425D/G/M 400R

Technical Manual
Volume 1
(Sections 1 to 4)

EUROTHERM

Invensys
An Invensys company

250mm Multipoint Recorder

Technical Manual

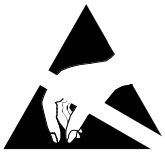
Overall List of Contents (Volume 1)

(Continued)

OVERALL LIST OF CONTENTS (Volume 2)

ASSOCIATED DOCUMENTS

HA245000	Recorder installation and operation manual
HA246958	Communications manual
HA247361	Memory card manual
HA247368	Recorder installation and operation manual
HA247733	Graphics units installation and operation manual
HA247897	Data acquisition unit Manual supplement



STATIC ELECTRICITY

High voltages (tens of kilo-volts) can be generated on the human skin through a number of mechanisms, such as friction between different materials (e.g. nylon and skin), and separation of similar materials (e.g. masking tape, nylon sheet). The gate-oxide region of all metal oxide semiconductors (MOS) is extremely thin, and can be damaged by voltages as low as 60 Volts. Modern MOS devices have built-in clamp diodes which reduce the incidence of obvious static damage considerably. It is possible however, even with such clamping diodes, to produce a small rupture in the oxide layer. This might not destroy the device immediately, but it may result in a gradual reduction in the performance of the device until, eventually, it fails.

For this reason, the following precautions should be taken when handling any recorder circuit board.

1. Personnel handling MOS devices, or circuit boards containing them, should wear antistatic materials such as cotton. Nylon clothing should be avoided.

2. All bench tops should be covered with conductive material (10^4 to 10^5 Ohms per square) maintained at the recorder chassis potential.

3. Circuit boards removed from a recorder should be placed into a static-safe bag, initially at the recorder chassis potential, for storage. Before re-fitting the board, the containing bag should again be returned to the recorder chassis potential.

4. Personnel handling MOS devices, or boards containing them, should wear a wrist strap connected (via a safety resistor) to the bench top, or if appropriate, to a suitable grounding point on the rack.

5. Leads of MOS devices removed from circuit should be shorted together using conductive foam or similar.

6. MOS devices should not be extracted from or inserted into circuit whilst the circuit board has power applied.

TERMINOLOGY

Antistatic

This term means that the material in question does not of itself generate static electricity. Such materials do not afford protection against external electric fields.

Static safe

This means that the material in question:

a) does not generate static electricity, and
b) any device enclosed in such material is safe from the effects of external electric fields.

Safety Notes

1. Whenever it is likely that protection has been impaired, the unit shall be made inoperative and secured against unintended operation. The nearest manufacturer's service centre should be consulted for advice.
2. Any adjustment, maintenance and repair of the opened apparatus under voltage, should be avoided as far as possible and, if inevitable, shall be carried out only by a skilled person who is aware of the hazard involved.
3. The Mains (supply voltage) wiring must be terminated in such a way that, should it slip in the cable clamp, the Earth wire would be the last wire to become disconnected.

WARNING!

Any interruption of the protective conductor inside or outside the apparatus, or disconnection of the protective earth terminal is likely to make the apparatus dangerous under some fault conditions. Intentional interruption is prohibited.

4. Where conductive pollution (e.g. condensation, carbon dust) is likely, adequate air conditioning/filtering/sealing etc. must be installed in the recorder enclosure.
5. This unit contains one or more batteries which must be treated and disposed of with care. In particular, batteries must not be shorted or an explosion can occur. Batteries should be disposed of in accordance with local regulations; they must not be discarded with normal refuse.
6. Signal and supply wiring should be kept separate from one another. Where this is impractical, shielded cables should be used for the signal wiring. Where signal wiring is carrying (or could carry, under fault conditions) hazardous voltages *, double insulation should be used.
7. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment might be impaired.
8. For portable and panel mounting equipment, the protective earth terminal must remain connected (even when the recorder is isolated from the mains supply) if any of the I/O circuits are connected to hazardous voltages*.

* A full definition of 'Hazardous' Voltages appears under 'Hazardous Live' in BS EN61010. Briefly, under normal operating conditions Hazardous voltage levels are defined as >30V RMS (42.4V peak) or >60V dc.

Symbols used on the recorder labelling

One or more of the symbols below may appear on the recorder labelling.

	Refer to the Manual for instructions
	Protective Earth
	This recorder for ac supply only
	This recorder for dc supply only.
	Risk of electric shock

Section 1

Overview

List of contents

SECTION 1: OVERVIEW

1.1 INTRODUCTION

This manual is divided into sections as listed below. For ease of use, certain parts of the Installation and Operation Manual have been repeated here. In case of discrepancy, that manual with the latest issue date should be regarded as definitive

1.1.1 Manual layout

Section 1 is an overview of the product, including a specification
Section 2 contains day-to-day servicing instructions for changing charts, printheads etc.
Section 3 contains a fault-finding guide, calibration procedures and diagnostics information
Section 4 consists of procedures for the replacement of belts, motors, lamps etc.
Section 5 lists spare parts available for the recorder.
Section 6 contains circuit diagrams (schematics and layouts) for the various circuit boards in the recorder.

1.2 SPECIFICATION

INSTALLATION CATEGORY AND POLLUTION DEGREE

This product has been designed to conform to BS EN61010 installation category II and pollution degree 2. These are defined as follows:

INSTALLATION CATEGORY II
The rated impulse voltage for equipment on nominal 230V ac mains is 2500V.

POLLUTION DEGREE 2
Normally, only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation shall be expected.

1.2.1 GENERAL SPECIFICATION

I/O Board types

Input board types	8-channel universal input; 16-channel dc input*
Output board type	8-channel relay output; 4/8 channel analogue output
Max. number of I/O boards per type	7 off 8-channel i/p, 6 off 16-channel i/p
	4 off 8-channel analogue o/p, 7 off 4-channel analogue o/p, 7 off relay o/p
Max number of inputs	96 dc inputs; 56 resistance inputs; 78 contact closure.
Max number of outputs	Relays: 8 x no of free slots; Analogue outputs: 32 in any combination of 4- or 8-channel boards
Maximum number of traced channels	45 in any combination of input, output and derived channels.

SBC memory size (current recorders)

AH261003	256kB RAM + 64kB EEPROM

SBC memory size (previous recorders)

AH243487U200	Type 2:	128kB RAM + 32kB EEPROM
AH243748U300	Type 3:	256kB RAM + 64kB EEPROM

* DC inputs are defined as Volts, mV, mA, thermocouple and contact closure, but do not include resistance inputs.

Environmental Performance

General		To BS2011: 1981
Temperature limits	Operation:	0 to + 50 ˚C
	Storage:	-20 to +70 ˚C
Humidity	Operation/Storage:	5 to 85% RH; non-condensing
Maximum altitude		< 2000 metres
Protection		IP54 (door and bezel); IP31 (sleeve).
Shock		BS EN61010 1990 (safety); IEC 873: 1986
Vibration		BS EN61010 1990 (safety); IEC 873: 1986.
		Also recovers from 2g peak at 10 to 150 Hz

Electromagnetic compatibility (EMC)

Emissions	BS EN50081-2
Immunity	BS EN50082-2

Electrical Safety

To BS EN61010: 1990 class 1.

Physical (Recorders)

Bezel size	288 mm. high x 360 mm. wide x 53 mm. deep.
Panel cutout size	273.5 mm high x 348 mm. wide. (+ 1.4 mm. - 0 mm.)
Depth behind bezel rear face	450 mm. (inc. rear cover); 410 mm. (no rear cover)
Weight (Eight-channel instrument)	20 kg. max.
Panel mounting angle	Up to ± 30˚ from vertical.

Physical (Graphics Display Units)

Bezel size	288 mm. high x 360 mm. wide x 68 mm. deep
Panel cutout size	273.5 mm high x 348 mm. wide. (+ 1.4 mm. - 0 mm.)
Depth behind bezel rear face	50 mm. + panel mounting clamp (protrudes by an amount dependent on panel thickness
Wall mounting centres	240 mm. vertical x 199 mm. horizontal

Physical (Data acquisition units)

Bezel size		Standard 6U high 19" rack fitting (265.2 mm x 483 mm.)
If panel mounted	Panel cutout	263 mm high x 434 mm. wide. (+ 1.5 mm. - 0 mm.)
	Fixing centers	190.5 mm vertical x 465.1 mm horizontal (Upper hole centres 32 mm. below top of cutout).
Depth behind bezel rear face		309 mm. including rear terminal cover

1.2.1 General specification (Cont.)

Performance	
Maximum scan and update rate	All parameters in 1 second
Maximum print rate (trending)	45 channels per second
Maximum chart speed	1500 mm/hr.
Clock accuracy	Better than 50 ppm
Printing system (recorders)	
Type	14-needle dot matrix printhead with six colour disposable ribbon cartridge.
Trace colours	Red, orange, green, blue, violet and black
Ribbon life	> 5 million dots per colour; > 1 million black text characters.
Print needle diameter	0.35 mm.
Dot spacing (vertical)	0.083 mm. (chart speed < 300 mm/hr.); 0.17 mm (600 mm/hr); 0.33 mm. (1200 mm/hr.); 0.42 mm (1500 mm/hr)
Dot spacing (horizontal)	0.4 mm.
Characters per line	104
Noise level	55 dBA max. (door closed).
Maximum print rate	45 channels / second (trending)
Paper transport (Recorders)	
Type	Tractor feed with selectable chart speed from 1 to 1500 mm/hr. (0.4 to 60 inches/hour)
Chart length	22 metres (z-fold - fold depth 75 mm.); 32 metres (roll)
Chart width	274.5 mm. overall; 250 mm. calibrated.
Chart visible length	155 mm.
Resolution (horizontal)	± 0.2 mm.
Pen-to-paper accuracy	0.25% of calibrated chart width
Transport accuracy	Better than 10 mm. in 32 meters
Power requirements:	
Line voltage (45 to 65 Hertz)	90 to 132 Volts or 180 to 264 Volts (User selectable).
Maximum power	120 W
Fuse type	Ceramic 20 mm. 3.15 Amp. Fast blow.
Interrupt protection	100 ms at 60% load.
Memory protection	
	EEPROM (for configuration)
	Battery-supported RAM for clock, totalisers etc.
RAM / clock-support battery type	Nickel-Cadmium (rechargeable)
Support period (no power to recorder)	3 months min. at 25 ˚C; 1 month min. at 50 ˚C.

1.2.2 UNIVERSAL 8-CHANNEL INPUT BOARD SPECIFICATION

General specification

Number of inputs		8
Termination		Edge connector / terminal block
Input types		DC Volts, dc millivolts, dc milliamps (with shunt).
		Thermocouple, Resistance thermometer (2- or 3-wire), Ohms, Contact closure
Input type mix		User selectable during channel configuration.
Measurement frequency		All channels in 1 second
Step response to within resolution		2 seconds
Noise rejection	Common mode:	150dB above 45 Hz. (channel-channel and channel-ground.)
	Series mode:	67dB above 45 Hz.
Maximum common mode voltage		250 Volts
Maximum series mode voltage		10 mV at lowest range; 500 mV peak at highest range.
Isolation (dc to 65 Hz; BS EN61010)		Installation category II; Pollution degree 2 (See page A -1 for definitions)
		300 V channel-to-channel (double isolation) and channel-to-ground (basic isolation)
Dielectric strength		2350 V ac (channel – channel) 1350V ac (channel – ground) (both 1 minute type-tests)
Insulation resistance		50 MΩ at 500V dc.
Input impedance		>10 MΩ (68.8kΩ for 10V range)
Over-voltage protection		60 Volts peak, 500 V through 50 kΩ resistor
Open cct. detection (to 200 mV range)		65 nA current max.; 8 seconds recognition time (max.); 40 MΩ minimum break resistance.

DC input ranges

Ranges available		-10 to +40 mV; -50 to 200 mV; -500 mV to +1 V; -5 V to +10 V (100V with attenuator)
Temperature performance (worst case)		
	-10 t o +40mV	80ppm/˚C pf reading + 27.9ppm/˚C of range
	-50 t o +200mV	80ppm/˚C pf reading + 12.4ppm/˚C of range
	-500mV to +1V	80ppm/˚C pf reading + 2.1ppm/˚C of range
	-5V to +10V	272ppm/˚C pf reading + 4.7ppm/˚C of range
Shunt/Attenuator	Fitting method:	Resistor modules mounted on user's terminal block
	Additional errors:	0.1% (shunt); (0.2% attenuator)

Range	Resolution	Performance (worst case) in instrument at 20 ˚C
–10 mV to + 40 mV	1.4 µV	0.083 % reading + 0.056 % range
– 50 mV to + 200 mV	14 µV	0.072% reading + 0.073% range
– 0.5 V to + 1 V	37 µV	0.070% reading + 0.032% range
– 5 to + 10 V	370 µV.	0.223% reading + 0.034% range

Thermocouple data

Linearisation errors	0.15 ˚C or better
Bias current	<2 nA (<10 nA at 70 ˚C)
Cold Junction (CJ) types (selectable)	Off, internal, external, remote.
CJ error	0.5 ˚C or better
CJ rejection ratio	25:1 minimum
Remote CJ	Via any user-selected input channel.
Upscale/downscale drive	Configurable for each channel

T/C type	Range (˚C)	Standard
B	+ 200 to + 1800	IEC584.1:1977
C	0 to + 2300	Hoskins
E	- 200 to + 1000	IEC584.1:1977
J	- 200 to + 1200	IEC584.1:1977
K	- 200 to + 1370	IEC584.1:1977
L	-200 to + 900	DIN 43710
N	- 200 to + 1300	IEC584.1:1977
R	- 200 to + 1760	IEC584.1:1977
S	- 50 to + 1760	IEC584.1:1977
T	- 250 to + 400	IEC584.1:1977
U	- 100 to + 600	DIN 43710-85
NiMoNiCo	- 50 to +1410	ASTM E1751-95
Platinel II	-100 to + 1300	Engelhard R83

Note: Previous versions of the recorder came with NiNiMo linearization instead of NiMoNiCo.

Continued

1.2.2 UNIVERSAL INPUT BOARD SPECIFICATION (Cont.)

3-wire RTD data

RTD linearisations: Pt100, Pt1000, Cu10, Ni100, Ni120

Linearisation errors: 0.012 ˚C or better

Influence of lead resistance error: 0.15 % of lead resistance

mismatch: 1 ohm per ohm.

RTD type	Range (˚C)	Standard
Pt 100	- 200 to + 850	IEC751: 1981
Pt1000	- 200 to + 850	Based on IEC751: 1981
Cu 10	-20 to + 250	General Electric
Ni 100	- 50 to + 170	DIN43760
Ni 120	- 50 to + 170	Based on DIN 43760

Pt100 figures (worst case)

Range ˚C	Resolution	Performance (worst case) in instrument at 20 ˚C
- 200 to + 200	0.02 ˚C	0.033% reading + 0.32 ˚C
- 200 to + 1000	0.14 ˚C	0.033% reading + 1.85 ˚C

Ohms ranges

Ranges available: 0 to 180Ω; 0 to 1.8kΩ; 0 to 10.0kΩ

Temperature performance (worst case)

0 to 180Ω: 35ppm/˚C of reading + 34.3ppm/˚C of range

0 to 1.8kΩ: 35ppm/˚C of reading + 14.6ppm/˚C of range

0 to 10kΩ: 35ppm/˚C of reading + 1.9ppm/˚C of range

Range	Lead resistance	Resolution	Performance (worst case) in instrument at 20 ˚C
0 to 180 Ω	10 Ω	5 mΩ	0.033% reading +0.070% range
0 to 1.8 kΩ	10 Ω	55 mΩ	0.033 % reading + 0.041 % range
0 to 10 kΩ	10 Ω	148 mΩ	0.037 % reading + 0.020 % range

Other linearisations

Tables available: $\sqrt{}$ value; $(value)^{3/2}$; $(value)^{5/2}$; User defined tables (up to 3 off)

Contact closure (switch) inputs

Type: Volt-free contact

Wetting voltage: 2.5 Volts nominal

Minimum latched pulse width: 125 ms.

