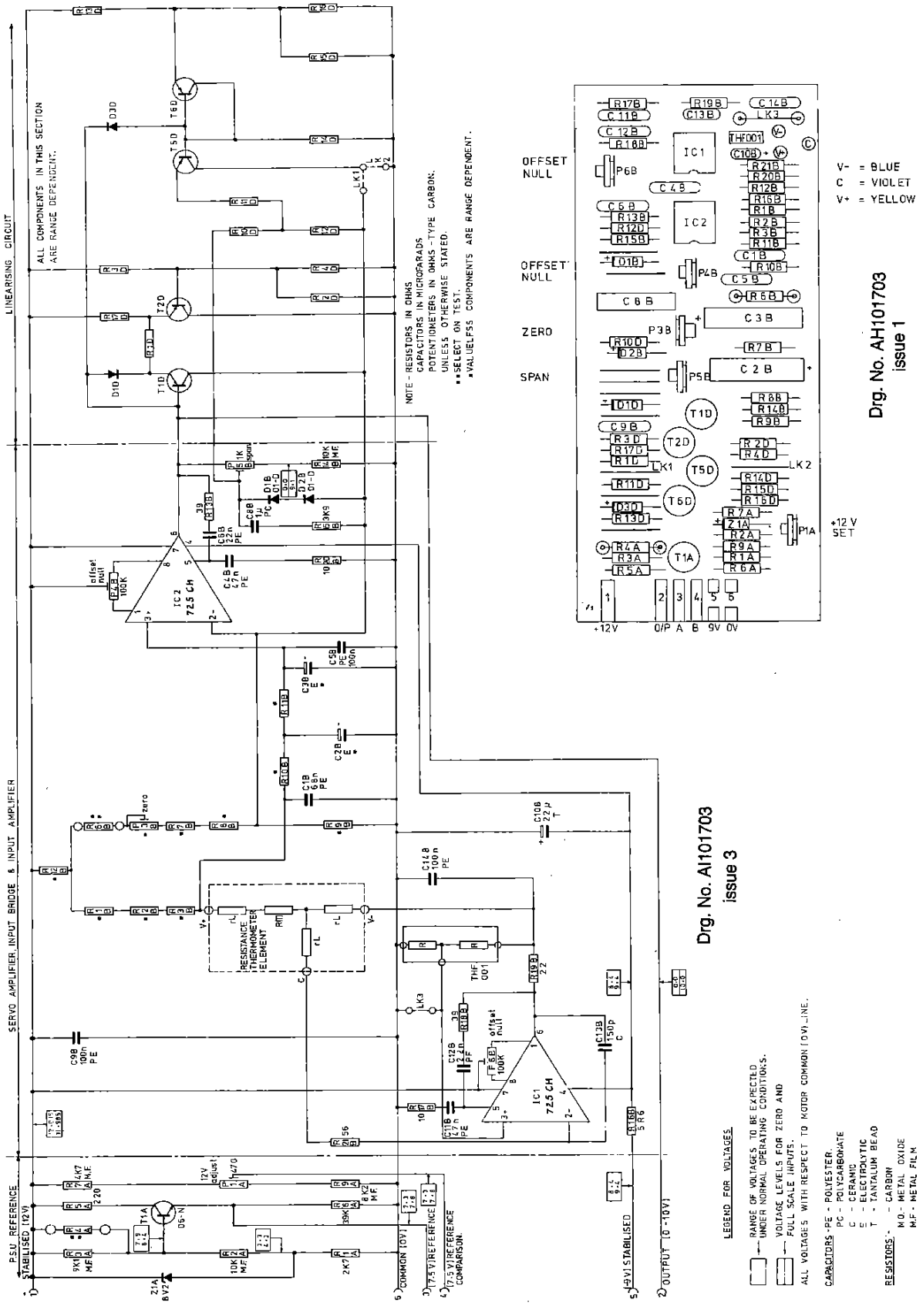
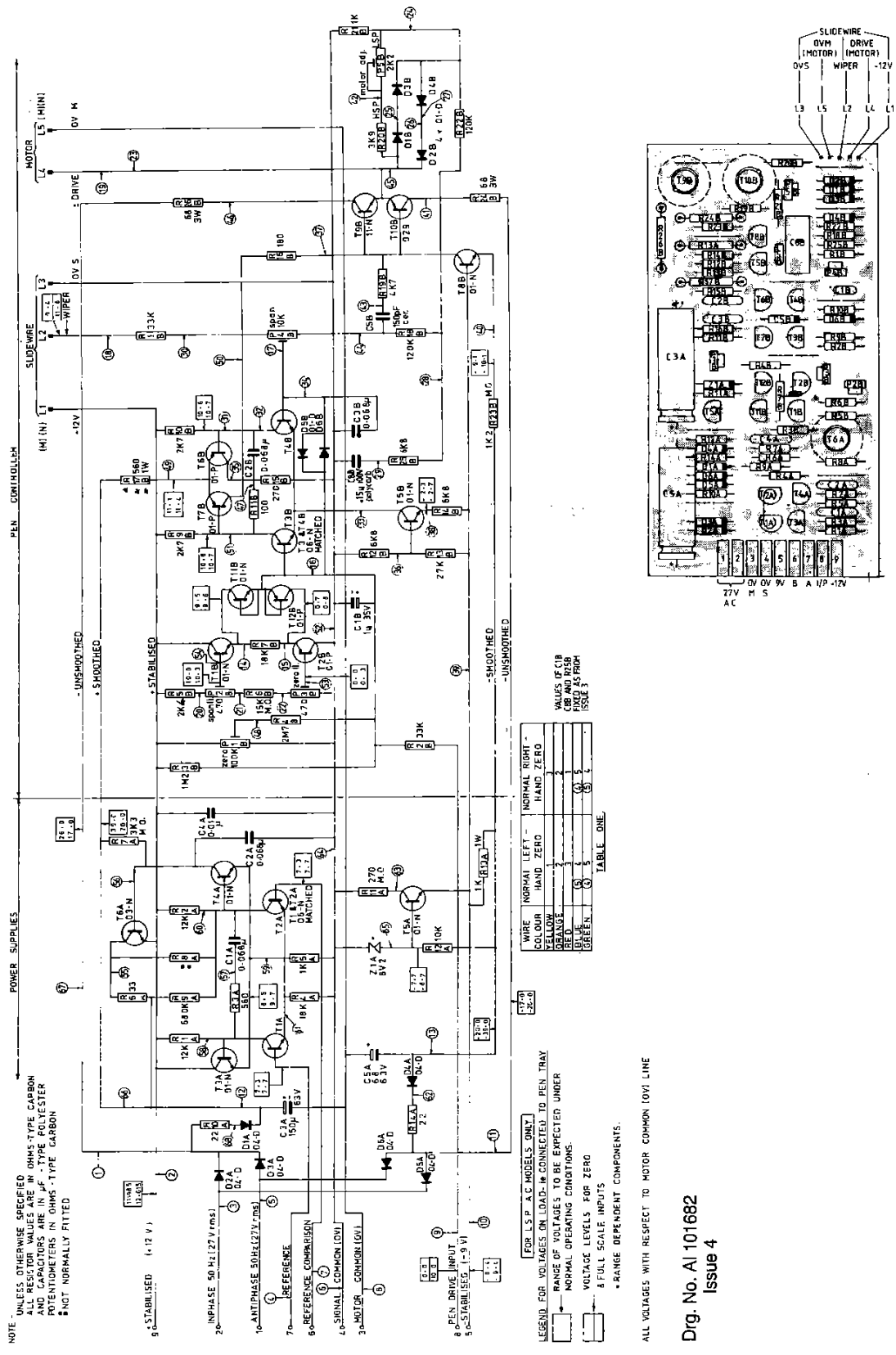


Figure 4.6 Resistance thermometer (3 wire) module no. AH 101703



Drg. No. AI 101682
Issue 4

Drg. No. AH101682
Issue 4

Figure 4.7 Pen drive board module no. AH101682

5.0 Major Option Schematics

Electric Writing
Hi/Lo Alarms (Option HLL)

Title	Figure
Electric Writing Module AH101706 — Circuit & Layout	5.1
Low Alarm PCB AH123640 — Circuit and Layout	5.2
High Alarm PCB AH123650 — Circuit and Layout	5.3
Model 300 Hi/Lo Alarms — Mechanical Layout	5.4
H.F. Pulse Rate Input Amplifier AH101701 — Circuit & Layout	5.5

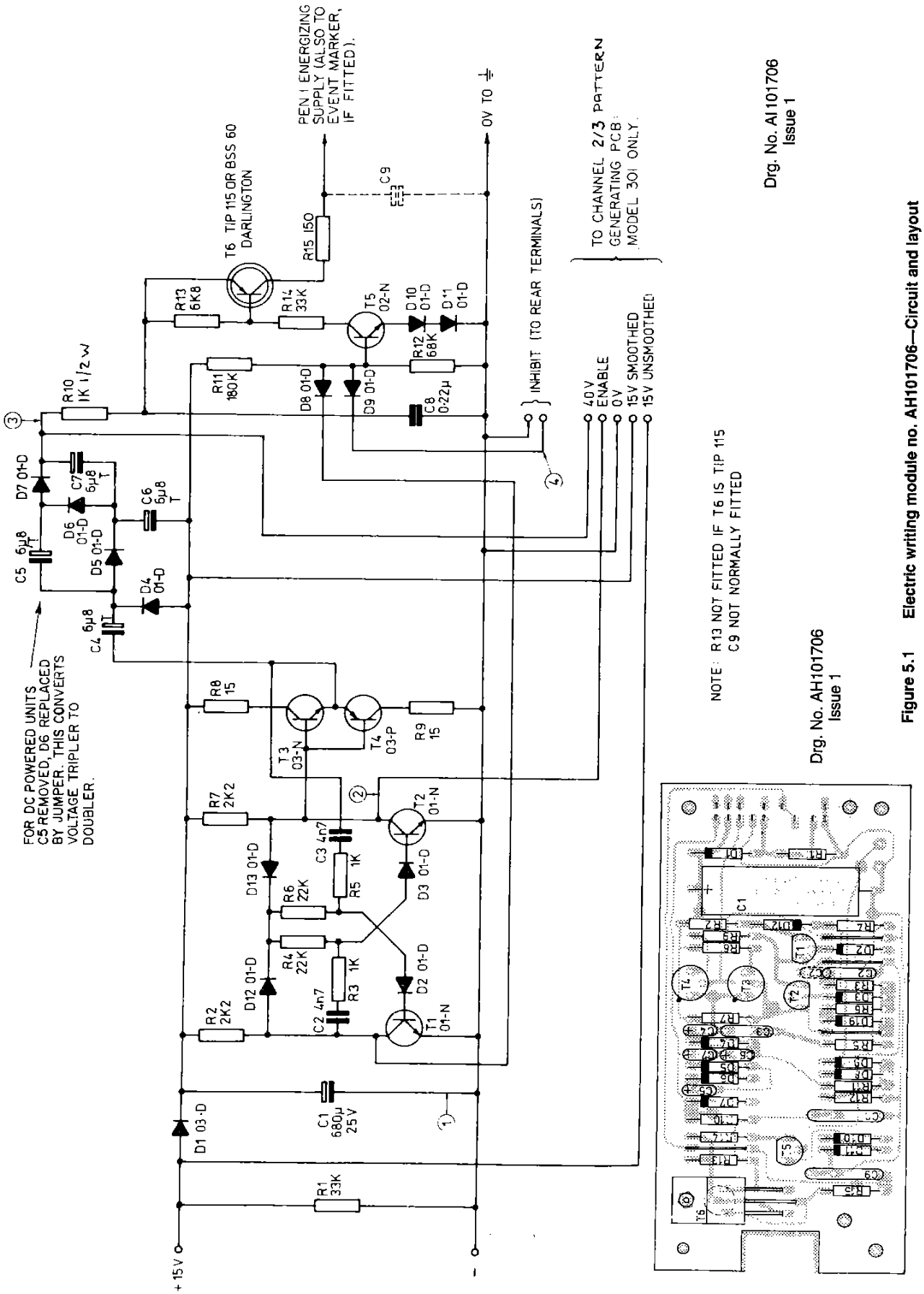


Figure 5.1 Electric writing module no. AH101706—Circuit and layout

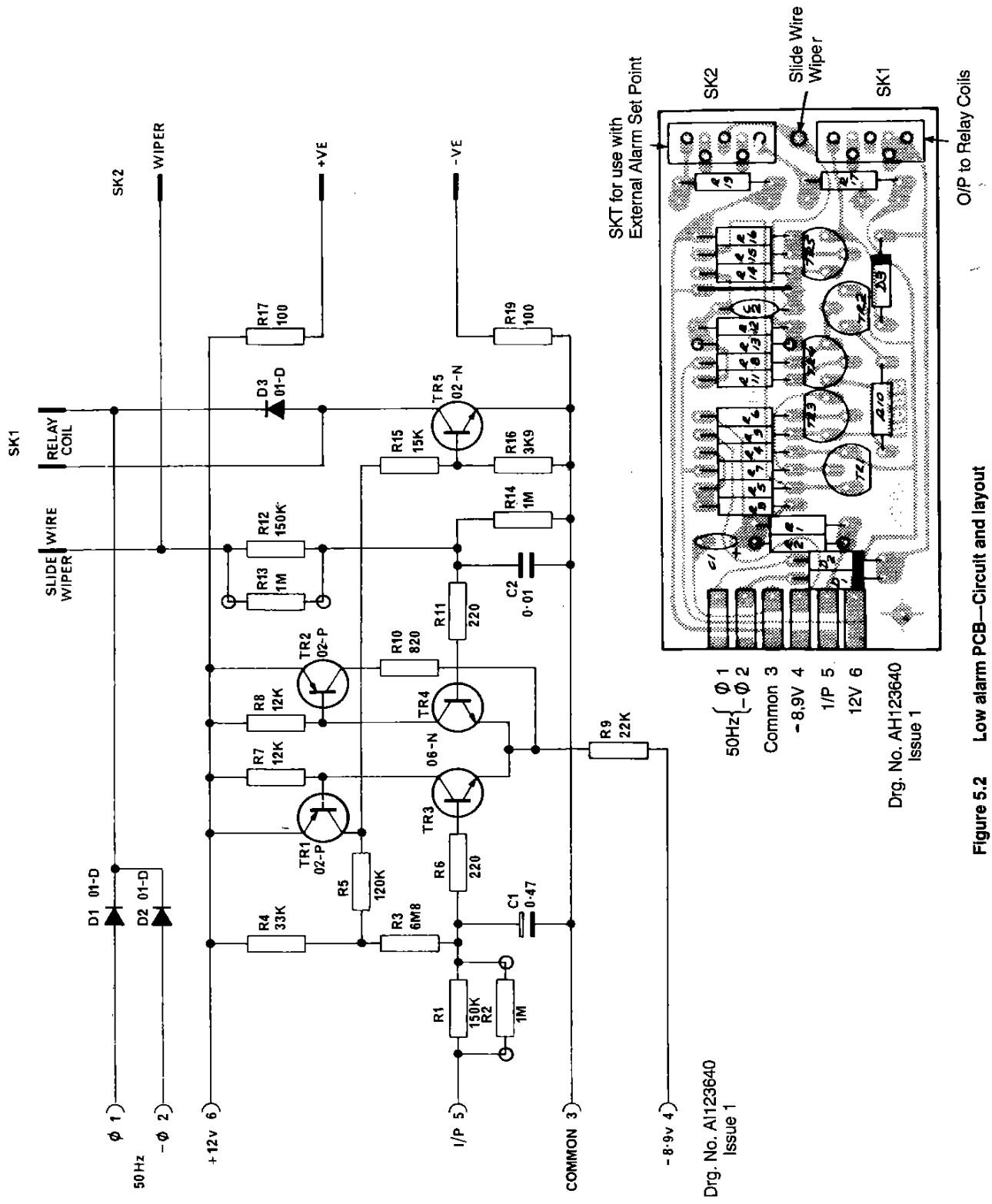
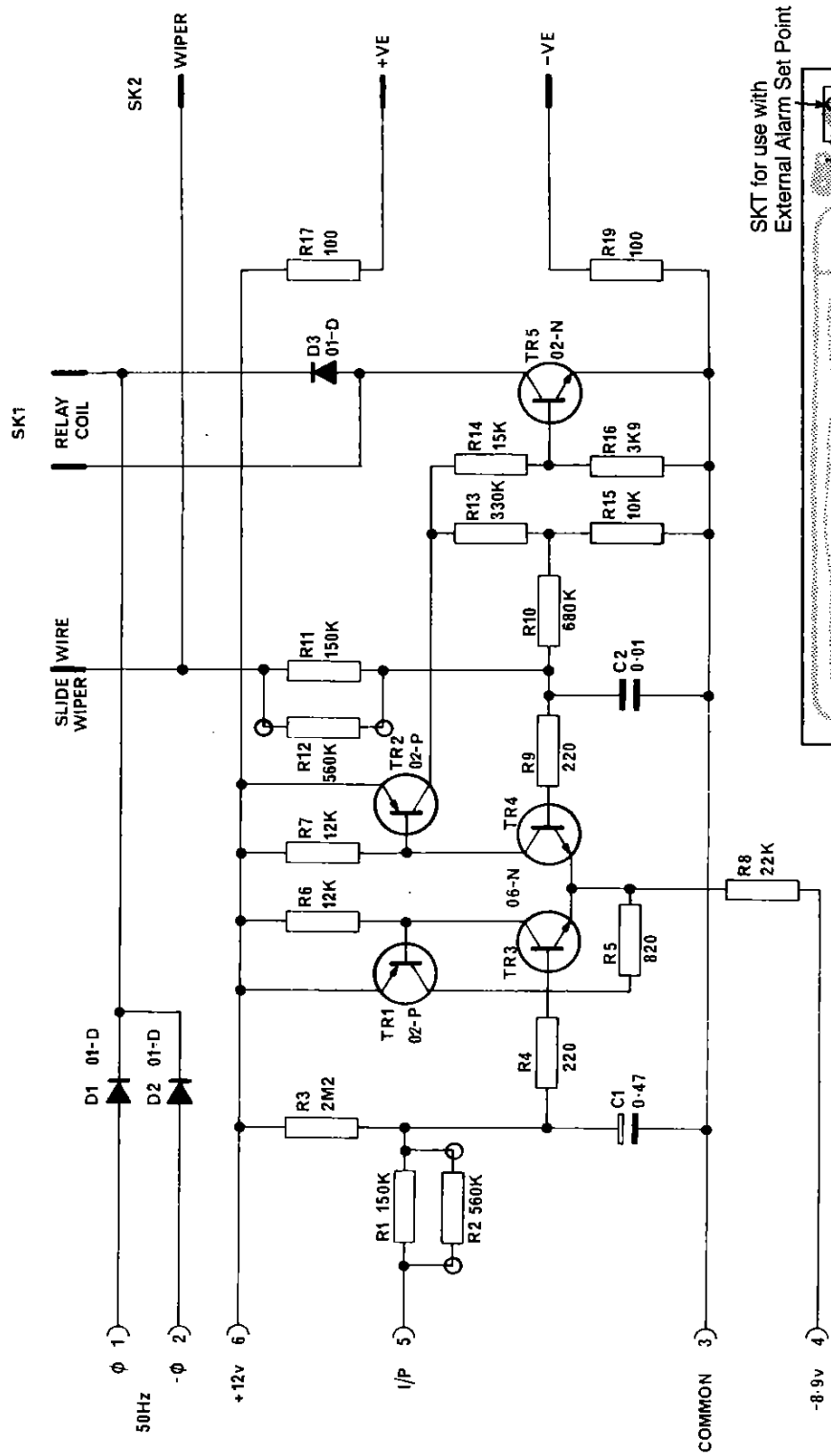