De-bounce: Inherent 1 second.

1.2.3 16-CHANNEL DC INPUT BOARD SPECIFICATION

General specification

Number of inputs		16
Termination		Edge connector / terminal block
Input types		DC Volts, dc millivolts, dc milliamps (with shunt). Thermocouple, Contact closure (not channels 1, 8, 16)
Input type mix		Software selected on configuration for each channel*.
Measurement frequency		All channels in 1 second
Step response		1.5 seconds
Noise rejection	Common mode:	150dB above 45 Hz. (channel-channel and channel-ground.)
	Series mode:	> 60dB between 10 to 100 Hz.
Maximum series mode voltage		Hardware range +50 mV.
Safety isolation (BS EN61010)		Installation category II; Pollution degree 2 (See page A-1 for definitions)
		300 V channel-to-channel (double isolation) and channel-to-ground (basic isolation)
Dielectric strength		2350 V ac (channel – channel); 1350V ac (channel – ground) (both 1 minute type-tests).
Input impedance		> 10 MΩ (68.8kΩ for 5V range)
Over-voltage protection		60 Volts peak, 500 V through 50 kΩ resistor
Open cct. detection (85 mV range only)		65 nA current (max.); 8 seconds recognition time (max.); 40 MΩ minimum break resistance.
Damping		2, 4, 8, 16, 32, 64, 128 or 256 secs. time constant, as configured.
		Damping improves o/p noise and performance figures listed in the table below.

DC input ranges

Ranges available	-15mV to +85 mV; -1.0 V to +5 V
Temperature performance (worst case)	
-15 to +85mV	80ppm/˚C of reading +12.9 ppm/˚C of range.
-1V to +5V	272ppm/˚C of reading +7.8 ppm/˚C of range.
Shunt	Resistor modules mounted on user terminal block
Additional error due to shunt	0.1%.

Range	Resolution	Performance (worst case) in instrument at 20˚C
–15 mV to + 85 mV	± 5.5 µV	0.072% reading + 0.071% range
– 1.0V to + 5 V	± 280µV	0.223% reading + 0.055 range

Thermocouple data (in addition to the above)

Linearisation errors	0.15 ˚C or better
Bias current	< 2 nA (< 10 nA at 70 ˚C)
Cold Junction (CJ) types (selectable)	Off, internal, external, remote.
CJ error	1 ˚C or better
CJ rejection ratio	25:1 minimum
Remote CJ	Via any user-selected input channel.
Upscale drive	Configurable for each channel

Note: Previous versions of the recorder came with NiNiMo linearization instead of NiMoNiCo.

T/C type	Range (˚C)	Standard
B	+ 200 to + 1800	IEC584.1:1977
C	0 to + 2300	Hoskins
E	- 200 to + 1000	IEC584.1:1977
J	- 200 to + 1200	IEC584.1:1977
K	- 200 to + 1370	IEC584.1:1977
L	-200 to + 900	DIN 43710
N	- 200 to + 1300	IEC584.1:1977
R	- 200 to + 1760	IEC584.1:1977
S	- 50 to + 1760	IEC584.1:1977
T	- 250 to + 400	IEC584.1:1977
U	- 100 to + 600	DIN 43710-85
NiMoNiCo	- 50 to +1410	ASTM E1751-95
Platinel II	-100 to + 1300	Engelhard R83

* Maximum of eight different linearisations (seven + linear) allowed per board.
Contact closure inputs not available on channels 1, 8 and 16.

1.2.3 16-CHANNEL DC INPUT BOARD SPECIFICATION (Cont.)

Other linearisations

Tables available	√ value; (value)$^{3/2}$; (value)$^{5/2}$;User defined tables (up to 3 off)

Contact closure (switch) inputs (not available for channels 1, 8 and 16)

Type	Volt-free contact
Wetting voltage	2.5 Volts nominal
Minimum latched pulse width	250 ms.
De-bounce	Inherent 1 second.

1.2.4 RELAY OUTPUT BOARD SPECIFICATION

No of relays per board		Eight
Contact format		Single pole change-over (single set of common, normally open and normally closed contacts)
Estimated life at 60VA load		1,000,000 operations
Max contact voltage*		250 Volts ac.
Max contact current*	Make:	8 Amps
	Continuous:	3 Amps
	Break:	2 Amps
Maximum switchable power*		60 watts or 500 VA
Isolation (BS EN61010)		Installation category II; Pollution degree 2 (See page 1-2 for definitions)
		300V ac channel-to-channel (double isolation)
		300V ac channel-to-ground (basic isolation)
Dielectric strength (1 minute type-tests)		1350V ac (contact to contact)
		2350V ac (channel to channel)
		1350V ac (channel to ground)

* With resistive loads.

With inductive loads, contact life = resistive life x reduction factor in figure 1.2.4

F1 = measured on representitive samples

F2 = typical values (according to experience)

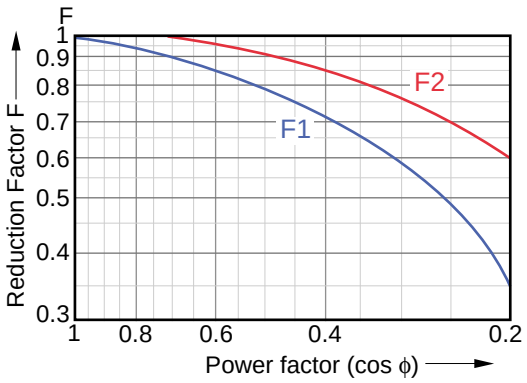


Figure 1.2.4 Reduction factor for inductive loads

1.2.5 ANALOGUE OUTPUT BOARD SPECIFICATION

General specification

Number of outputs		Four or eight as ordered
Termination		Edge connector / terminal block
Output types		Current or Voltage as configured for each channel
	Current:	0 to 25mA max. at up to 24 V
	Voltage:	-1 to 11V at up to 5 mA
Output frequency		All channels in 1 second
Output damping		250msec rise time (10% to 90%)
Resolution		0.025% full scale, monotonic.
Isolation (dc to 65 Hz; BS EN61010)		Installation category II; Pollution degree 2 (See page 1 - 2 for definitions)
	Channel to channel:	30V RMS or dc (double isolation)
	Channel-to-ground:	30V RMS or dc (basic isolation)
Dielectric strength (1 minute type tests)		2350V ac (channel to channel)
	Channel to channel:	1350 V ac (channel to ground)
Insulation resistance		50 MΩ at 500V dc.

1.3 THE RECORDERS

The 250mm multipoint recorder is a powerful self contained data acquisition and recording instrument, capable of acquiring data from up to 96 analogue or 78 digital inputs. The standard model comes with a display and keyboards to ease operation and configuration.

The graphics recorder is similar, but has a touch sensitive display screen located where the standard recorder's door window/secret-'til-lit keyboard normally sits. This display screen allows data to be displayed in trend, bargraph or group mode, independently of what is being traced on the chart. It also allows the normal operator and configuration menus to be displayed, including a QWERTY keyboard. The graphics unit can also be used as a master to up to seven slave recorders and/or I/O racks.

Also included in this manual, in Annex A and Annex B, are details of data acquisition systems and graphics display units (without chart drive or I/O boards) models

The instrument can perform the following functions on data received:

1. Scan the inputs for alarm conditions, annunciate them and , if required, initiate complex actions.
2. Process input data to derive other parameters (optional extra).
3. Display input and/or derived values on the integral 80-character vacuum fluorescent display or display screen.
4. Trace or log results on the chart, or record them on a memory card.
5. Store results in an internal memory for subsequent replay (optional extra - not graphics units).
6. Allow access to results from a host computer (standard for graphics units; optional extra for standard models).

1.3.1 General description

ENCLOSURE

The recorder is housed in a compact case which fits a panel cutout 273.5 mm. high, by 348 mm. wide.

STANDARD DISPLAY

All data and status information, as well as operator and configuration 'pages' are displayed on a three-colour vacuum fluorescent display. This is arranged as two lines of 40 blue characters, each character having a green and a red underline segment. The underline segments are used to provide:

1. Bar-type indication of measured values (process variables)
2. Clear alarm indication
3. Cursor facilities to simplify operation and configuration.

GRAPHICS DISPLAY

The standard door window area is replaced by a full colour touch sensitive display, which in addition to the above, can provide full page trend, bargraph and group status displays. A further feature allows the user to look at any process variable at any time since the recorder was last initialised.

1.3.1 GENERAL DESCRIPTION (Cont.)

WRITING SYSTEM

The 250 mm (calibrated width) chart is available in 32-metre roll, or 22-metre z-fold formats. The roll cassette has automatic take-up for the chart.

Up to 45 traces can be updated every second, in any of six distinct colours. Flexible alarm messages and logs can also be printed. Other powerful features include line thickening, adaptive recording and interpolation, all of which are more fully described in section 1.3.2 below, under 'Tracing'.

KEYBOARDS (STANDARD RECORDERS)

A set of hardkeys, softkeys (functions depend on display menus) and a numeric keypad are an integral part of the upper panel.

The lower part of the recorder door includes a full alpha-numeric keyboard which is 'secret-'til-lit '(i.e. it appears only when needed). At other times it is transparent, to allow a clear view of the chart.

KEYBOARDS (GRAPHICS UNITS)

In addition to the above, a number of hardkeys appear at the bottom of the display screen, to allow the 'Plant summary' or 'Area', 'Alarm Summary', ' Multi-group' and 'Operator' displays to be called.

If the OPERATOR key is pressed, the screen displays a simulation of the standard 80-character display and lower keyboard. This allows the standard Operator and Configuration Menus to be called, the only difference being that the graphics keyboard is QWERTY instead of the 'A to Z' arrangement of the standard unit.

INPUTS AND OUTPUTS

Measurements are carried out by one or more high-performance input boards. These boards are easily configurable to accept voltage, current, resistance (8-channel board only) including RTDs, and contact closure (digital) inputs.

A scaled and linearised version of an input signal can be output using the 8-channel analogue output board. The user can configure the required output type (Volts or mA) and ranging. The analogue output board (available in four- and an eight-channel versions) can also output derived variables and comms inputs, and each channel can act as a transmitter power supply providing 24V at up to 25mA.

A rugged eight-channel relay board provides contact closure outputs for alarms, events etc.

> Note: These relays are normally energised (i.e. they are de-energised under alarm conditions). This provides a fail-safe system in case of relay failure, or of loss of power to the recorder.

Signal wiring to the I/O boards is terminated at terminal blocks accessed by removing the recorder rear cover. See the Installation and Operation Manual for wiring details.

1.3.2 Recorder functions

MEASUREMENT OF PROCESS VARIABLES

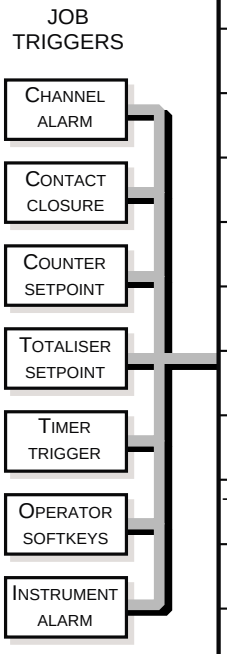
Up to 96 input channels are supported, each of which can be thermocouple, mA, Volts or contact closure. In addition, the 8-channel Universal input board also supports resistance inputs (including RTDs). The Maths pack options further provide derived channels in sets of 32. The TCT option supplies 12 each of Totalisers, Counters and Timers.

Input channel values are displayed using up to five digits with a user-configurable decimal point position. Derived channels are displayed, either using up to seven digits with configurable decimal point position, or in scientific notation (i.e. D.DDD±ee) as defined in the channels's configuration. Totaliser and counter values are displayed as seven or eight-character values as defined in the relevant totaliser / counter configuration.

The recorder updates all values at a rate of once per second, unless large numbers of calculations are being carried out when a slower rate may be necessary. In such cases, a message can be configured to appear, to indicate that the rate has dropped. The update (cycle) rate can also be set up as a part of instrument configuration, to override the normal 1 second rate.

JOBS

A 'job' changes the operation of the recorder. As shown in figure 1.3.2a, a job's action can be initiated by one of a number of triggers e.g. a channel alarm. Jobs can be set up to be active only whilst the initiating source is active (or whilst it is inactive), or to carry out a particular task as a result of a single trigger. Up to four of the job actions shown in the figure can be initiated by a single trigger. Figure 1.3.2a assumes all options to be fitted.



Job types	Job actions (up to four per trigger)
CHART JOBS	Switch chart drive on; Switch to chart speed B; Switch to print mode B; Advance chart
TRACE JOBS	Trace specified channel / group; Select zone B for specified channel group; Select colour B for channel /group; rapid scale print.
ALARM JOBS	Acknowledge alarms of specified group; Disable alarms in specified group; Sound Buzzer.
MESSAGE JOBS	Output specified message to chart, display, rolling memory or memory card.
LOGGING JOBS	Output specified log; Switch to log interval B; Switch to archive interval B.
DERIVED CHANNEL JOBS	Reset / trigger /disable / trace / switch a specified channel or group of channels.
TIMER JOBS	Start / reset specified timer; Reset all timers (global reset)
COUNTER JOBS	Increment / decrement / preset / disable specified counter. Preset or disable group of counters
TOTALISER JOBS	Preset specified totaliser / group of totalisers Disable specified totaliser or group of totalisers
ROLLING MEMORY JOBS	Start / stop replay; Enable / disable input; Trigger sample; Select sample interval B.
RELAY JOBS	Operate specified relay on specified relay output board
CLOCK JOBS	Add / subtract one hour; Load preset time
MEMORY CARD JOBS	Switch chart copy on / off; Replay specified report; Stop replay of current report.

Figure 1.3.2a Job triggers and actions

1.3.2 RECORDER FUNCTIONS (Cont.)

TRACING

The recorder traces the first 45 variables which are configured to be 'trace on'. The recorder traces input channels in preference to derived channels, so if derived channels are to be traced, there must be fewer than 45 input channels set to trace-on. This should be remembered when configuring channels to be conditionally on or off (e.g. trace channel N whilst in alarm).

Individual traces can be configured to have two print zones. Which of these two is used is selected either by Job or by operator action. These zones define the span, scale-type and chart area to be used.

Two of the six colours can be defined for each channel. Which of these two is used is selected either by Job or by operator action.

INTERPOLATION

For each process variable, the normal scanning of the printhead will place a single dot on the chart for each measurement. If the traced value is changing rapidly these dots can be widely spaced, making the trace as a whole difficult to read. With interpolation enabled, a horizontal line is dawn between consecutive dot positions, making the trace easier to interpret. When enabled, (part of Chart Configuration), interpolation applies to all channels.

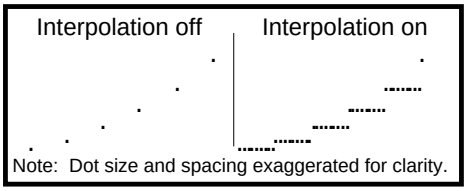


Figure 1.3.2b Interpolation example

ADAPTIVE RECORDING

Normally, the trace is updated each time the chart position is incremented. At slow charts speeds, this means that transients and other high speed changes in input value could be missed. With adaptive recording enabled (part of Chart Configuration), the printhead traces even high speed changes in the input variable by placing one or more extra dots on the chart, in between chart increments. When enabled, adaptive recording applies to all channels.

LINE THICKENING

This feature causes the trace for each selected channel to be widened to ease long-distance viewing, at the expense of some loss in trace resolution. Display accuracy is NOT affected.