Figure 5.2 Low alarm PCB—Circuit and layout



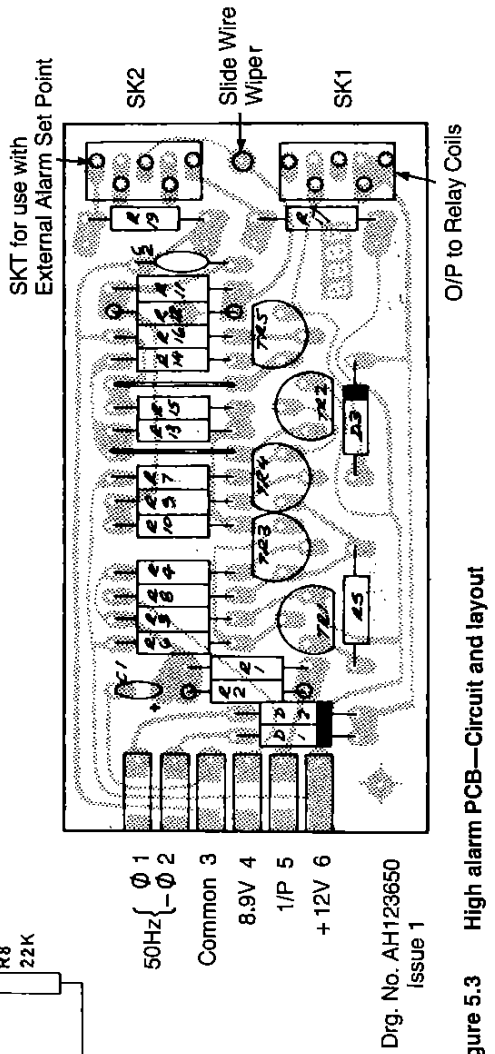


Figure 5.3 High alarm PCB—Circuit and layout

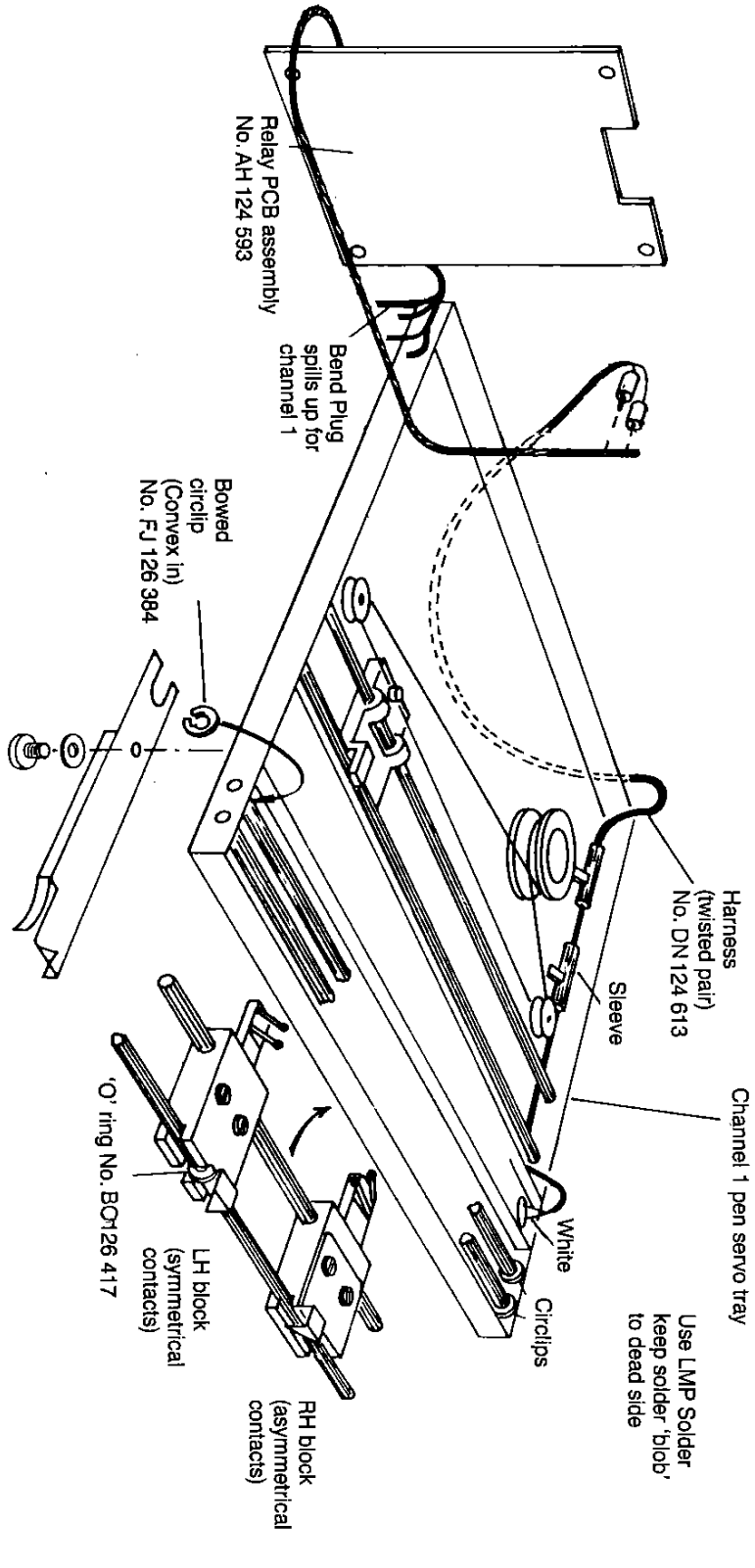


Figure 5.4 Model 300 HI/LO alarms—Mechanical layout

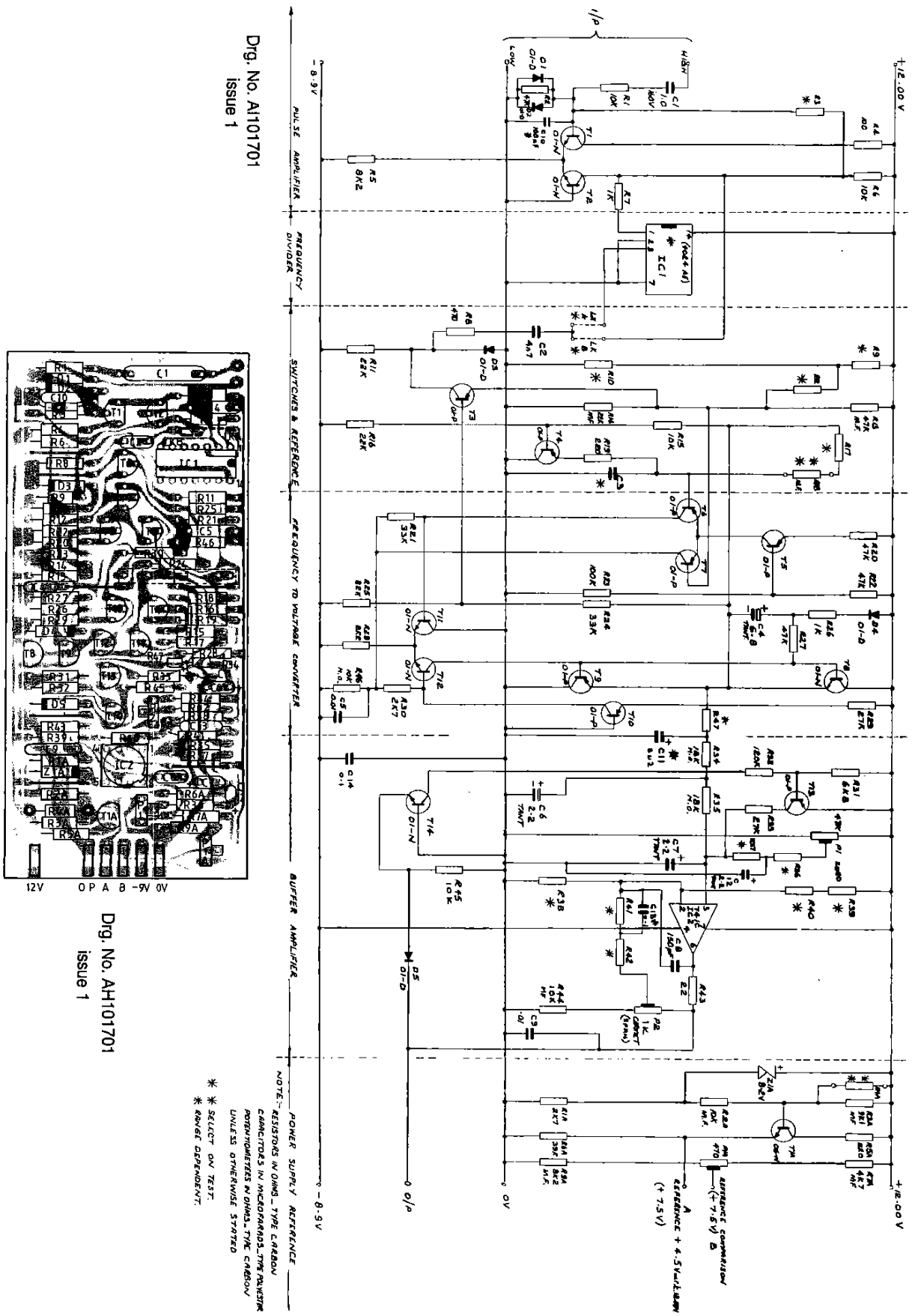


Figure 5.5 HF pulse rate input amplifier (non-isolated)—Circuit and layout

6.0 Chassis Wiring & Assembly Diagrams

Construction*

	Figure
Model 300 Chassis Layout	6.1
Pen Tray Components	6.2
Roll Cassette Components	6.3
Z-Fold Cassette Components	6.4