DOT DENSITY

This feature allows dot density to be selected high or low. High dot density increases trace visibility at but reduces ribbon life. When enabled (part of Chart Configuration) the density setting applies to all channels.

1.3.2 RECORDER FUNCTIONS (Cont.)

MESSAGE TYPES

There are three categories of message which can be printed on the chart:

Trace tags. Channel tags (up to seven characters, entered as a part of Channel Ident configuration) are printed adjacent to the channel trace in the same colour as the trace.

Cyclic messages. Scales, with tags, descriptors and engineering units, chart speed, logging interval, time and date are printed cyclically at a rate sufficient to ensure that at least one such message is always visible to the operator no matter what the chart speed.

Demand messages. Alarm, event and change messages are generated asynchronously. 50 configurable messages can also be printed as a result of Job action. Configuration of these messages (Instrument MSG'S) can be simplified by embedding times, dates and process variable values as described in the TEXT SOFTKEY section of the Installation and Operation manual (Currently section 3.3.3).

PRINT MODES

The recorder can operate in any one of three modes to print data on the chart:

Trace Priority. All message types can be printed, but the trace is not broken (i.e. message printing will be slow at low chart speeds). All demand messages are queued until printed. If the queue overflows, 'Message lost' is printed on the chart.

Text priority. As Trace Priority above except:

1. If the print queue is more than 70% full, in which case text printing takes priority, and the chart is advanced at an appropriate rate to print all the messages. The traces are therefore broken/distorted.
2. Tabular logs always break the trace (see 'Logging' below).
3. Columnar logs never break the trace (see 'Logging' below).

Text only. All cyclic messages and variable traces are inhibited - only logs and demand messages are printed.. Text only mode is used for report generation, alarm logging etc. If the print queue overflows, "Message lost' is printed on the chart.

GROUPS

This feature allows up to 16 otherwise unrelated process variables to be place in one or more groups to be acted upon together (e.g. disable alarms in a specified group). The operator can select a particular group for display, so only the items in that group are scrolled through at the display, not every single enabled variable.

There are 12 groups available (17 for the graphics unit) one of which (default name 'Everything') contains all variables. The name of this group can be changed, but the contents are fixed. The content of the remaining 11(16) is set up in Group Configuration.

1.3.2 RECORDER FUNCTIONS (Cont.)

LOGS

Logs are alpha-numeric reports showing the current values of a specified group of variables. Which group is allocated to which log is set up as a part of the log configuration , and the content of each group is set up as a part of Group Configuration.

Logs can either be printed on the chart, or if the relevant option is fitted, they can be directed to a memory card. Log destination (chart or card) is set up as a part of Log configuration.

LOGGING TO CHART

Logs are printed in black (with a coloured underline for status indication), either on demand, or as a result of a job becoming active.

Log 1 can be printed automatically, at one of two configurable log intervals (Chart configuration) selectable from the operator menu. If the relevant option is fitted, log 2 can also be printed automatically, at one of two configurable archive intervals (Memory card configuration) selectable from the operator menu.

Two chart logging formats are available as follows:

Tabular logs. When tabular log mode is in operation, the relevant values are printed across the full width of the chart. The number of values per line depends on how much information (e.g. descriptors, tags) is to be included (see Group configuration).

Column logs. When column log mode is in operation, each logged value is printed on a separate line, at the left edge of the chart. It is thus possible, (using the zoning feature to ensure the traces are to the right - hand side of the chart), to print a log without overprinting the traces.

Up to 12 logs are available, each of which can be allocated a ‘group’ as described in section 4.8. The printing of a log can be initiated in the following ways:

a) by the operator (section 3.3.4)
b) as a result of job action (section 4.1.4)
c) for log 1, automatically, at one of two fixed time periods (log intervals).
d) if memory card archiving software is fitted, log 2 can also be printed automatically at one of two fixed time periods (archive intervals) set up as a part of the memory card configuration

The content of the log depends on how the group has been configured (e.g. do channels have descriptors / tags, units printed etc.) as described in section 4.5.

Operator action. Log printing can be initiated, at any time, by the operator, from the LOG softkey in the level 1 Operator Menu.

Job action. As shown in figure 1.3.2a, one of the jobs types available is ‘Logging’. Within this category, a particular log number can be selected for printing when the job becomes active, and / or the logging interval can be selected to ‘B’.

1.3.2 RECORDER FUNCTIONS (LOGS) (Cont.)

LOG INTERVAL

Two log intervals (A and B) can be entered as a part of the chart configuration. The intervals are in hours and minutes; an entry of 0:0 disabling automatic log printing. As supplied by the factory, log interval A is set to 00:00 (off); interval B to 01:00 (1 hour). Under normal conditions, log interval A is used by the recorder. Log interval B is selected either by the operator from the CHART menu, or by job action.

ARCHIVE INTERVAL

If memory card archiving software is fitted, two archive intervals (A and B) can be entered, as a part of the memory card configuration, for the automatic printing of log 2. Interval A or B is selected for use from the top level Operator menu or by job action. The intervals are in hours, minutes and seconds; and entry of 00:00:00 disabling automatic printing. As supplied by the factory, both archive intervals are set to 00:00:00 (off). Refer to the Memory Card manual for full details.

LOGGING TO MEMORY CARD

Logging to memory card is initiated in exactly the same way as logging to chart, described above, except that the destination (set up in Log configuration) is a file name instead of ‘chart’. Refer to the Memory Card manual for full details.

NETWORK LOGGING

Where a network exists, logs can be printed at that network unit which has address 1. For recorders with network software installed, an extra destination ('net printer') appears in the Log configuration page.

ALARMS

Each process variable can have up to four alarm setpoints associated with it, each of which can be one of the following types:

1. Absolute high / low
2. Deviation in / out
3. Rate–of–change rising / falling
4. Contact closure (discrete input) high/low (only if 'input type' set to DIG for the channel)

Each of the above types can be defined to be:

1. Off
2. Trigger (initiates jobs but is not otherwise annunciated in any way)
3. Latching: Remains active and initiates jobs until the alarm is both acknowledged AND the source is no longer active.
4. Non-latching: Remains active and initiates jobs for only as long as the source is active. Acknowledgement has no effect (unless jobs are set up to become active on acknowledgement).

All of the above alarm attributes are set up as a part of the Alarm or Job Configuration for the relevant channel, totaliser etc. If the Operator Permissions are appropriately set (Configuration ACCESS menu) the operator can access and change the setpoints without the password.

1.3.2 RECORDER FUNCTIONS (Cont.)

INTERNAL EVENTS

Internal events fulfil two functions:

1. They allow internal instrument sources (e.g. operator softkeys) to initiate jobs
2. They allow any instrument alarm, channel alarm, timer, counter, totaliser or contact input to be ANDed or ORed with any other source, to initiate jobs.

MATHS PACK

The maths pack option comes as Maths pack 1, Maths pack 2, or Maths pack 3. With Maths pack 1 or 2, a further 32 channels (derived channels) are made available for each maths pack option fitted. Maths pack 3 supplies 96 derived channels and also incorporates totalisers, counters and timers and is intended for use as a Continuous Emissions Monitoring option.

Each of the maths pack options allows new variables to be derived from others. For example, Relative Humidity can be calculated from wet and dry temperatures and atmospheric pressure inputs. Full details are to be found in the Options section of the Installation and Operation Manual supplied with the recorder.

QUALITY MONITORING OPTION

This option is intended to support the generation and replay of process limits associated with quality standards, furnace run-up, sterilizer validation and any other process using quality profiles. The option consists of maths pack level 2 and a trace generation maths function. This function generates an output according to one of six generator programs and would be used, typically, as a quality standard to be traced on the chart along side one or more actual readings, to act as a comparison.

FUNCTIONS

The level one (basic arithmetic) functions are as follows:

Constant	Multiply
Copy	Divide
Add	Modulus
Subtract	

The level two functions are as follows:

Square root	Polynomial
Channel / Group / Rolling averages	Relative humidity
e^x	F value
$\log_e x$	Mass flow (linear) and square root)
10^x	Mass flow (square root)
$\log_{10} x$	Zirconia probe
Rate of change	Switch inputs
Sample and hold	Stopwatch
Channel min/max	Time stamp
Latching min/max	High Select
Group min/max	Low select

1.3.2 RECORDER FUNCTIONS (Cont.)

TOTALISERS/COUNTERS/TIMERS (TCT) OPTION

Each TCT option contains 12 each of totalisers, counters and timers.

TOTALISERS

Each totaliser integrates a given input in order to derive, for example, total flow, from a flow rate input. High and low cutoffs can be defined, and each totaliser can be configured to count either up or down. A threshold can be set up to initiate jobs in the same way as for channel alarms. Providing access is permitted, the operator can view and can preset totalisers without password entry.

COUNTERS

Each counter can be incremented or decremented as a result of job action, and they are used to count such things as alarms, contact closures etc. Provided access is permitted, the operator may preset the value of each counter. A threshold can be set up to initiate jobs in the same way as for channel alarms.

TIMERS

Timers allow the recorder's real time clock to initiate up to four jobs. Provided access is permitted, the operator can start and reset timers without password entry. Timers can be used in conjunction with counters to measure elapsed tome, and the timer status (e.g. time remaining) can be displayed by the operator.

ROLLING (FIFO) MEMORY

Rolling memory (32kB) allows 60 minutes of recording for 12 channels at 120 mm/hr (or equivalent) to be saved in memory (not graphics units). The stored data can be replayed either as the result of operator action, or by job. The rolling memory feature can be used:

a. to trace an alarm with pre-alarm data included
b. to replay a record
c. to change charts without losing data

OPERATOR ACCESS PERMISSION

Access to all Configuration menus, and access to some Operator menus are initially password protected. It is possible to enable / disable operator access to the following functions, using the ACCESS softkey, as described in the Installation and Operation Manual.

Selection of chart speed A/B	Derived channel control
Selection of log interval A/B	Counter pre-setting; edit preset
Selection of Mode A/B	Timer control
Chart on/off -line selection	Totaliser presetting; edit preset
Zone selection	Memory card formatting
Alarm setpoint adjustment	Memory card status / directory display
Operator message edit	Save / Restore configuration to/from memory card
Display group selection	Archive interval selection
Log initiation	Memory card on-off-line selection

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Section 2

Day-to-day service

List of contents

2.1 CHART INSTALLATION / REPLACEMENT

Note: The following instructions assume a used chart is to be replaced. When fitting a chart for the first time, follow only the relevant sections. If required, the recorder can be switched on by opening the door and operating the push-button switch at the bottom right hand corner of the recorder.

When the chart is finished, the printer stops (Printer off LED flashes), the system error LED flashes and a 'chart out' message appears at the display, with one softkey caption: CLEAR. Operation of the CLEAR key allows normal operation of the recorder to continue, except of course for tracing. After a new chart has been fitted, a 'Press START key' message appears with one softkey caption: START. Operation of the START key returns the channel tracing functions to normal.

Before changing the chart, it is recommended that the cartridge is 'parked', as follows:

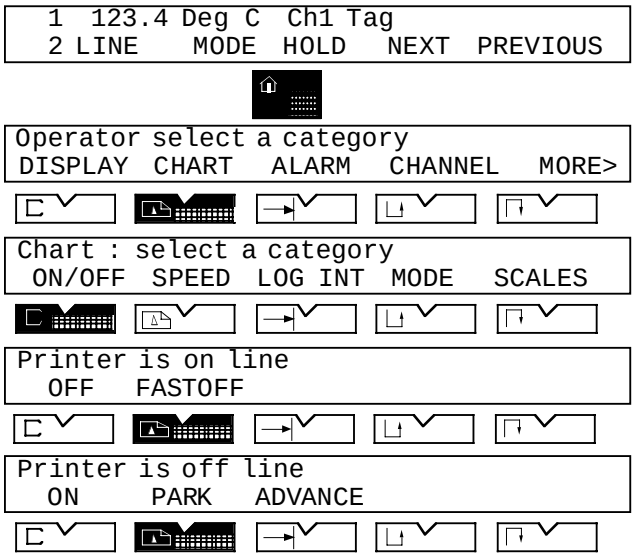
a. Operate the 'Home' hard key.

b. Operate the CHART softkey.

c. Operate the ON/OFF softkey, then the FAST OFF softkey and wait until the legend on the top line of the display reads 'Printer is off line'

d. Operate the PARK softkey and ensure that the print cartridge parks at the centre of travel.

Note the position of the ADVANCE softkey.



2.1.1 Z-Fold chart replacement

Open the recorder door by lifting, then rotating the latch clockwise.

Pull the paper guide forwards, as shown, and disengage the remaining chart from the drive sprockets. Pull the end of the chart downwards clear of the platen.

Open the lower paper tray by rotating it forwards as shown in the figure, and remove the old chart.

Remove any residual paper dust from the paper tray.

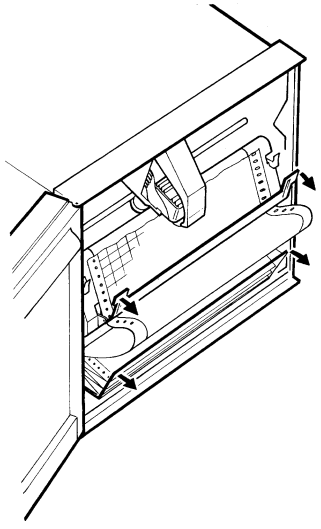


Figure 2.1.1a Z-fold chart removal

2.1.1 Z-FOLD CHART REPLACEMENT (CONT.)

Release the platen by pushing upwards on one or both of the latches, as shown. Swing the platen forwards to reveal the upper paper tray. Remove any residual paper dust.

Check that the printhead / ribbon cartridge guide bar is clean and shiny. Check the drive belts for the printhead/cartridge and for the ribbon are in good condition.

If not, carryout remedial action as described in Preventive Maintenance below, or in Section 4 (Replacement procedures) as appropriate.

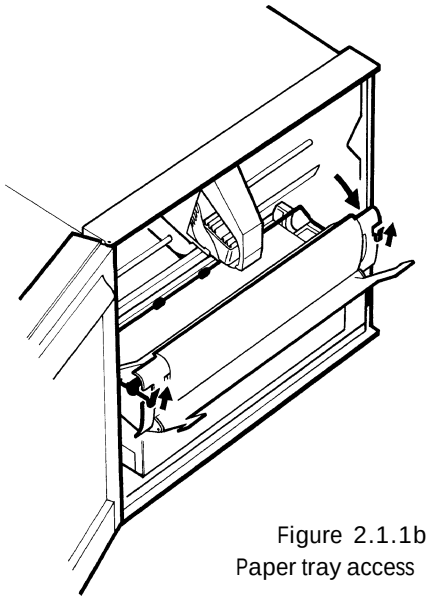


Figure 2.1.1b
Paper tray access

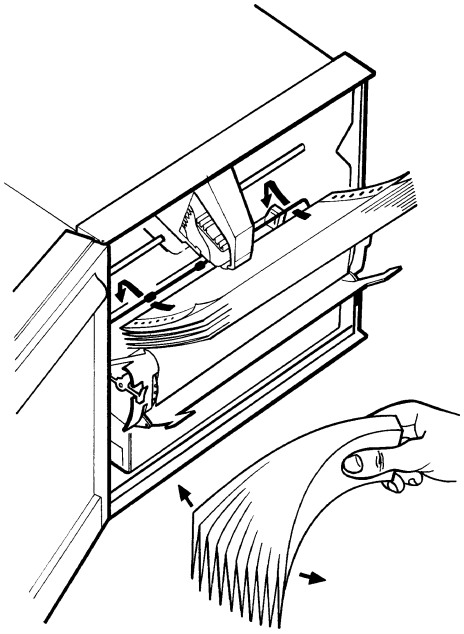


Figure 2.1.1c Z-fold chart loading (1)

Remove the new chart from its packing, and fan (as shown in the figure) several times to separate the leaves, and to remove loose paper dust. Ensure that the leaves are fully separated, or the paper transport will not operate correctly.

Orient the chart such that the red 'end of chart' line is at the bottom, and the circular chart holes are to the left (i.e. the elongated slots are to the right).

Place the chart into the upper paper tray.

Unfold the top two or three leaves.

Push the platen closed **ENSURING THAT IT LATCHES CORRECTLY INTO PLACE**.

If the chart is loaded correctly, the circular holes will be on the left, and the printed grid will be uppermost, with no red line showing.

Pull the paper guide forwards and feed the end of the chart through the gap between the platen and the paper guide. Close the paper guide, ensuring that both sets of chart holes locate correctly on the drive sprockets, and that the horizontal grid lines are parallel with the chart guide.

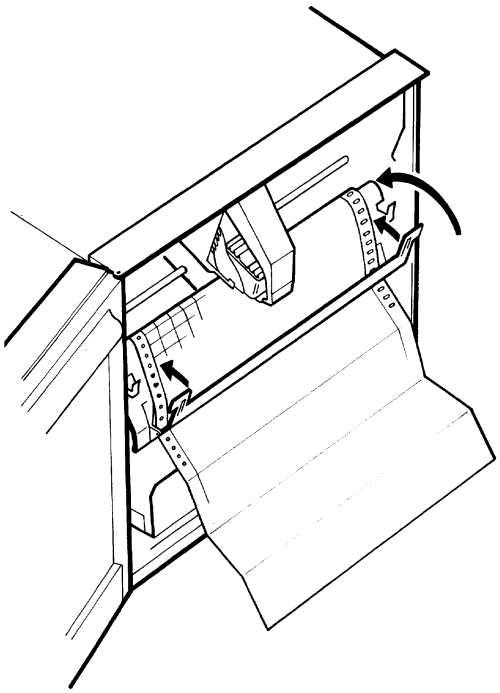


Figure 2.1.1d Z-fold chart loading (2)

2.1.1 Z-FOLD CHART REPLACEMENT (CONT.)

Open the lower paper tray and introduce the first leaves of chart into it.

Close the paper tray and, if necessary, apply power to the recorder and use the ADVANCE softkey to feed extra paper through.

Ensure that the paper lies naturally (i.e. the fold direction is the same as when packed by the chart manufacturer).

FAILURE TO ENSURE THAT THE CHART FOLDS NATURALLY, WILL RESULT IN THE EVENTUAL MALFUNCTIONING OF THE CHART FEED.

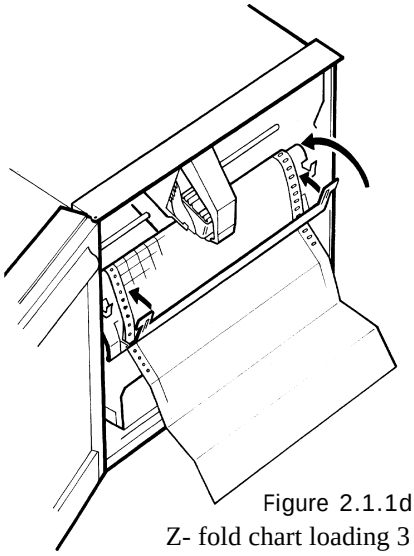


Figure 2.1.1d
Z- fold chart loading 3

2.1.2 Roll chart replacement

Note: The roll chart cassette is designed such that once loaded, the paper winds itself onto the take-up spool without operator intervention. The chart must **NOT** be attached to the take-up spool using adhesive tape etc, since this will make subsequent removal of the chart difficult without rewinding the entire chart.

Open the recorder door by lifting the bottom of the catch up and out and then turning it clockwise.

Release the platen by pushing upwards on one or both of the latches, as shown. Swing the platen forwards to reveal the upper paper tray. Remove the empty tube and discard. Remove any residual paper dust.

Check that the printhead / ribbon cartridge guide bar is clean and shiny. Check the drive belts for the print- head / cartridge and for the ribbon are in good condition.

If not, carry out remedial action as described in Preventive Maintenance below, or in Section 4 (Replacement procedures) as appropriate.

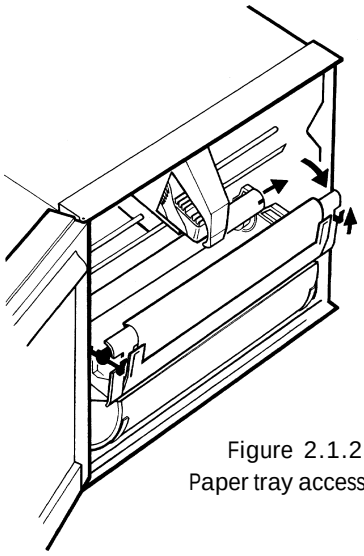


Figure 2.1.2a
Paper tray access

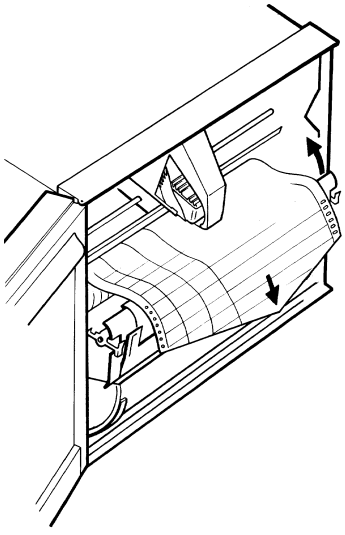


Figure 2.1.2b Roll chart loading (1)

Remove the new chart from its packing. Unroll the first 10 to 20 cm, and place the roll in the tray, with the leading edge to the top (i.e. with the chart grid showing).

Push the platen closed **ENSURING THAT IT LATCHES CORRECTLY INTO PLACE.**

2.1.2 ROLL CHART REPLACEMENT (CONT.)

Pull the paper guide forwards and feed the end of the chart through the gap between the platen and the paper guide. Close the paper guide, ensuring that both sets of chart holes locate correctly on the drive sprockets, and that the horizontal grid lines are parallel with the chart guide.

If the chart is loaded correctly, the circular holes will be on the left and the printed grid will be uppermost, and aligned with the paper guide.

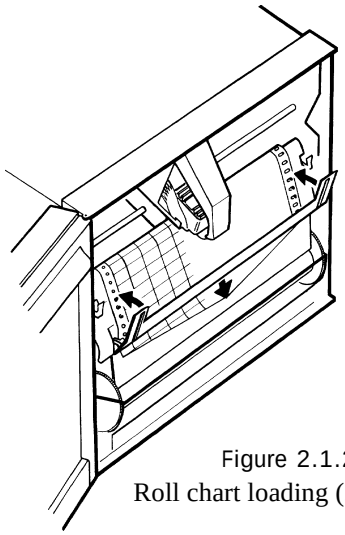


Figure 2.1.2c
Roll chart loading (2)

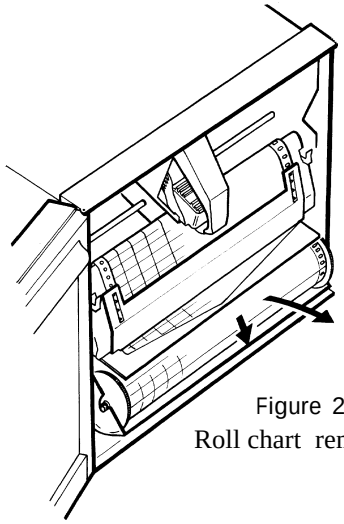


Figure 2.1.2d
Roll chart removal

Open the lower paper tray, and remove the take-up spool with the old chart.

Remove the take-up spool gear wheels from the old chart by pulling them away from the inner tube. Slide the tube out from the used chart and re-fit the gear wheels, ensuring that the keys on the gear hubs are aligned with the key-ways in the tube.

Return the take up spool to the lower paper tray, and check for free rotation.

Close the paper tray and apply power to the recorder.

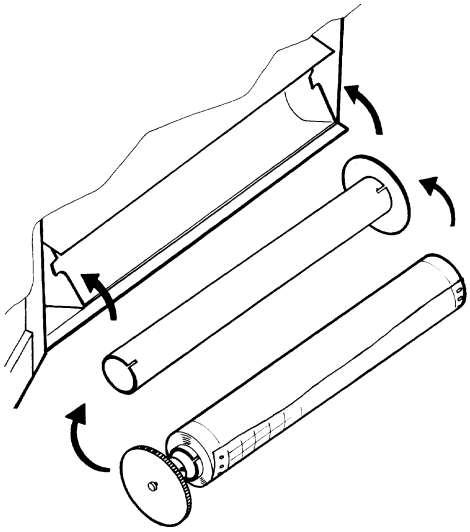


Figure 2.1.2e Take-up spool

2.1.3 Roll chart review

With roll charts it is possible to remove the take-up spool whilst recording is in progress and to unwind the chart manually in order to look at the tracings, messages etc. so far.

In order to return the chart, open the lower paper tray and, whilst holding it down as far as it will go, re-fit the take-up spool, ensuring there are no twists in the 'loose' loop of chart. Close the paper tray.

The auto take-up feature of the recorder will ensure that the chart is re-wound neatly onto the take-up spool.

2.2 RIBBON CARTRIDGE REPLACEMENT

CAUTION

Before attempting to change the ribbon cartridge, it is essential to ensure that:

1. The recorder is not powered, OR
2. The printhead is parked.

Switch the printer off-line, park the printhead / cartridge and release the platen as described in section 2.1.1 above.

Slide the ribbon cartridge to the right to remove it from its carriage.

Unpack the new ribbon cartridge and introduce it into the carriage. Push the cartridge fully to the left, ensuring intimate contact between the side of the cartridge and the carriage.

If the ribbon cartridge is reluctant to slide fully home, the knob at the right hand side of the cartridge should be turned anti-clockwise a few degrees to allow the ribbon drive to engage.

Close the platen **ENSURING THAT IT CLICKS INTO PLACE**.

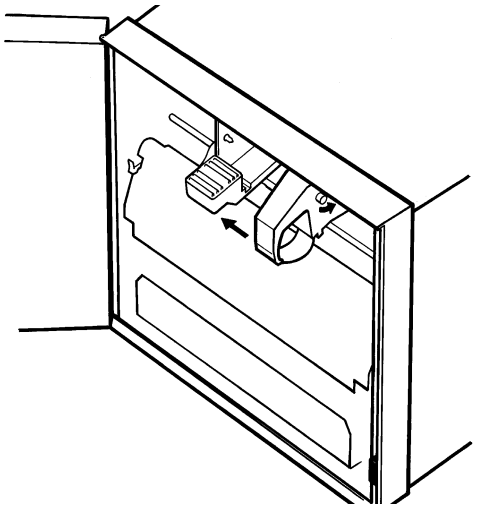


Figure 2.2 Ribbon cartridge replacement

2.3 PREVENTIVE MAINTENANCE

Operation of the recorder is generally maintenance free. It is recommended however, that

a. Each time the chart is changed, any accumulations of paper dust are removed.
b. Every six months, the print head reaction bar (A in figure 2.3) is cleaned of paper dust and then smeared with a small amount of a light lubricant such as WD40, applied using a lint-free cloth.
c. Every six months, the reaction bar (A in figure 2.3) is rotated a few degrees.

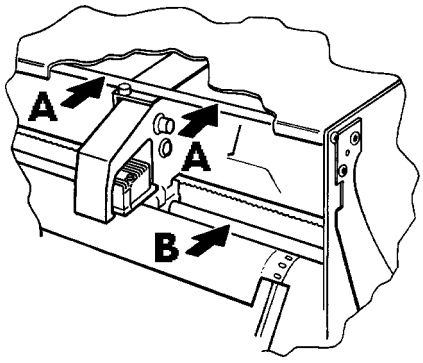


Figure 2.3 Reaction Bar location

CAUTION

On no account should the print head guide bar (B in figure 2.3) be lubricated, as this will damage the 'oilite' bearing in the printhead carriage.

Section 3

Fault finding and diagnostics

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(Continued)

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SECTION 3: FAULT FINDING AND DIAGNOSTICS

3.1 FAULT FINDING GUIDE

3.1.1 Recorder completely inoperative

Refer to figures 3.1.1 a, b and c as appropriate.

Loss of power

1 Check that the recorder is switched on (figure 3.1.1)
2 Check the supply voltage wiring to the rear of the recorder.
3 Check that the supply voltage is present at the recorder supply
4 Check the supply voltage fuse (figure 3.1.1)
5 Open the recorder door and see if the 'Watchdog' LED on the writing system control board is on (Green). This LED is located towards the left side of the circuit board as shown in figure 3.1.2.
6 If the watchdog LED is off, remove the writing system (section 4) and see if the LEDs on the forward facing edge of the I/O boards are on. If not check that the on-off button on the Power Supply unit is being correctly operated by the on-off switch at the front of the recorder. If so, replace the power supply unit.
7. If any of the LEDs is on, check all the ribbon cable connections for integrity, and check the harness from the PSU to the writing system board. If the problem remains unsolved, contact your local service centre for advice.

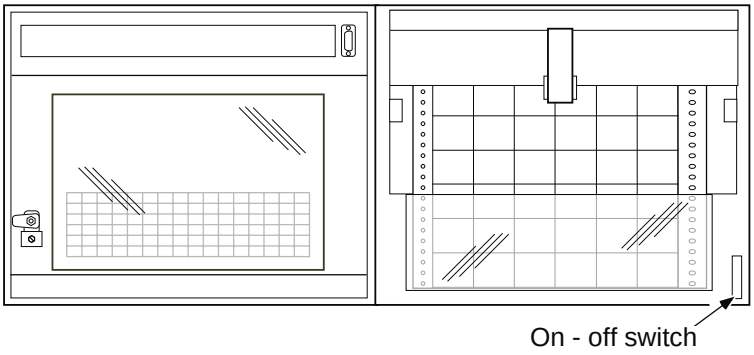

Figure 3.1.1a On-off switch (Recorders)

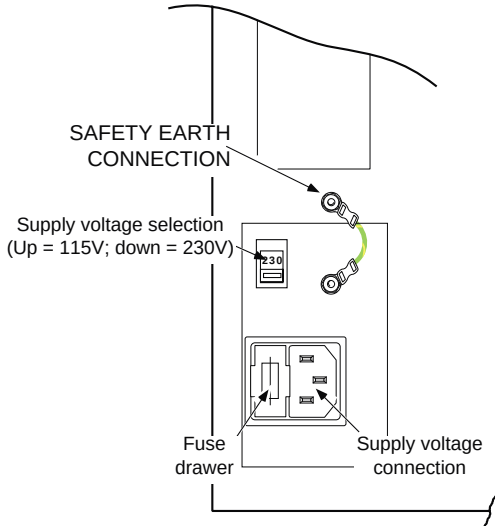

Figure 3.1.1b Supply voltage components (Recorders)

3.1.1 RECORDER COMPLETELY INOPERATIVE (CONT.)

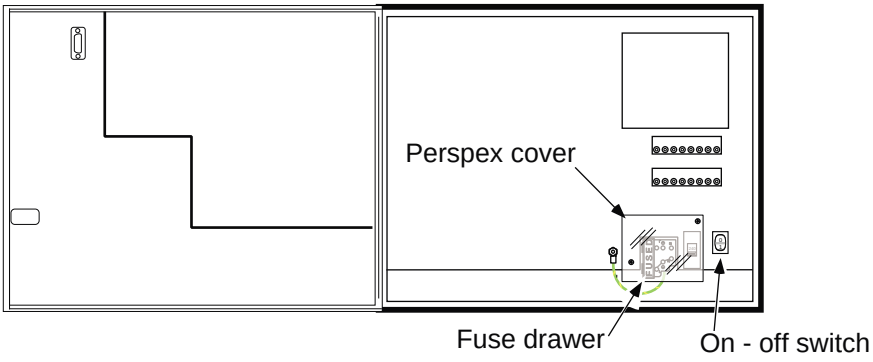

Figure 3.1.1c On-off switch and supply voltage components for Graphics Display Units

3.1.2 Chart not moving correctly (rest of recorder operating normally)

Printer off line — If the 'Printer OFF' LED (or warning symbol for graphics units) is illuminated, the chart is held. Use the operator menu to set the printer ON-line

Channel config. — All channels set to Trace OFF, or all traces are conditional upon Job action. Use Channel Configuration - TRACE softkey to reconfigure if required.