Wiring Information

Model 300 Chassis Wiring — Single Speed Chart Drive	6.5

***IMPORTANT:** See section 7.0 Spares List, before ordering parts.

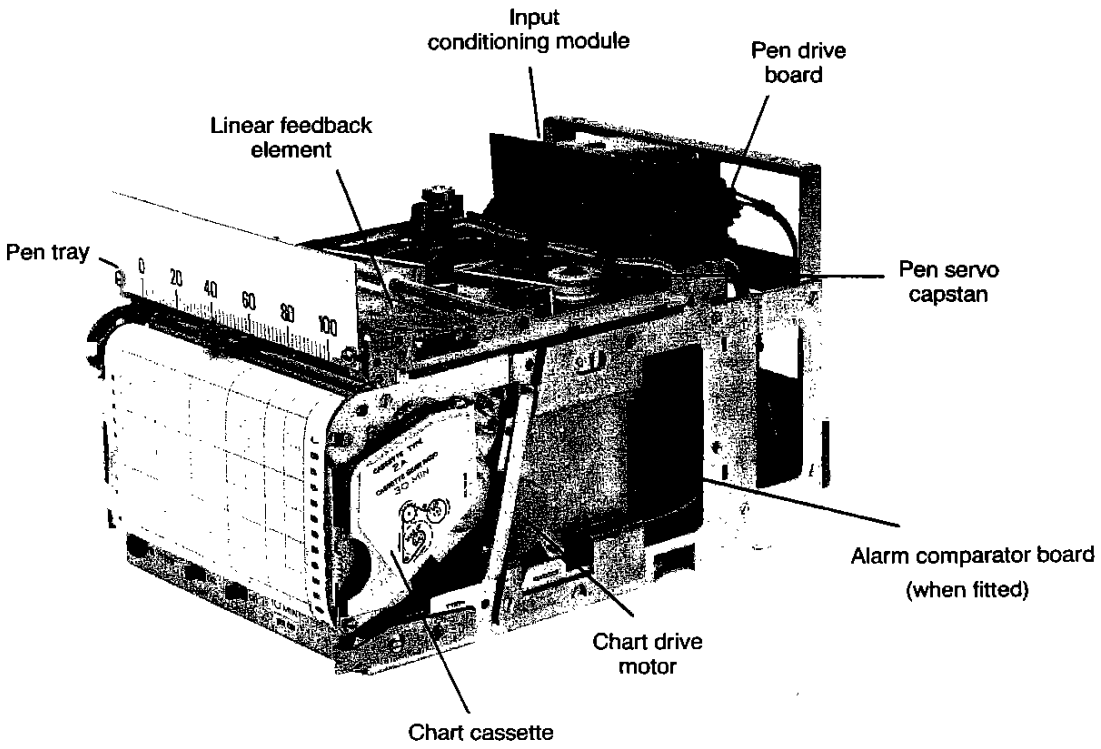


Figure 6.1 Model 300 chassis layout

Pen Tray

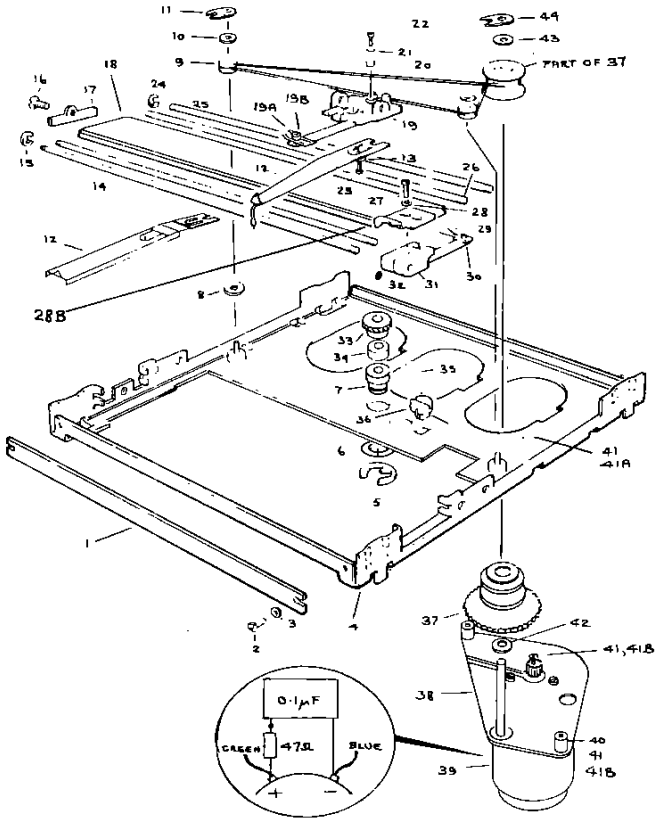


Figure 6.2 Pen tray components

Item	Part No.	Qty	Description
1	—	1	Scale and backing plate
2	FB009H03	2	M2.5 × 3mm pan head screw
3	FC12335H	2	M2.5 plain washer
4	See item 4 table on the right		
5	FJ126385	1	Circlip
6	FC12307H	1	Crinkle washer M2.5
7	BE100570	1	Collar
8	BT101242	2	M2 Acetate washer
9	BD101323	2	Cord pulley
10	BT101242	2	M2 acetate washer
11	FI126382	2	Grip ring
12	See item 12 table on the right		
13	FC12335F	1	M2 plain washer
14	BE100584	2	Spindle — high/low alarm
15	FJ126383	4	Circlip Am1501-15
16	FB013F06	1	M2 × 6mm countersunk screw
17	BA100699	1	Leaf spring
18	LA100971	1	Slide film assembly
19	LA101481	1	Pen block assembly, including threaded insert (flush fastener) and two pressure adjusting screws
19A	LA101845	1	Contact assembly
19B	FB016C02	1	M1.4 × 2mm cheesehead screw
20	BE100635	1	Pillar
21	FC12335D	1	M1.6 plain washer
22	FB090D05	1	M1.6 × 5mm screw
23	FB002F04	1	M2 × 4mm panhead screw
24	FJ126383	4	Circlip
25	BE100569	1	Spindle (fine ground finish)
26	BE100650	1	Spindle (plated finish, or has identifying groove)
27	FB002F04	4	M2 × 4mm panhead screw
28	FC12335F	4	M2 plain washer
28A	BA124584	1	Alarm pointer — left hand
28B	BA124585	1	Alarm pointer — right hand
29	LA101842	1	Alarm Contact assembly — left hand
29A	LA101843	1	Alarm Contact assembly — right hand
30	FB016C02	2	M1.4 × 2mm cheesehead screw
31	BD125179	2	Alarm contact block
32	BO126417	2	'O' ring
33	BE100564	1	Knurled nut
34	BE100565	2	Spacing pillar
35	BK100634	1	Capillary 'L' piece
36	BD101336	1	Tube retainer
36A	LA101030	1	Pen motor, plate and capstan assembly, complete; includes items 37 through 44, available separately
37	LA100941	1	Gear and capstan assembly, complete
38	LA101032	1	Motor plate assembly
39	DK122471	1	Motor, including 14T pinion
40	BE100630	2	Pillar
41	FB016F04	7	M2 × 4mm cheesehead screw
41A	FC12335F	2	M2 plain washer
41B	FC12307F	5	M2 lock washer
42/43	BT1051242	2	M2 acetate washer (one above, one below item 37)
44	FI126382	1	Grip ring
—	BK127743	1M	Ink feed tubing

Item 4:

LA124624	1	Pen tray without alarms, capillary OR
LA124621	1	Pen tray without alarms, FTD horizontal OR
LA124618	1	Pen tray without alarms, electric writing OR
LA124630	1	Pen tray with alarms, capillary OR
LA124627	1	Pen tray with alarms, FTD horizontal OR

(All include item 5 through 11)

Item 12:

LA124570	1	FTD cartridge holder, horizontal OR
LA100901	1	Capillary pen OR
LA122081	1	Electric writing stylus
LA230393		Event pen, FTD OR
LA122674		Event pen, capillary OR
LA122377		Event pen, electric writing

Roll Cassette

Item	Part No.	Qty	Description
1	BA100380	1	Front plate
2	FB013F03	2	M2 × 3mm countersunk screw
3	BE100587	3	Tie bar
4	BH100702	2	Spring clip — right hand
4A	BH100701	2	Spring clip — left hand
5	FC12307F	2	M2 lock washer
6	FB016F04	2	M2 × 4mm screw
7	BA100385	1	Gear cover
8	—	1	Gear set; gears, listed elsewhere, available separately
9	LA122108	1	Right hand plate assembly
10	FB013F04	4	M2 × 4mm countersunk screw
11	LA100866	1	Take-up roller end plate
12	CI126390	1	Pin tension
13	FJ126387	1	Circlip
14	LA100910	1	Retaining finger assembly (option CRO)
15	FG100605	2	Gear stub
16	BE100844	2	Idler gear
17	BA100693	1	Return spring (option CRO)
18	FJ126387	2	Circlip
19	LA122107	1	Left hand plate assembly
20	LA100919	1	23T gear and spindle assembly
21	LA100920	1	105T gear assembly
22	BD101327	1	Clutch cone
23	CI126390	1	Pin tension
24	FX101246	1	Acetate washer
25	LA101521	1	Sprocket roller assembly
26	BH100691	1	Clutch spring
27	CI126388	1	Circlip
28	BE100574	1	Take-up roller tube
29	LA100884	1	Supply roller assembly
30	LA101171	1	Transfer shaft assembly