Paper problem — If the 'System Error' LED (warning symbol for graphics units) is flashing, the chart may be used up. If so, replace the chart. If not, set the printer OFF line from the operator menu, and remove the chart. Hold the paper-out actuator (located at the right hand end of the platen) up, and operate the ADVANCE softkey. If the chart drive pin belts do not operate correctly, but the motor is running, or attempting to, replace the platen assembly.

Drive problem — With the recorder door open, observe the green 'Watchdog' LED on the writing system board (figure 3.1.2) (The LED is visible over the top of the chart/platen.) If the LED is off, check the loom from the PSU to the writing system for integrity, and replace if necessary. If this fails to solve the problem, replace the writing system board. If the LED is flashing, the on-board microprocessor system has failed: replace the writing system board.

If the LED is on, switch the recorder off and carry out the following checks:

1 Check that the toothed belt from the motor to the chart pinion is undamaged; replace if necessary (See section 4)
2 Check that the motor loom is undamaged, and that it is properly connected into the writing system board (CON 1 in figure 3.1.2)
3 If steps 1 and 2 do not reveal the fault, then, taking adequate precautions against static discharge damage, remove the writing system board, and check for any obvious signs of damage to ICs 4 and 5.
4 If damage is apparent, check the resistances between pins 1 and 2, and between pins 3 and 4 of the flying-lead part of CON 1. If either reading lies outside the range 5 to 15 Ohms, replace the motor and the writing system board.
5 If damage is not apparent check the resistances between pins 1 and 2, and between pins 3 and 4 of the flying-lead part of CON 1. If either reading lies outside the range 5 to 15 Ohms, replace the motor. If the readings are acceptable, replace the writing system board.

ROLL CHARTS ONLY

1 Remove the take-up spool, switch the recorder on, and check that the take-up motor is rotating correctly.
2 If not, switch the recorder off and check that the motor pinion can rotate freely. Insert the take-up spool and check that it can rotate freely. If not, check the chart drive mechanics, and if these are 'free', replace the take-up motor.

3.1.2 CHART NOT MOVING CORRECTLY (CONT.)

Roll charts (Cont.)

3 If the motor pinion rotates freely, check that the motor loom is undamaged and that it is properly connected into CON 4 on the writing system board.

4 Check the motor resistance across pins 1 and 2 of the flying lead half of CON 4. If this is less than 50 Ohms replace the motor.

5 Check the voltage across pins 1 and 2 of the circuit-board mounted half of CON 4. If above 8.5 Volts, replace the writing system board. If not, replace the motor.

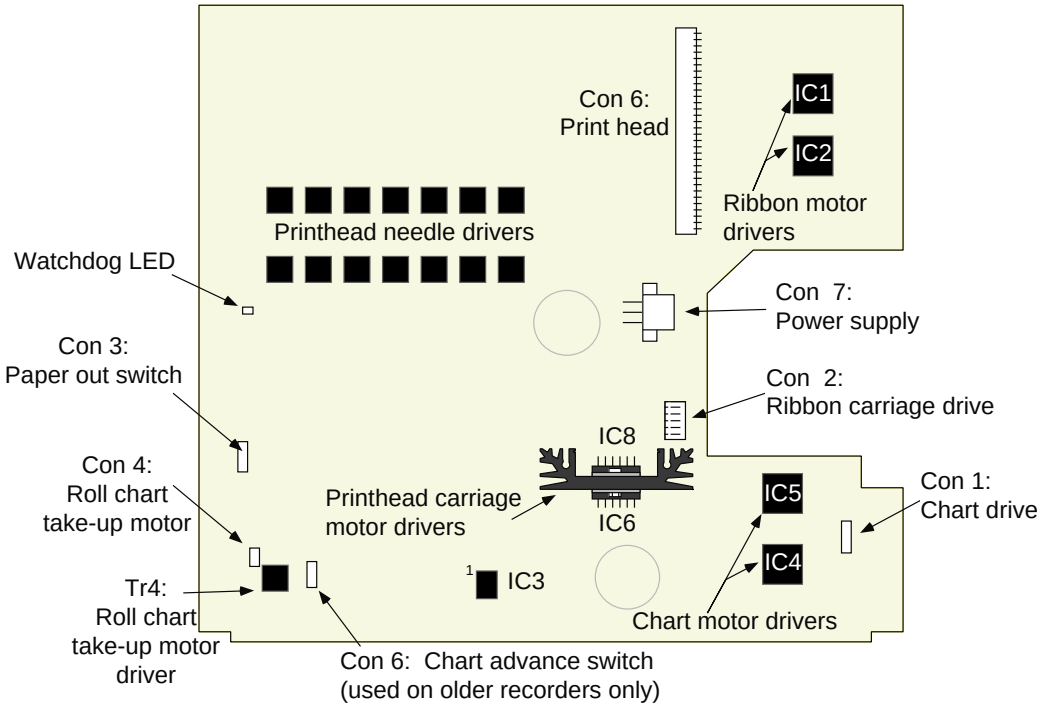

Figure 3.1.2 Writing system control board

3.1.3 Printhead carriage not moving (rest of recorder operating normally)

Printer off line — If the Printer OFF LED (or warning symbol) is active, the chart is held, and printhead movement is inhibited. Use the operator menu (CHART) to set the printer ON-line

Paper out — If the System Error LED (or warning symbol) is active, check that the paper is not exhausted. Check the paper-out detector and writing system watchdog LED as described in 3.1.2 above.

Drive Problem — SWITCH THE RECORDER OFF

1 Check that the toothed belt from the motor to the printhead carriage is undamaged, and replace it if necessary (section 4.9)

2 Check that the printhead moves freely* from side to side (without excessive play). If so, go to step 4. If not, release the toothed belt from the left-hand pulley and re-check. If the carriage now moves freely, replace the motor.

3 If the printhead carriage is still not free, remove it and investigate the mechanics for jamming. Go to step 5.

4 If the printhead carriage is free to move, check the motor loom for damage, and ensure that it is securely connected to the writing system board at CON 2.

5 If the above do not solve the problem check the carriage drive motor and drive circuitry as described for Chart Drive above. The relevant references are IC 6, IC 8, and CON 2 pins 1/2 and 3/4. The motor resistance should lie in the range 0.5 and 2 Ohms.

* Because the motor is a stepper motor, a certain 'roughness' may be felt in this movement.

3.1.4 Writing system fails to initialise

SYMPTOM

When the instrument is switched on, the writing system fails to initialise fully (i.e. the printhead starts to traverse but then stops).

CHECKS

Switch the recorder off and slide the printhead to approximately the centre of travel. Switch the recorder on and note the direction in which the printhead moves.

MOVES TO THE RIGHT

Check the condition of the printhead flexi cable, in particular tracks 20 to 28 (track one is at the top at the writing system board connector (CON 5). If the flexi cable is damaged, replace the printhead assembly. If the flexi is undamaged, ensure that it is correctly connected at both ends. If both ends are securely mated, try replacing the feedback PCB. If this still fails to cure the problem, replace the writing system board as well.

MOVES TO THE LEFT

If the printhead moves to the left an fails to stop before coming to the end of travel, or before hitting the edge detect 'finger' located at the left hand end of travel), carry out the following checks:

1 Open the writing system, and check that the edge detect 'finger' passes through the slot in the opto. If not, investigate the mechanics of the system for general 'tightness' and for looseness or distortion in the edge detect finger.
2 If the finger passes through the opto correctly, enter the diagnostics menu (section 3.3) and check the edge detector status.

   If this is 'good', replace the writing system board.

   If the status is 'bad', switch off and check that the flexi cable between the writing system board and the printhead is properly terminated at both ends, and correct if necessary.

   Switch the printer OFF line (using the Operator CHART menu), and use an oscilloscope to check the opto output at IC 3 pin 13 on the writing system board, whilst running the printhead backwards and forwards over the edge detect finger. (IC 3 is located near the bottom of the writing system board, slightly left of centre - see figure 3.1.2).

   If a good 'edge' is seen, replace the writing system board. If not, replace the opto (feedback) board. If this fails to solve the problem, replace the printhead flexi-cable.

If the printhead moves to the left, detects the edge detect finger, starts moving to the right and stops, carry out the following checks:

1 Check that the flexi cable is properly terminated in the feedback PCB connector.
2 If this is correct, check that the feedback strip (running across the width of the recorder, behind the platen) is in the centre of the feedback opto slot, and that it is clear of paper debris.
3 Check the paper out detector as described in 3.1.2 above.
4 If the paper out detector is working properly, check that the resistance of each of tracks 20 to 28 of the flexi (track 1 is at the top edge) is less than 1 Ohm from end to end. If the flexi is in good order, change the feedback PCB, and if the problem persists, change the writing system board.

3.1.5 Traces not appearing (rest of recorder operating normally)

Ribbon cartridge

1 If the printhead can be heard, but traces and messages are not appearing on the chart, replace the ribbon cartridge
2 Check that the toothed belt from the motor to the ribbon drive pinion is undamaged; replace if necessary.
3 Check that none of the needles has snagged the ribbon
4 If the above checks do not solve the problem, check the ribbon drive motor and drive circuitry as described for the chart drive in section 3.1.2 above. The relevant component references are IC 1, IC 2 and CON 5 (the flexi-cable connector) where resistances of less than 10 Ohms should be exhibited between tracks 29 and 30, and between tracks 31 and 32 of the flexi cable, with it disconnected from the writing system board.

Printhead problem

If the printhead cannot be heard but the carriage is moving normally across the chart, and the ribbon is being driven, replace the printhead. If this fails to cure the problem, replace the writing system board.

Other possibilities

Chart drive OFF line
All channels configured off (should still print cyclic messages)

3.1.6 Display not operating (rest of recorder operating normally)

STANDARD RECORDERS

Board problem

1 If keyboard operations 'beep', and the display is not operating, replace the high-voltage board (section 4). If this fails to solve the problem, replace the display board.
2 If keyboard operations do not 'beep' And the chart illumination is OK, check the status LED visible through a small aperture in the inside of the door (fig 3.1.6).
   a If the LED is continuously on, check the harness between the door and the PSU.
   If the loom is undamaged, replace the high voltage board located at the rear of the display. If this fails to cure the problem, replace the keypanel.
   b If the LED is flashing, replace the display board.
   c If the LED is off, check the loom between the door and the power supply and replace if necessary.
3 If keyboard operations do not 'beep' and illumination has failed, check the loom between the door and the power supply and replace if necessary.

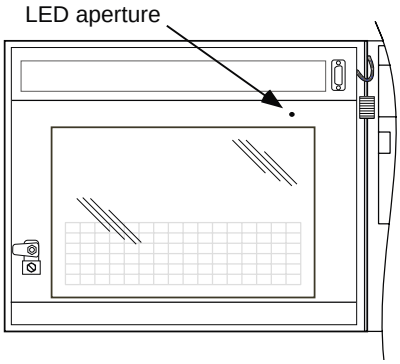

Figure 3.1.6 LED aperture

GRAPHICS RECORDERS/GRAPHICS DISPLAY UNITS

Power supply

If the display panel is totally blank, check the loom between the door and the power supply, and replace if necessary.

Comms failure

If an 'instrument not responding' message appears, and the unit continuously attempts to initialise itself, check the loom between the door and the comms module at the back of the recorder, and replace if necessary.

Calibration

If the display appears normal, but does not respond properly to touch, re-calibrate the screen as described in section 4.13.1.

Backlighting

If only one half (top or bottom) of the display is properly illuminated, the backlighting unit should be replaced.

3.1.7 PVs outside specified tolerance

Input open circuit	Check sensor leads and termination
Configuration problem	Check that the input ranges, scales, printing zones etc. are as required. For thermo-couples, check the cold junction type and settings.
Unsuitable environment	Check that the ambient temperature and humidity are within specification limits
Faulty input board	May affect more than one channel; replace board.

3.2 CALIBRATION

This section describes a means by which the calibration of input boards can be checked. If a fault is suspected, it is recommended that the VIEW softkey of the Calibration Adjust menu is used to ensure that the channel in question has not previously had its calibration adjusted. If user adjustment has been carried out, the FACTORY softkey can be used to restore factory calibration.

Notes:
1. Calibration check must be carried out with the recorder located is an area in which the ambient temperature is maintained at 20 ± 1.0 ˚C. The checks must be carried out only after the recorder has been switched on for a minimum of 1 hour with the rear terminal cover fitted and with the door closed.
2. It is recommended that a configuration print be taken before calibration checks are carried out.

3.2.1 DC Inputs (8- channel input board)

The accuracies quoted against the equipment below are necessary to demonstrate that the recorder is performing to specification. If appropriate, these accuracies may be relaxed according to customer requirements.

Note: Two versions of the 8-channel input board exist, a 1-Hertz version, normally used in multipoint recorders, and a 4 Hertz version normally used in continuous-trace recorders. The measuring accuracy associated with these versions is different, so it is important to know which board is being calibrated. The easiest way to tell, if any doubt exists, is by looking at the part number printed on the PROM (IC 4) label. These part numbers are: RD246557 for the 1 Hz. board and RD249266 for the 4 Hz. board.

EQUIPMENT REQUIRED

1. Voltage reference (absolute accuracy: ± 2.5 µV)
2. Reference temperature in the range 0 to 60˚C (absolute accuracy: better than ± 0.05˚C)
3. Suitable connecting cable, including compensation cable for any cold junction checks to be carried out.

CALIBRATION CHECK

1. Connect all the channels to be checked to the voltage reference as indicated in figure 3.2.1. Ensure that the recorder rear terminal cover is in place after wiring.
2. If required, configure a group to contain all the relevant channels.
3. For the first channel to be checked, use the channel configuration pages to set the input type to ‘mV’, linearisation to ‘Linear’, and the scale and range to the first of the input ranges in table 3.2.1 below. Use the ‘Configuration Copy’ feature to copy this setup to all other relevant channels.
4. Set the output of the voltage reference to the first checkpoint value in table 3.2.1, and check that each channel’s value, as shown on the display, is equal to the voltage reference, within the specified tolerance. Note that at least an hour should have passed since the rear terminal cover was replaced after wiring.
5. Set the reference voltage to each of the remaining checkpoints in turn*, and check that the displayed values are correct.
6. For the first channel to be checked, set scale and range to the next hardware range in table 3.2.1. Use the Configuration Copy feature to copy this configuration to all other relevant channels.
7. Repeat steps 4, 5 and 6, until all the hardware ranges have been checked.
8. Restore original input wiring and configuration if necessary.

* Note: This process is time consuming and it is recommended that, unless a fault is suspected, only checkpoints 1, 6 and 10 in the table are checked for each range.