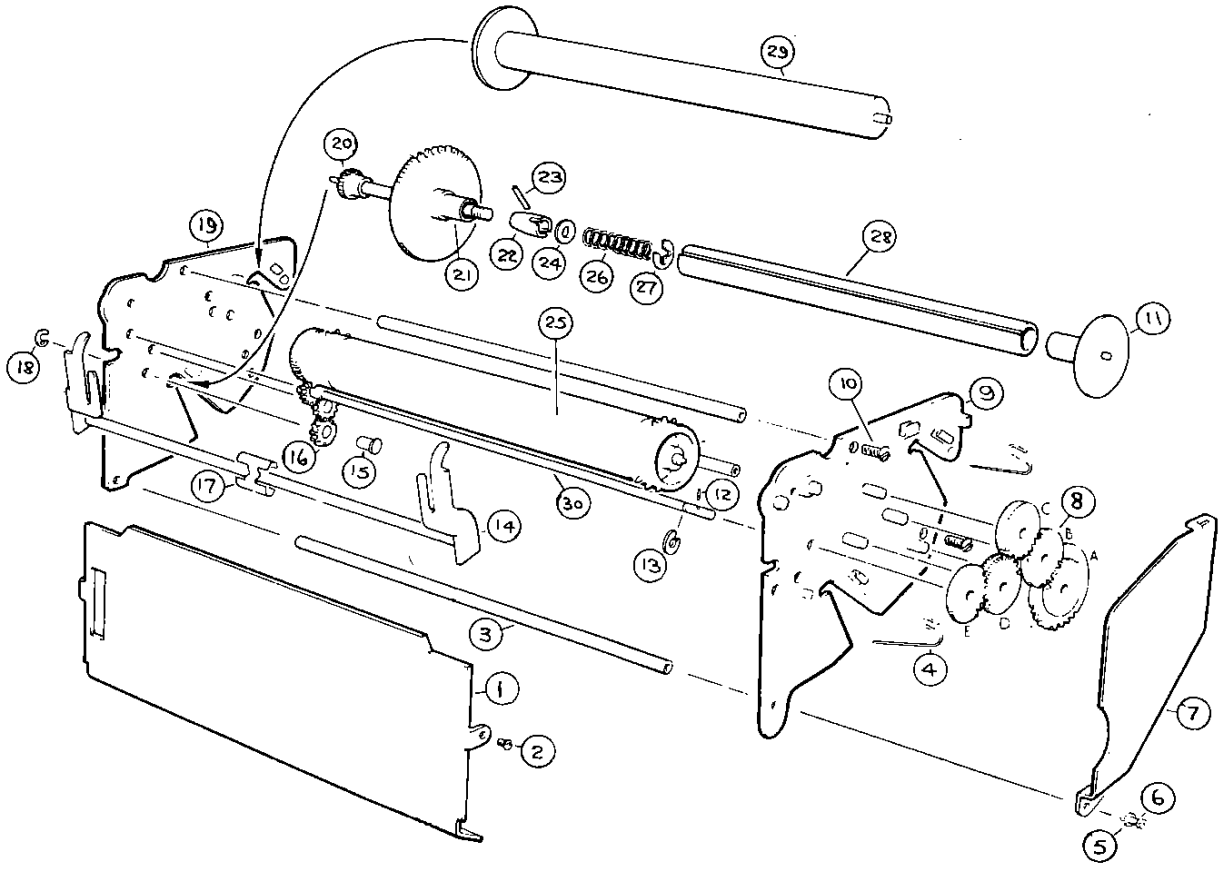


Figure 6.3 Roll cassette components

Z-Fold Cassette

Item	Part No.	Qty	Description
1	FG123372	2	Guide arm pin
2	FB094H06	2	M2.5 × 5mm socket screw
3	FX101246	2	Acetate washer
4	BD123381	1	Guide arm — left hand
5	BE100587	1	Tie bar
6	BG123398	1	Spacer
7	BD123380	1	Guide arm — right hand
8	BA122046	1	Paper receptacle
9	FB073F03	2	M2 × 3mm screw
10	FC12307	1	M2.5 lock washer
11	FB009H03	1	M2.5 × 3mm panhead screw
12	BA100385	1	Gear cover
13	—	1	Gear set; gears, listed elsewhere, available separately

Item	Part No.	Qty	Description
14	FB013F04	6	M2 × 4mm countersunk screw
15	LA122108	1	Right hand plate assembly
16	BH123370	1	Spring clip — right hand
	BH123371	1	Spring clip — left hand
17	LA122107	1	Left hand plate assembly
18	BE100587	3	Tie bar
19	LA101171	1	Transfer shaft assembly
20	LA101521	1	Sprocket roller assembly
21	FJ126387	1	Circlip
22	CI126390	1	Pin tension
23	BA123379	1	Paper feed trough