3.2.1 DC INPUTS (8 CHANNEL BOARD) (CONT.)

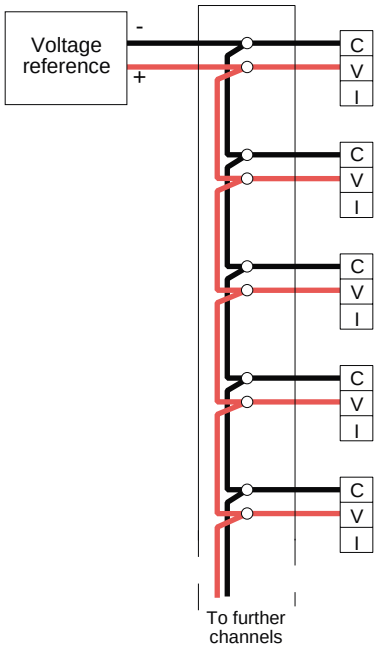

Figure 3.2.1 Calibration wiring (8-channel input board)

Input range (mv)	Check points (mv)										Max tol. (± mV)	
	1	2	3	4	5	6	7	8	9	10	1Hz	4Hz
-10 to + 40 mV	-10	-4.4	1.1	6.7	12.2	17.8	23.3	28.9	34.4	40	0.05	0.06
-50 to + 200 mV	-50	-22.2	5.5	33.3	61.1	88.9	116.7	144.4	172.2	200	0.23	0.28
-500 to +1000 mV	-500	-333	-167	0	167	333	500	667	833	1000	1.32	1.56
-5000 to +10000 mV	-5000	-3333	-1667	0	1667	3333	5000	6667	8333	10000	13.1	15.5

Table 3.2.1 Calibration checkpoints (8-channel input board)

3.2.2 DC inputs (16 channel board)

The equipment and technique used for the 16 channel dc input board calibration is the same as for the 8-channel board, but figure 3.2.2 and table 3.2.2 should be used.

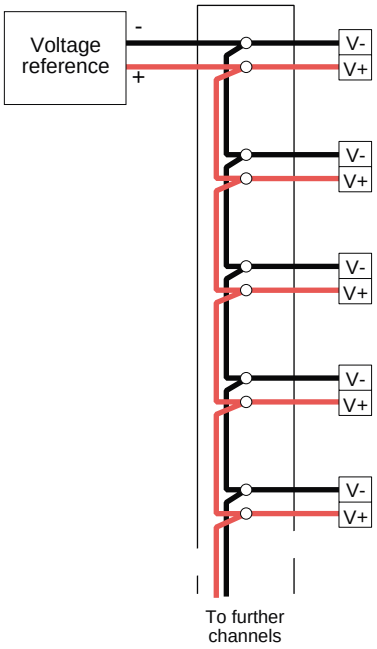

Figure 3.2.2 DC Calibration check wiring (16-channel input board)

Input range (mv)	Check points (mv)										Max. tol (± mV)
	1	2	3	4	5	6	7	8	9	10	
-15 to + 85 mV	-15	-3.8	7.3	18.4	29.5	40.6	51.7	62.8	73.9	85	0.1
-1500 to + 5000 mV	-1500	-780	60	670	1390	2110	2830	3560	4280	5000	5.2

Table 3.2.2 Calibration checkpoints (16 channel board)

3.2.3 Internal cold junction compensation (CJC) checking

These checks are carried out by placing the relevant type of calibrated thermocouple in a temperature reference (e.g. triple-point device), and connecting it to an input channel using thermocouple or temperature compensated cable.

The channel is configured as follows:
Input type = Thermocouple
Linearisation = type of thermocouple being used
CJC = Internal
Range and scale: appropriate to the temperature reference.

The displayed value for the channel to which the thermocouple is connected is then checked (after a suitable time period) to ensure that the channel reading is equal to the reference temperature to within 1.3˚ ± thermocouple accuracy.

3.2.4 Resistance inputs (8 channel board only)

The accuracy quoted against the equipment below is necessary to demonstrate that the recorder is performing to specification. If appropriate, this accuracy may be relaxed according to customer requirements.

EQUIPMENT REQUIRED

1. Resistance box 0 to 10 kΩ (Absolute accuracy: 5 mΩ)

Note: Calibration checks must be carried out with the recorder located in an area in which the ambient temperature is maintained at 20 ± 1 ˚C. The checks must be carried out only after the recorder has been switched on for a minimum of 1 hour with the rear terminal cover fitted and with the door closed.

CALIBRATION CHECK

1 It is recommended that to save time, all the channels to be checked are connected to a terminal block as indicated in figure 3.2.4 For low resistance values, the resistance of the wiring from resistance box to input termination may have an effect. Ensure that a suitable gauge of wire is used. Ensure that the terminal cover is in place after wiring.
2. If required, configure a group to contain all the relevant channels
3. For the first channel to be checked, use the channel configuration pages to set the input type to 'Ohms', linearisation to 'Linear' and the scale and range to the first of the input ranges in table 3.2.2 below. Use the configuration copy feature to copy this configuration to other relevant channels.
4. Connect the resistance box to the first channel to be checked, using the terminal block. Set the resistance value to the first checkpoint value in table 3.2.4, and after a suitable time period (see note above), check that the channel's displayed value is equal to the applied resistance within the specified tolerance (taking into account the lead resistance if relevant).
5. Set the resistance box to each of the remaining checkpoints in turn * and check that the displayed values are correct.
6. Repeat steps 4 and 5 for the remaining hardware ranges.
7. Repeat steps 4 to 6 for the remaining channels.
8. Restore any input wiring and restore configuration for the relevant channels.

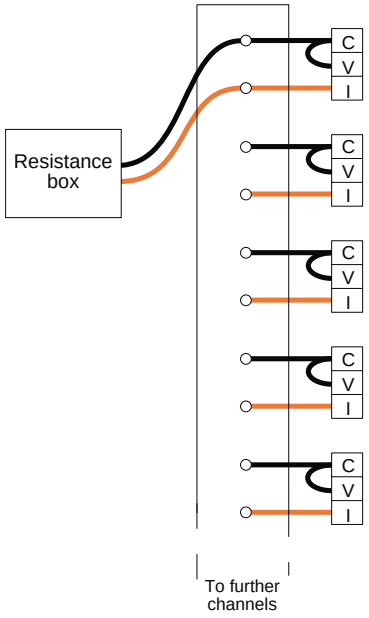

Figure 3.2.4
Calibration check wiring: resistance inputs

* Note: The above process is time consuming and it is suggested that, unless a fault is suspected, only checkpoints 2, 6 and 10 are checked for each range.

Input range (Ω)	Check points (Ω)										Max tol. (± Ω)	
	1	2	3	4	5	6	7	8	9	10	1Hz	4Hz
0 to 180 Ω	0	20	40	60	80	100	120	140	160	180	0.252	0.256
0 to 1800Ω	0	200	400	600	800	1000	1200	1400	1600	1800	2.16	2.29
0 to 10kΩ	0	1120	2240	3360	4480	5600	6720	7840	8960	10000	16	16

Table 3.2.4 Resistance input calibration checkpoints.

3.3 DIAGNOSTICS

As indicated in figure 3.3, operation of the DIAGS softkey calls the first of the diagnostics pages to the display. The following notes are intended to clarify the information contained in the figure.

3.3.1 SBC

This softkey allows the user to view details of the control board computer.

3.3.2 BOARD

Operation of this softkey calls information for the board fitted at address 1 to the display. The informations is: Board type, serial number and software version number. The page scroll key is used to display information for boards at other addresses.

3.3.3 PRINTER

As shown in figure 3.3, operation of this softkey calls a further display, allowing the user to check various parts of the writing system operation.

VALUES

Operation of this softkey causes the first of three display pages referring to the accuracy of the printhead to be called to the display.

The first page displays:

a. Hexadecimal (HEX) values for the optos used to determine printhead position across the chart. Any value other than 0 or F is acceptable. A value of 0 or F indicates that there is a problem with the opto.
b. Mark / space ratio (0 to 100%) within 3%

The second page (accessed by operation of the page scroll up key) shows whether the maximum and minimum values for the opto currents are acceptable. The reported value (S in figure 3.3) is either N (opto is working correctly) or Y (opto or feedback strip is faulty, or the printhead cable has failed).

The third page, accessed by a further operation of the page up key, shows the following:

a. Whether the edge detector opto is working correctly (SSSS = Good) or not (SSSS = Bad)
b. The backlash in the system in mm.
c. Quadrature phase error in degrees, between -90 and +90 degrees (QQQ in figure 3.3)

DENSITY

CAUTION

The printhead - platen gap is factory set for optimum recorder performance, and should not be adjusted unless a strip down and / parts replacement has occurred, and even then, adjustment should be undertaken only by skilled personnel. In particular, the setting of the gap to less than 0.5 mm will lead to 'snagging' of the ribbon.

Operation of the DENSITY softkey causes the recorder to print lines of characters (Tg) across the chart. A softkey (PAUSE / RUN) allows the test to be paused to allow adjustments in print density to be made. These adjustments are made using a small screwdriver inserted through a hole in the top of the chassis, to release an eccentric bearing at the top of the printhead carriage. The bearing is then rotated by inserting a small lever (e.g. Allen key) into one of the holes in the bearing mount, and moving it sideways. This adjusts the gap between the printhead and the platen. The gap spacing should be between 0.5 and 0.7 mm.

3.3.3 PRINTER (CONT.)

RESET

This is used to attempt to clear any faults found. Operation of RESET also causes the VALUES readings to be updated.

VERSION

Used to display the version number of the installed writing system software.

3.3.4 RELAYS

Operation of this softkey causes a display of relay status for that relay board (if any fitted) with the lowest address. Status is shown as E (energised: not in alarm) or D (de-energised: in alarm). Relays can be toggled between E and D, using the field scroll keys. Other relay boards (if fitted) can be accessed using the page scroll keys.

3.3.5 OUTPUT

Allows two analogue output channels to be exercised so that their actual outputs can be compared with their required outputs. All other channels are set to their 'on error' status (section 4.4.2 - output channels).

```
Output     n ±DDDDD.DD UUUUU ±dd.dd uu
for card N n ±DDDDD.DD UUUUU ±dd.dd uu
```

N	Slot number	Initially, the lowest slot number containing an analogue output (AO) board. When all the channels of this board have been scrolled through (Page keys) the next slot with an AO board fitted will appear. When all AO channels have been scrolled through, the first AO board is returned to.
n	Channel number	Pairs of channels are scrolled through using the Page keys.
±DDDDD.DD	Control value	User entered control value in engineering (UUUUU) units.
UUUUU	Engineering units	The engineering units the channel is configured in.
±dd.dd	Actual value	The output value in Volts or mA (uu) as configured
uu	Actual units	The output type (V or mA) as configured

The only user accessible fields are the ±DDDD.DD fields which can be accessed using the cursor keys.

Notes:
1 All AO channels except the two on display are set to their 'On error' value
2 The message 'No analogue channels configured' appears if no analogue channels have been configured.

3.3.6 CJ TEMP

Operation of this softkey causes the temperatures being measured by the cold junctions associated with the first relevant I/O board address to be displayed. The field scroll keys can be used to toggle between Fahrenheit and Celsius. Further boards are accessed using the page scroll keys.

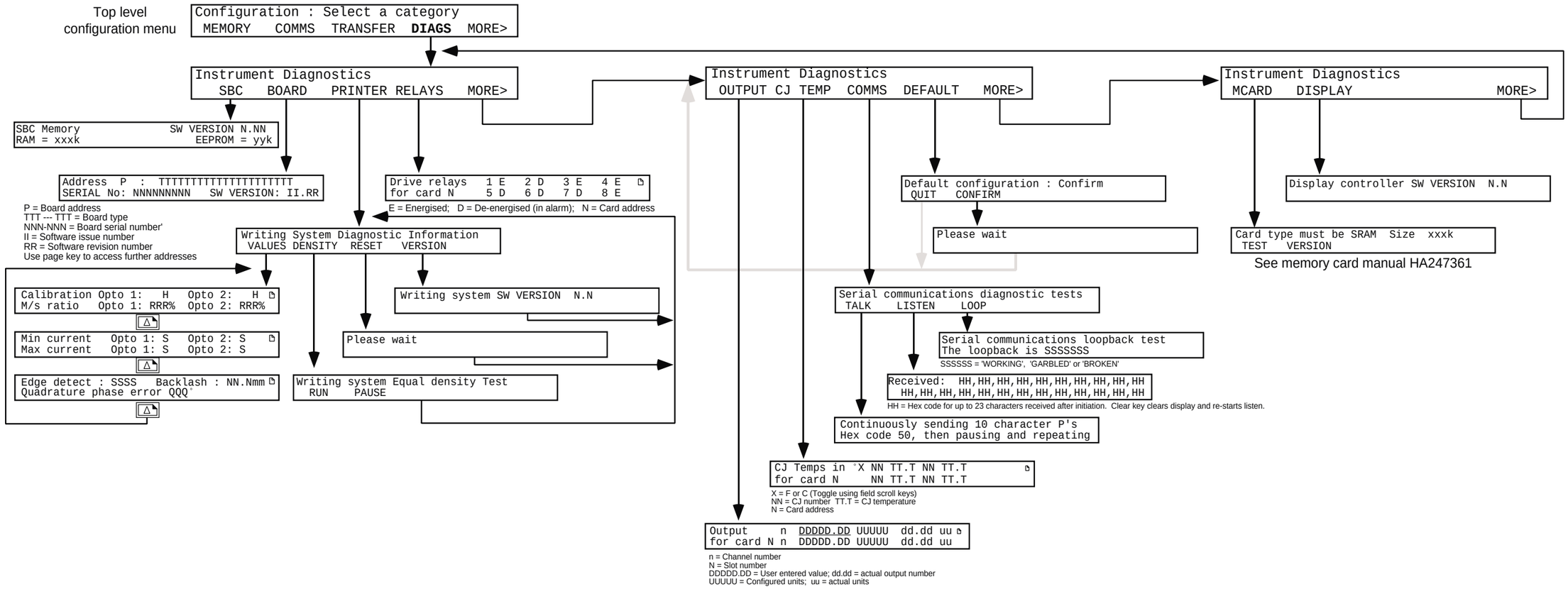

Figure 3.3 Diagnostics Menu

3.3 DIAGNOSTICS (CONT.)

3.3.7 COMMS

Operation of this softkey calls a further softkey 'page' allowing the user to send or receive data and to check that the serial link is performing correctly. **The communications tests are all run with comms parameters set as follows: Baud Rate = 9600, Data Bits = 8, Stop bits = 1, Parity = none.**

TALK

Operation of this softkey causes a string of 10 characters P (hex 50) to be transmitted, followed by a pause, then a further 10 characters P and so on until the Cancel or Enter hardkey is operated.

LISTEN

Operation of this softkey causes the next 23 characters to be received to be displayed. Operation of the Cancel or Enter hardkey returns to the menu.

LOOP BACK

BEFORE INITIATING THIS TEST, THE Tx AND Rx CONNECTIONS MUST BE SHORTED TOGETHER AT ONE POINT IN THE TRANSMISSION LINE.

Operation of this softkey calls the loopback test page, showing that up to the point at which Rx and Tx are shorted, the link is working correctly (WORKING), working incorrectly (GARBLED) or not working at all (BROKEN).

3.3.8 DEFAULT

Operation of this softkey, followed by operation of the CONFIRM softkey, causes the factory configuration to be written to the recorder's data base.

This operation overwrites any customer-entered configuration data.

3.3.9 MCARD

TEST

This softkey allows testing of the memory card controller and memory card, if the option is fitted. At the end of the test, Memory card test PPPP is displayed, where PPPP is either 'pass' or 'fail'.

Test overwrites memory card contents

VERSION

Operation of this softkey displays the version number of the memory card controller software.

3.3.10 DISPLAY

Operation of this softkey displays the version number of the display controller software.

3.4 ADJUST

This section shows how an input/output channel can be adjusted to the required range for non-standard inputs, how the pens are aligned with the chart calibration marks, and how to calibrate input channels. The adjustments are described in three subsections: Input, Chart and Calibration.