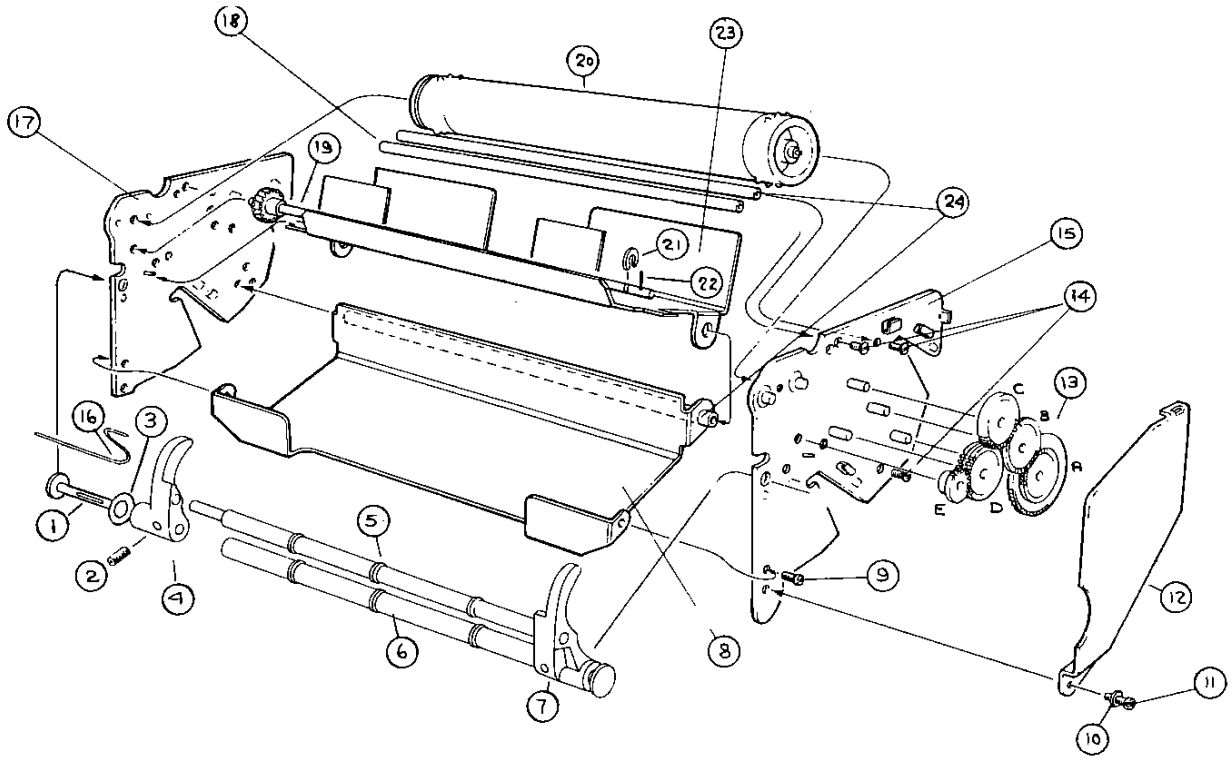


Figure 6.4 Z-fold cassette components

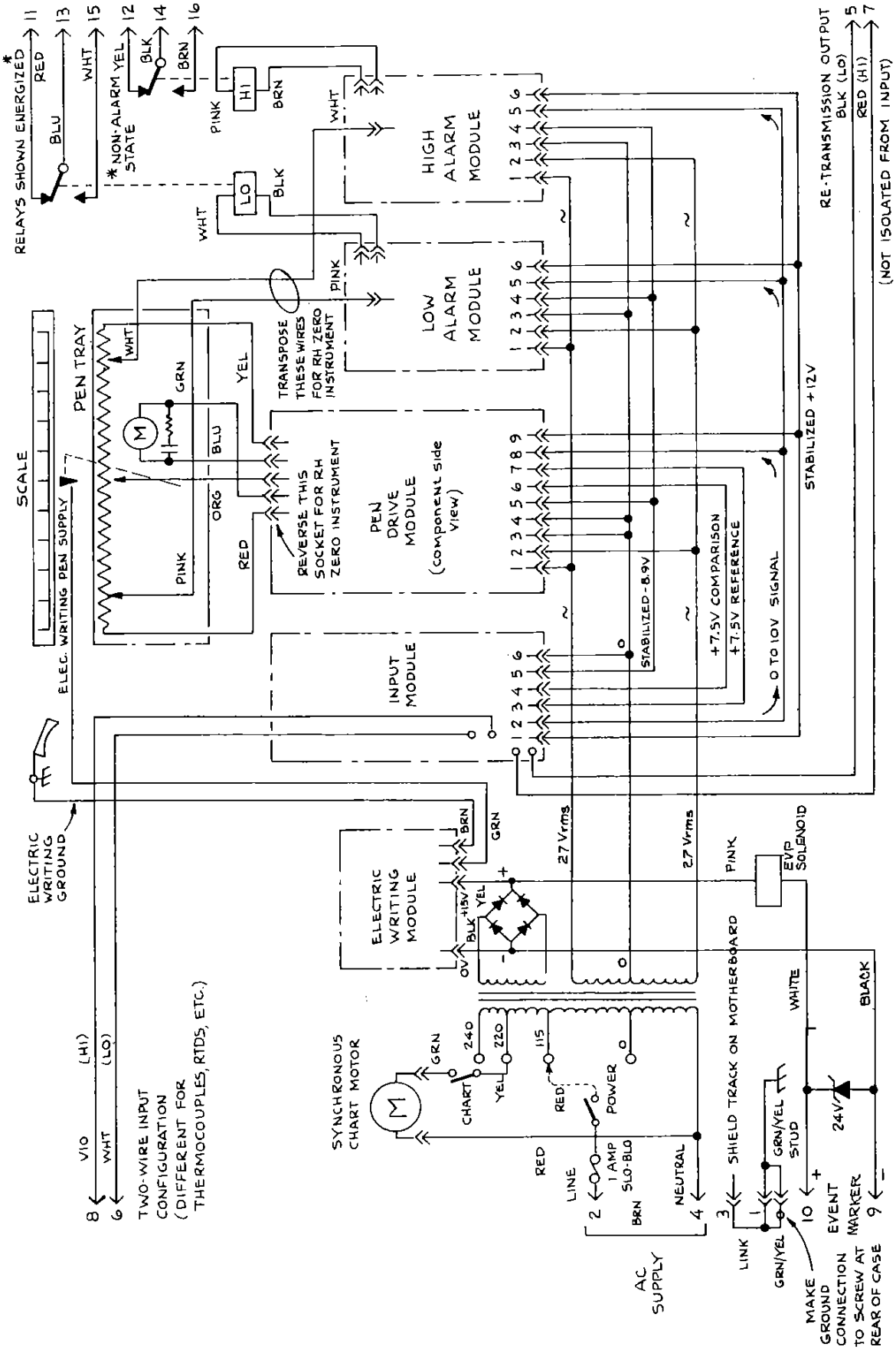


Figure 6.5 Model 300 chassis wiring — Single speed chart drive.

7.0 Spares List

In order to maintain operation within specification it is Company policy to supply certain sub-assemblies rather than part assemblies or piece-parts. This is because the assemblies are either manufactured using special tools or jigs, or require testing after assembly.
Individual components are listed with the assembly diagrams in Section 5 for identification, and non-critical parts may be supplied from this list.
A priced list of spare parts is available on request.

Section 7 Contents List

7.1 Charts
7.2 FTD Pens and Capillary Ink Cartridges
7.3 Conversion to FTD
7.4 Adding Event Marker
7.5 Conversion Kits
7.6 Writing System and Servo System
7.7 Input Function Cards
7.8 Cases
7.9 Chart Drive System
7.10 Options
7.11 Chassis
7.12 Servicing Aids

7.1 Charts

The following table shows the part numbers and descriptions of stock charts.
When ordering charts please specify type (roll, Z-fold, or electric), number of divisions, and the part number.

Roll charts (15 metres long)
Z-fold charts (supplied in boxes of 2 × 8 metres long)
Electric writing roll charts (15 metres long)

Description	Part Numbers		
	Roll	Z-fold	Electric
40 division grid	20001	20001Z	20001E
45 division grid	20002	20002Z	20002E
50 division grid	20003	20003Z	20003E
60 division grid	20004	20004Z	20004E
70 division grid	20005	20005Z	20005E
75 division grid	20327	20327Z	N/A
50 division grid 100 to 0	20041	20041Z	20041E
50 division grid 0 to 100	20047	20047Z	20047E
Square root grid 0 to 10	20093	N/A	N/A
50 division 12 hour time markings 1cm = 30 mins	20094	N/A	20094E
75 division grid 0 to 150°c	N/A	GD120750Z	N/A
10 division grid 1 to 10	N/A	N/A	20071E

7.2 FTD Pens and Capillary Ink Cartridges

Fibre tipped disposable pens	Part Number
Blue	LA 125451
F.T.D E.V.P. (purple) — single pen	LA 230393
Capillary system ink cartridges (box of 4)	
Red	EG 127745
Green	EG 127746
Blue	EG 127747
Black	EG 127748
Capillary system pen tips (pack of 4)	HL 101401

7.3 Conversion to FTD

Set of parts to convert 300 to FTD (without alarm limits)	LA 125330
Set of parts to convert 300 to FTD (with alarm limits)	LA 125336

7.4 Adding Event Marker

	Part Number
Adding event marker pen option	
Event marker pen kit (capillary)	LA 125348
Event marker pen kit (disposable)	LA 128702
Event marker pen kit (electric writing)	LA 123674

7.5 Conversion Kits

(a) Set of parts to convert ink writing recorder to electric writing	LA 125351

7.6 Writing System and Servo System

Pen tray Assemblies, without Limit Alarm Contacts

Capillary ink writing	LA 124624
FTD ink writing*	LA 124621
Electric writing system	LA 124618

Pen Tray Assemblies, complete with High and Low Limit Alarm contacts

Capillary ink writing	LA 124630
FTD ink writing*	LA 124627

Alarms cannot be fitted to electric writing recorders.

*FTD = Fibre tipped disposable pen.

Pen Arm Assemblies

Capillary ink writing	LA 100901
FTD ink writing*	LA 124570
Electric writing system	LA 122081
Event Pen — Electric Writing	LA 122377
Event Pen — Capillary	LA 122674
Event Pen — FTD	LA 230393

Writing system: capillary

Ink feed tubing	BK 127743
Ink pipe, L-piece	BK 100634
Retaining moulding for L-piece	BD 101336
Ink priming bulb	JA 127744
Ink bottle carrier assembly, 4-way	LA 124636
Priming tube bracket assembly, 3-way	LA 124638
Blanking plug for control panel	BD 015254

*FTD = Fibre tipped disposable pen.