3.4.1 Input adjust

APPLY

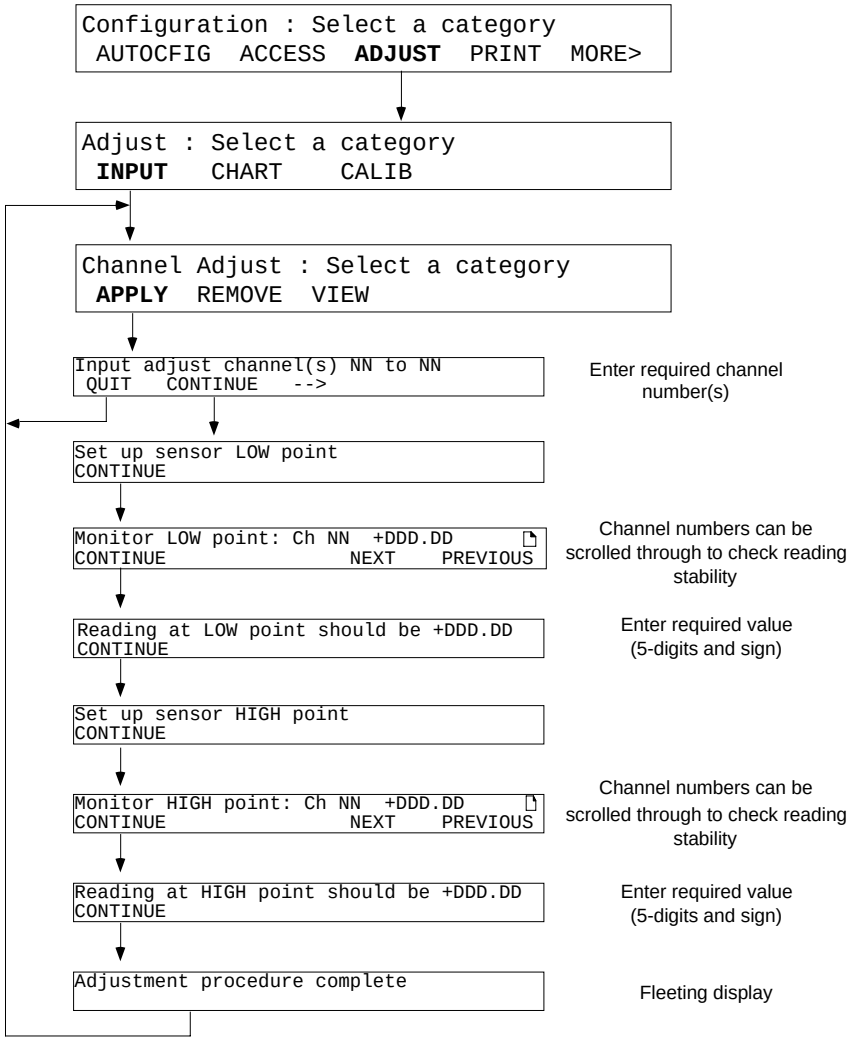

Figure 3.4.1 Channel Input Adjust menu

To adjust one or more channels, the prompts are followed as shown in figure 3.4.1 above. Numbers of channels to be adjusted and required values are entered using the numeric keypad. The monitor pages can be used for scrolling through the channels to ensure that the readings are all steady before adjustment is applied.

3.4.1 INPUT ADJUST (CONT.)

REMOVE

Note: It is possible to disable input adjustment, using the 'VIEW' page described below.

In order to remove any adjustment, the REMOVE softkey is operated to call the first 'remove' page:

```
Remove input adjust for ch(s) NN to NN
QUIT   CONFIRM
```

Operation of the CONFIRM softkey causes a return to the 'INPUT, CHART, CALIB' page, via a 'fleeting' display page: 'Input adjust removal procedure complete', which displays for three seconds.

VIEW

Operation of the VIEW softkey will call one of the two pages depicted below:

```
NN DDDDDDDDDDDDDDDDDDD unadjusted
```

```
NN DDDDDDDDDDDDDDDDDDD adjusted
Use adjustment YYY
```

In both cases, NN is the channel number, and DDD—DDD is the channel descriptor. The page scroll key can be used to scroll through the channel numbers.

The 'Use adjustment' field can be used to disable the adjustment, when set to 'no'. Use adjustment is set to 'Yes' as a default.

3.4.2 Output adjust

This allows the range of the analogue output to be adjusted to account for tolerance errors in external equipment. The technique used is:

1 To specify a low point, and then after a stabilisation time, to enter the value which is read by the external equipment.
2. To repeat the above for a high point.

The output board then calculates newoffsets and gains for the channel.

Notes:
1. The CLEAR key is used to set the DDDDD.DD value to zero.
2. Adjust REMOVE and VIEW operate in a similar way to that described for input channels above.
3. Adjust is not available for channels with 'Constant' as their input source.

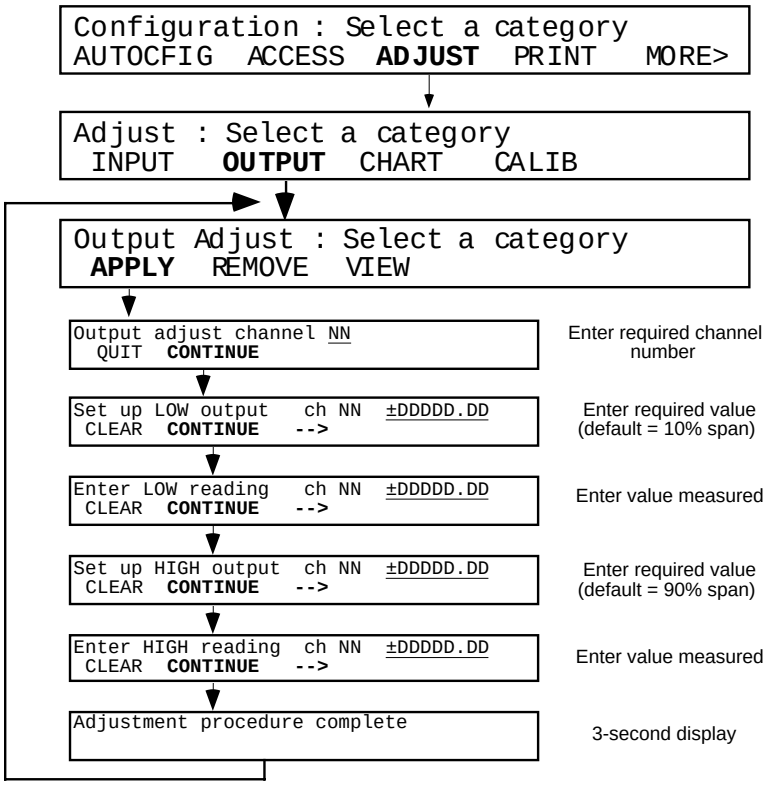

Figure 3.4.2 Output channel adjust menu

3.4.3 Chart adjust

Operation of the CHART softkey causes the recorder to go into pen calibration mode. The printhead continuously scans from zero to full scale, leaving a line of dots at or close-to the zero and full scale calibrations of the chart. The display changes as follows:

```
Chart paper calibration
<<ZERO    ZERO>>        <<SPAN SPAN>>
```

The <<zero and zero>> softkeys are used to align the printhead zero with the chart zero, and the <<span and span>> softkeys are used to align the printhead full scale with the chart full scale.

Operation of the Enter hard key causes the new zero and span to be read into the recorder. On the second operation of Enter, the display returns to the 'INPUT, OUTPUT, CHART, CALIB' page.

3.4.4 CALIB softkey (8 channel input board only)

This feature allows 8-channel input board channels to be calibrated to the user's own requirements.

It is recommended that for maximum accuracy, the Input calibration be carried out before the Cold Junction calibration.

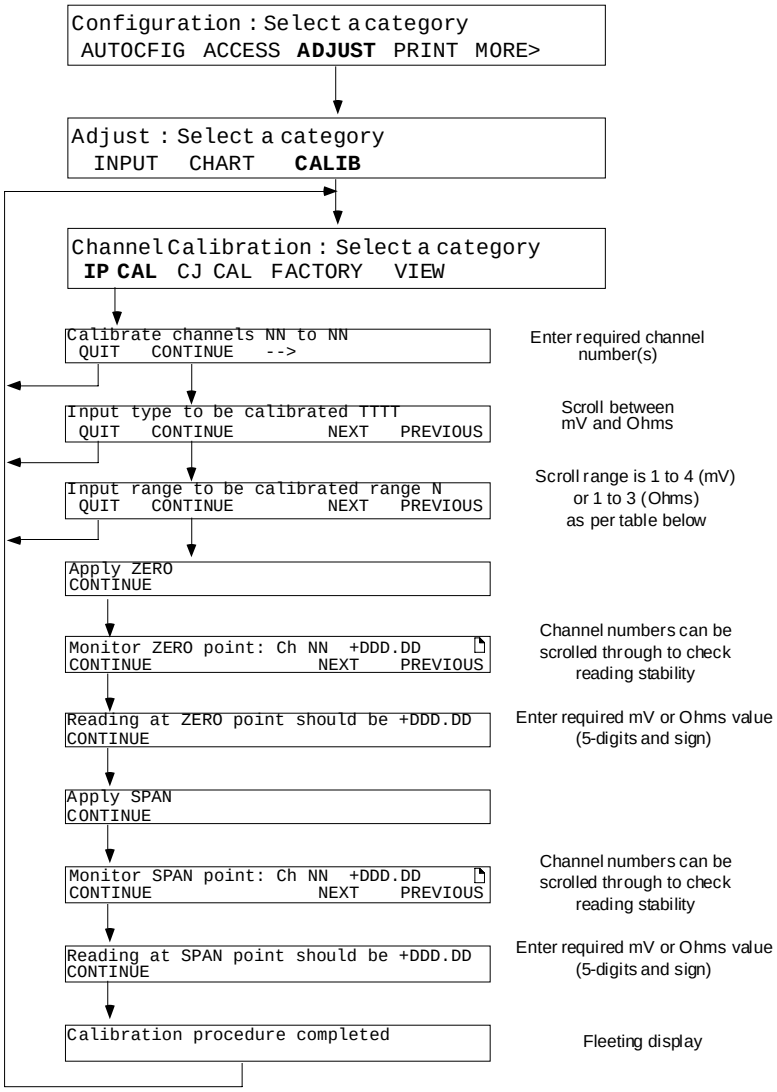

Figure 3.4.4 Input channel calibration menu

The input ranges (range N) above, are given in table 3.4.4 below. The user must choose the lowest possible of the available ranges which will suit the application.

Range number	mV ranges	Ohms ranges
1	0 to 40 mV	0 to 180Ω
2	0 to 200 mV	0 to 1,800Ω
3	0 to 1,000mV	0 to 10,000Ω
4	0 to 10,000mV	N.A.

Table 3.4.4 Input ranges

3.4.3 CALIB SOFTKEY (CONT.)

CJC CALIBRATION

Before this procedure can be carried out it is necessary to connect a thermocouple, (or thermocouple simulator) of a known type, held at a known reference temperature, to each of the input channels to be calibrated. The channels must then be configured for that type of thermocouple, and have 'internal' set as their cold junction compensation type.

Operation of the CJ CAL softkey calls the first Cold Junction calibration page to the display:

```
Calibrate cj(s) for channel(s) NN to NN
 QUIT   CONTINUE
```

The relevant channel number(s) are entered using the numeric keys. 'CONTINUE' calls the next page:

```
Apply reference temperature
 QUIT   CONTINUE
```

Continue calls the next page:

```
Monitoring reference : ch NN   +DD.DDD
 CONTINUE
```

The page scroll keys can be used to scroll through the selected channels to ensure that they are all stable, before the adjustment is applied. Continue calls the next page:

```
Reference temperature is TT.T C
CONTINUE
```

The known reference temperature (TT.T) is entered using the numeric keys. CONTINUE initiates the calibration procedure.

```
CJ calibration procedure complete
```

RESTORE FACTORY CONFIGURATION

Operation of the FACTORY softkey calls the 'Use factory cal' page to the display. The relevant channel numbers are entered using the numeric keys.

```
Use factory cal for channel(s) NN to NN
 QUIT   CONFIRM
```

Operation of CONFIRM returns the relevant channel(s) (including CJs) to factory calibration. A 'fleeting' display (Return to factory cal procedure complete) appears for three seconds.

3.4.4 CALIB SOFTKEY (CONT.)

VIEW

Operation of the VIEW softkey allows each channel to be scrolled through, to determine whether factory or field calibrations are in use for input and cold junction compensation.

```
NN DDDDDDDDDDDDDDDD cal being used    🗋
Input : FFFFFFF Cold junction : FFFFFFF
```

where NN is the channel number, DDD — DDD is the channel descriptor and FFFFFFF is either ‘Factory’ or ‘Field’ as appropriate.

The page scroll keys can be used to view other channels.

3.5 RECORDER MESSAGES

This section gives interpretations for messages, which appear at the display for the guidance of the user.

BAD REMOTE COLD JUNCTION TEMPERATURE

This message appears at any time if a channel measuring a remote temperature is OFF or is not generating a valid output. The message remains until the CLEAR softkey is operated.

```
Bad Remote Cold Junction Temperature
  CLEAR
```

BATTERY BACKED RAM CLEARED

This message appears at power-up if the battery is exhausted, if there is a fault in the battery circuitry, after a battery disconnection with power off or after Autoconfigure. The message remains until the CLEAR softkey is operated.

```
Battery backed RAM cleared
  CLEAR
```

BATTERY FAILURE

This message appears at any time if the battery is exhausted, or if there is a fault in the battery circuit. The message remains until the CLEAR softkey is operated.

```
Battery failure
  CLEAR
```

3.5 RECORDER MESSAGES (CONT.)

CLOCK FAILURE

This message appears at power-up if the clock has lost date or time, if the battery pack is exhausted or has been changed with power off, or if there is a hardware fault in the clock circuit. Use the CLEAR softkey to remove the display, then set the time and date as described in the Installation and Operation Manual (under Instrument Configuration).

```
Clock failure
  CLEAR
```

CONFIGURATION ACCESS DISABLED BY COMMS

This message appears if an attempt is made to enter configuration after a 'DP' command mnemonic has been received by the recorder over the serial communications link. Configuration may not be entered until an 'EP' command mnemonic has been received. See the Communications Manual for details.

```
Configuration access disabled by comms
```

CONFIGURATION TOO COMPLEX - CHANGE LOST

This message appears after an attempted configuration change which would result in a configuration too big for the memory. The message remains until the CONTINUE softkey is operated when the recorder re-initialises, deleting the offending change.

```
Configuration too complex - change lost
CONTINUE
```

CONFIGURATION TOO COMPLEX - DEFAULTING

This message appears after an Autoconfigure, where the requested option set / configuration is now too complex for the memory. The message remains until the CONTINUE softkey is operated, at which point the recorder defaults and then re-initialises.

```
Configuration too complex - defaulting
CONTINUE
```

DATABASE CORRUPTED

This message appears at power up if the EEPROM is missing from the control board, or if a new EEPROM has been fitted.

```
Data base corrupted - Defaulting
```

EEPROM DATA BASE CORRUPTED

This message appears at power-up or at configuration change if the EEPROM is faulty or if it has just been set to 'Default' *via* the diagnostics menu. The display remains until the CLEAR softkey is operated.

```
EEPROM Data base cleared
  CLEAR
```

3.5 RECORDER MESSAGES (CONT.)

FAILURE TO ADJUST

This message appears during input adjust procedure if the channel being adjusted is not an analogue input/output type, or if there is a hardware or an internal communications failure within the recorder. If the channel is definitely an analogue input or output, a service engineer should be contacted.

```
Failed to adjust channel NN
CONTINUE
```

Operation of the CONTINUE key will call any further channels for which the adjustment failed. When all channels have appeared, the adjustment complete message appears:

```
Adjustment procedure complete
```

FAILURE TO CALIBRATE

This message appears during the input calibration procedure if the channel being calibrated is not an analogue input type, if there is a hardware or internal communications failure within the recorder or if the calibration limits are exceeded. The message also appears during CJ calibration, if the associated channel input type is not a thermocouple. The configuration of the channel should be checked, and if correct, a service engineer should be contacted.

```
Failed to calibrate channel NN
CONTINUE
```

Operation of the CONTINUE key will call any further channels for which the calibration failed. When all channels have appeared, the calibration complete message appears:

```
Calibration procedure complete
```

```
CJ Calibration procedure complete
```

FAILURE TO REMOVE ADJUSTMENT OR CALIBRATION

This message appears if an attempt is made to remove an adjustment or calibration previously entered (sections 3.4.1 and 3.4.3), if the channel has been switched off or removed, if a hardware or internal communications failure has appeared or if the channel is not an analogue input/output type.

```
Failed to remove adjustment on ch NN
```

```
Failed to return ch NN to factory cal
```

INVALID INDEX

This message appears if a channel / totaliser etc. number is entered which is greater than the maximum number of channels / totalisers etc. fitted.

```
Invalid index
```

3.5 RECORDER MESSAGES (CONT.)

INVALID CONFIGURATION

This message appears if one part of the configuration conflicts with another e.g. if the linearisation type does not match the input type.

```
Invalid configuration
```

PRINTER MUST BE OFF LINE

This message appears if chart calibration or configuration print is requested with the printer on line. The operator CHART category must be entered , and the chart switched off- line.

```
Printer must be off line
```

PRINTER MUST BE ON LINE

This message appears if a 'Quick Scale Print' is requested with the printer off line. The operator CHART category must be entered , and the chart switched on-line.

```
Printer must be on line
```

UPGRADING DATABASE

This message appears after software upgrade. The message remains until the upgrade has initialised.

```
Upgrading database - please wait
```

WRITING SYSTEM FAILURE

This message appears at any time if the printhead flexi-cable is damaged or disconnected or if there is a hardware failure in the drive circuitry or in the Hall effect switch on the pen tray. The message remains until the CLEAR softkey is operated.

```
Writing system failure
  CLEAR
```

> RANGE

This appears whenever the value of the I/O signal lies above the currently selected hardware range.