Servo pen drive system

Pen drive board	AH 101682 U018
Parts for pen drive board connector	
Pen drive board connector stake	CI 127794
Pen tray loom connector socket	CI 129269
Pen tray loom connector socket insert	CI 129384
Pen drive motor/capstan assembly	LA 101030
Capstan assembly	LA 100941
Sliding contact assembly, gold	LA 101845
Pen block assembly	LA 101841
Feedback element c/w mounting plate (alarms version)	LA 100971
Feedback element c/w mounting plate (non-alarms version)	LA 127427
Pen drive cord	DS 127867
Limit alarm sliding contact (gold), left hand	LA 101842
Limit alarm sliding contact (gold), right hand	LA 101843
Limit block contact and pointer, left hand	LA 125139
Limit block contact and pointer, right hand	LA 125140

7.7 Input Function Cards

Please state input range

1 DC mV, Volts (1mV min, 550V max)
2 DC mA (100mA min 1A max)
3a AC mV, Volts (up to 49 volts max)
3b AC Volts (50 Volts rms and above: max 500 V rms)
4a AC Amps, less than 1A rms
4b AC Amps, 1A or 5A rms, including external boxed current transformer
5 Potentiometric pressure transducer (min resistance 480 ohm)
6 Power supply frequency (45—55, 55, 55—65 Hz)
7 Square root extraction (linearised)
8 Pulse, rate and frequency (20Hz min span, 1 MHz max span). State P/P voltage
9 Temperature from resistance thermometer (Please specify whether 2, 3 or 4 wire system)
10a Standard temperature from thermocouple (please specify thermocouple type) CJC 10:1 min span 10mV
10b High grade thermocouple amplifier CJC 20:1 min span 4 mV
11 Multi-range clip-on ammeter COA001 (includes 0-5V AC Card)
12 Strain gauge pressure transducer
13 Differential temperature from grade 1 4 wire resistance thermometers — min span 10°C
14 Function generator PCB AH 123200

dc mA shunt resistor mounted on terminal block
RSO — retransmission signal option (0 to 10 volts) 0.25 mA max. 2 wire inputs only.

7.8 Cases

	Part Number
Mark II Industrial 300	
Mark II DIN Standard 300	
Mark II DIN with lock 300	
Double Steel Panel case	
Protective plastic carrying case	
Instrument carrying cradle 300	LA 233097

Standard Colours		Factory colour Code
Fathom Blue	BS 4800 18C-39	(01)
Black	BS 381 C401	(02)
Storm Grey	BS 4800 00A-13	(03)
Dove Grey	BS 381-C694	(18)
Morning Mist	BS 2660 9-094	(04)
Dark Admiralty Grey	BS 381 C632	(13)
Light Admiralty Grey	BS 2660 9-095	(12)

Case Alternatives
Steel panel mounting case and door assembly in colour other than those listed previously (please specify BS No. type of finish and glass or perspex window).
Industrial door assembly for steel panel mounting case, complete with hinge pins, hinge pin spring and latch in standard Fathom Blue (BS 4800 18C-39), please specify glass or perspex window.

Door assembly for DIN standard mounting case:—
Perspex window LA 126642
Glass window LA 126582
Door fitted with lock

Engraved perspex channel identification label for Heavy duty door — maximum 35 characters.
Stencilled plastic label for DIN door (max 25 characters)
Rack MTG Panel
19F 19" Frame for mounting up to 3 DIN style recorders.
BPNL Blanking panel for 19" frame (please state colour).

300 Mark II Heavy duty case mounting clamps	LA 129710
300 Mark II Din Case Mounting Clamps	LA 129711
4-Way Case Socket — nickel	LA 015282
4-Way Case Socket — gold (used with thermocouple and resistance thermometer inputs)	LA 015283
8-Way case socket — nickel	LA 015281

Numbered retaining strips for 8-way block—

BLANK	BD 015248
"9-11-13-15"	GE 015250 U002
"10-12-14-16"	GE 015251 U002

Numbered retaining strips for 4-way block—

BLANK	BD 015249
"1-3"	GE 015252 U007
"2-4"	GE 015253 U007
"5-7"	GE 015252 U008
"6-8"	GE 015253 U008

Hinge Pin	FG 100645
Hinge Pin Spring	BH 100704
Door Key — Standard	BA 100305
Door Key — Ring Type	BA 100306
Glass Window — 300	BT 101250
Perspex window — 300	BT 101251

7.9 Chart Drive System

***Please specify chart speed**

Roll chart cassette, ink writing*	LA 124662
Roll chart cassette, electric writing*	LA 123382
Take-up Clutch assembly	LA 124614
Disc and pin assembly	LA 100886
Supply roller assembly	LA 100884
Paper Guide Assembly	LA 100910
Z-fold chart cassette*	LA 124660
Plastic guide arm for Z-fold cassette R.H.	BD 123380
Plastic guide arm for Z-fold cassette L.H.	BD 123381
Cassette gear cover	BA 100385

7.10 Options

Event marker pen arm/solenoid assembly (capillary ink system)	LA 101035
Event marker priming tube bracket assembly	LA 101022
Event marker arm and solenoid assembly (FTD)	LA 127180
Electric writing event marker pen arm/solenoid	LA 123674
Low alarm pcb	AH 123640
High alarm pcb	AH 123650
Limit alarm relay mounting pcb	AH 124593 U-300
Limit alarm relay	DB 015177
Limit alarm sliding contact (gold) l.h.	LA 101842
Limit alarm sliding contact (gold) r.h.	LA 101843
Limit block contact and pointer left hand	LA 125139
Limit block contact and pointer right hand	LA 125140
Power supply pcb for electric writing	AH 101706-018
Electric writing earthing assembly	LA 101042
Electric writing event marker pen arm/solenoid	LA 123674

Cassette gear trains

5 sec, 5 min	LA 125235
10 sec, 10 min	LA 125236
20 sec, 20 min	LA 125237
30 sec, 30 min	LA 125238
1 min, 12 min, 60 min	LA 125239
2 min, 24 min, 2 hrs	LA 125240
2.5 mins, 2.5 hrs	LA 125241

Chart drive motor/gearbox assemblies, synchronous, fixed speed.	**Part Number**
125:2, 220 Volts, 50 Hertz	LA 124650
75:1, 220 Volts, 60 Hertz	LA 124651
750:1, 220 Volts, 50 Hertz	LA 124652
900:1, 220 Volts, 60 Hertz	LA 124653
3750:1, 220 Volts, 50 Hertz	LA 124654
4500:1, 220 Volts, 60 Hertz	LA 124655

7.11 Chassis

Motherboard (no alarm)	AH 123310
Motherboard (with alarm)	AH 123310-U100
Connector stakes for motherboard pcb	CI 127656
PCB connector socket (makes with COM 008)	CI 015187
Mains transformer assembly: 110, 220, 240V	LA 124642
Fuseholder	CP 015161
Power or chart ON/OFF switch	DC 127782
Fuses 1 amp (pack of ten)	CH 050013
4-way chassis plug — nickel	LA 015288
4-way chassis plug — gold (used with thermocouple and resistance thermometer inputs)	LA 015287
8-way chassis plug — nickel	LA 015285
Blank retaining strip for 8-way terminal block	BD 015248
Blank retaining strip for 4-way terminal block	BD 015249
Chassis Components	
Front side plate, right hand	BA 100361
Front side plate, left hand	BA 100362
Control panel label, fixed speed "per cm"	GA 100396
Control panel label, FTD fixed speed "per cm"	GA 125953

7.12 Servicing Aids

Servicing Connector	LA 125444
Servo Amplifier Extender Board	AH 122320
Input Amplifier Extender Board	AH 122310
Pen Tip Replacement and Pen Alignment Tool	BD 123218
Ink flushing bulb	JA 127162
Eurotherm 239 Millivolt Source	
PCB Servo Test Assembly	AH 125433

Recommended Spares Kit comprising:
(Capillary System)
1 off Pen Drive Board
1 off Pen Motor and Capstan
2 Metres Pen Drive Cord
1 off Potentiometric Feedback Element
2 metres Ink Feed Tubing
1 Sliding contact assy. Gold

Recommended Spares Kit comprising:
(F.T.D. System)
1 off Pen Drive Board
1 off Pen Motor and Capstan
2 metres Pen Drive Cord
1 off Potentiometric Feedback Element
I Sliding contact assy. Gold.