< RANGE

This appears whenever the value of the I/O signal lies below the currently selected hardware range.

BAD RNG

This message appears if the requested range (Volts) exceeds the capability of the associated I/O board.

3.5 RECORDER MESSAGES (CONT.)

BAD LIN

This applies only to the 16-channel dc input board. Only seven different linearisations plus linear can be stored for the 16-channel board. The BAD LIN message appears if more than eight different linearisations (including 'Linear') are requested.

ERROR

This message appears when there is a hardware fault on the relevant I/O board.

OFF

This appears for any channel configured OFF

O FLOW

Appears if the channel value lies outside the range -99,999,999 to +99,999,999 and the display format is not configured as 'scientific'.

NO DATA

This appears when a derived (i.e. maths pack) channel has not had time to calculate a value; for example, channel averages appear as 'No data' until the first averaging period has expired.

RANGING

The message appears whilst the I/O board is processing the requested range configuration.

CHANNEL NN FAILURE

This message is printed on the chart if a hardware failure in channel NN is detected.

DERIVED VARIABLE NN RUN TIME ERROR

This is printed on the chart when a derived variable cannot calculate a value. Examples are if the divisor in a divide function passes through zero, or if the input value to a square root extraction function goes negative.

NO ANALOGUE CHANNELS CONFIGURED

This message appears if the OUTPUT diagnostics softkey is operated, when no analogue output channels have been configured.

This page is deliberately left blank

Section 4:

Replacement procedures (current recorders)

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Section **Page**

SECTION 4 REPLACEMENT PROCEDURES

CAUTION

When removing or fitting circuit boards/harnesses etc, ensure that the recorder is switched off or isolated from Mains (Line) power. Insertion of circuit boards or the mating of electrical connectors (other than the battery pack connector) with power applied, will result in damage to circuit board components.

4.1 INTRODUCTION

Before starting any of the following procedures, it is recommended that a copy is taken of the recorder configuration using the Configuration Transfer facility, the memory card (if fitted), or by operating the PRINT softkey in the top level configuration menu followed by ALL.

Once the recorder has been re-assembled, the AUTOCONFIGURE feature can be used to update the recorder data base with details of I/O boards, channels and options fitted.

4.1.1 Print configuration

This allows the instrument configuration to be printed on the chart if the annotation option is fitted.

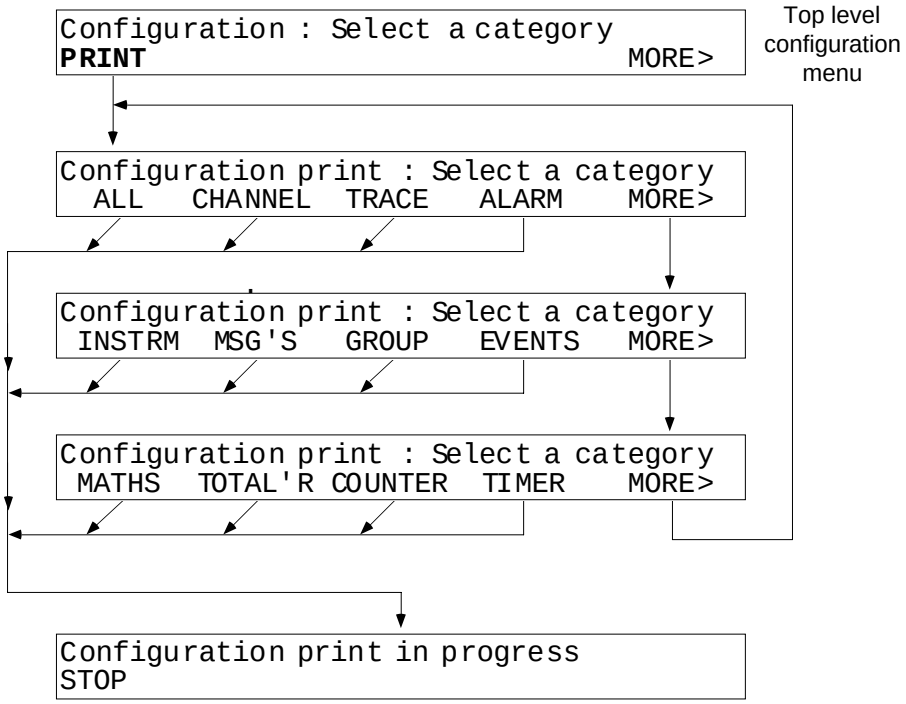

Figure 4.1.1 Configuration print

Note: Operation of the 'ALL' softkey causes a full configuration print which can take a considerable time. Operation of any of the other softkeys causes only that section to be printed.

4.1.2 Configuration transfer

This feature allows the transfer of configuration between recorders or between the recorder and a host computer, using the nine-way 'D-type' connector located on e inside of the door. The INSTALLATION section of the relevant installation and operation manual gives details of wiring.

CAUTION

This transfer operation will erase the destination recorder's configuration

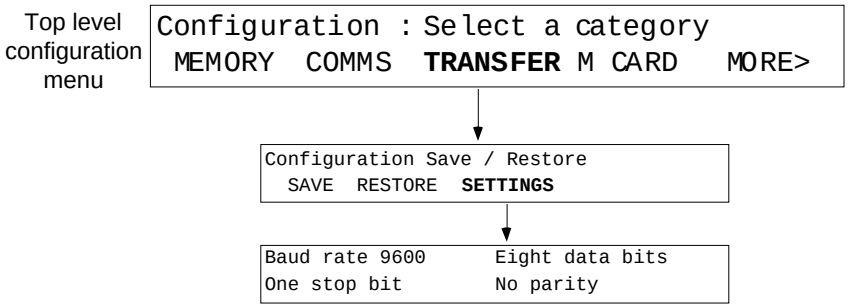

Figure 4.12 Configuration-transfer configuration

TRANSFR		Calls the configuration transfer page to the display. Before initiating transfer, ensure that a suitable cable is fitted between the recorder and the other device, including a signal voltage converter if necessary.
	SAVE	Initiates an XMODEM transfer of the recorder's configuration via the 9-way D-type port located in the door. This can be used to copy the configuration to another recorder (previously set to 'RESTORE' or to store the recorder's configuration in any device capable of XMODEM transfer.
	RESTORE	Allows a configuration to be loaded from another recorder (set to SAVE) or from a PC or other configuration terminal.
	SETTINGS	Allows the field scroll keys to be used to set the Baud rate to 19200, 9600, 4800, 2400, 1200, 600, 300 or 110. (Must be the same at both devices - the higher the Baud rate, the quicker the transfer.) The other settings are fixed, as depicted in the figure above.

4.1.3 Memory card

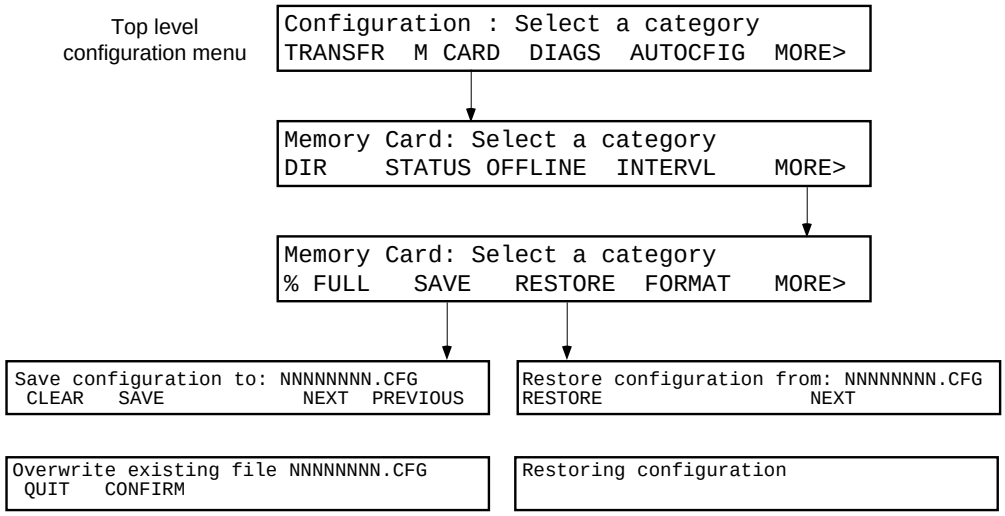

Figure 4.1.3 Memory card configuration pages

CONFIGURATION SAVE

This feature allows a recorder's configuration to be saved to a memory card if fitted (always fitted with graphics recorders) and subsequently restored.

SAVE — Saves the recorder's configuration to the file name in the top line of the display. File names can be scrolled through and / or edited using the NEXT, PREVIOUS AND —> softkeys. The second display page depicted above appears if the specified file name already exists on the card.

CONFIGURATION RESTORE

This feature allows a recorder configuration to be retrieved from a memory card,

RESTORE — Restores the configuration stored at the file name at the top line of the display. The NEXT softkey is used to scroll through the files on the card. See the Memory card manual for further details of the Save and Restore functions.

4.2 REMOVAL OF THE WRITING SYSTEM

Isolate the recorder from all high-voltage signals (both supply and signal).

Open the recorder door (by lifting the bottom of the latch, then turning it clockwise). For convenience, remove the chart and the ribbon cartridge.

With the cassette open, locate the two (captive) securing screws ('A' in figure 4.2a), and undo them.

Pull the writing system forwards until it reaches its stops, then lift the writing system out of the case (figure 4.2b)

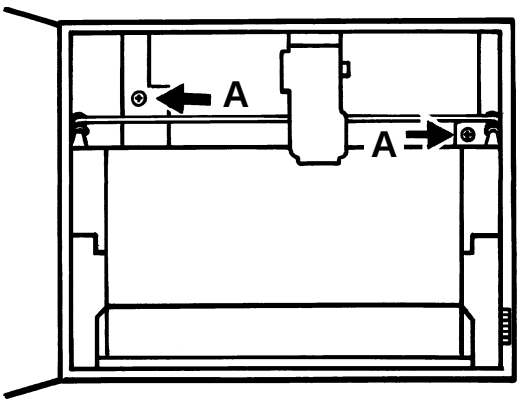

Figure 4.2a Securing screws

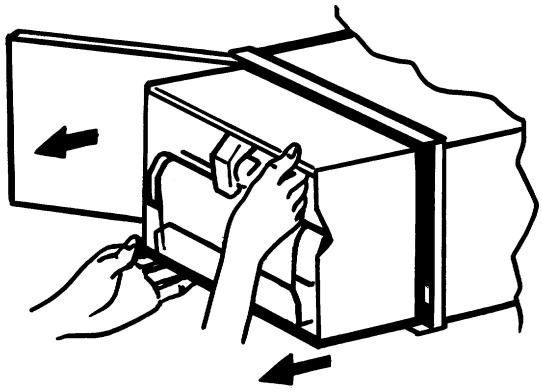

Figure 4.2b Pull the writing system for wards

Remove the circuit board retainer (figure 4.2c). Remove the writing system, unclipping the harness and releasing the connector (figure 4.2d) as they become accessible.

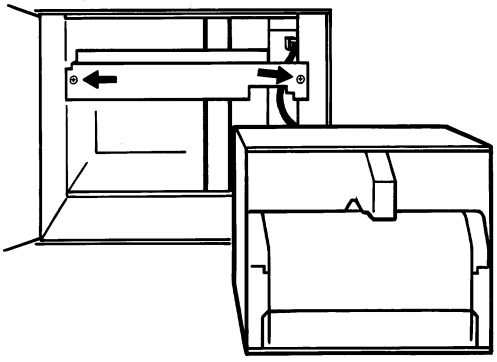

Figure 4.2c PCB retainer securing screws

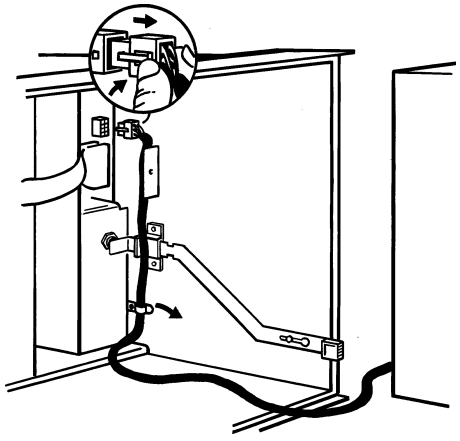

Figure 4.2d PSU connector release

4.3 REMOVAL OF PRINTHEAD CARRIAGE ASSEMBLY

CAUTION

The following procedure involves the handling of the printhead 'flexi' cable. This cable must be treated with care, and in particular it must not be folded, as any 'kinks' introduced will severely reduce the life of the cable once re-installed.

Remove the writing system as described in section 4.2 above.

At the rear of the writing system, release the two 1/4 turn fasteners securing the circuit board to the writing system chassis.

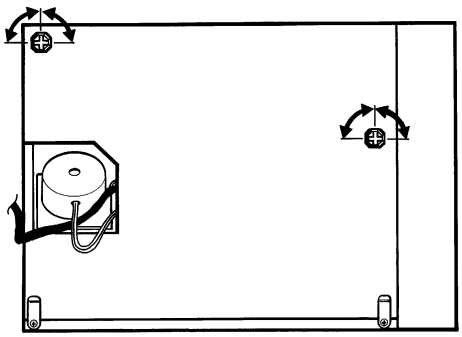

Figure 4.3a
Writing system circuit board release

Remove the flex-cable by first removing the two plastic rivets securing it to the board, then carefully prising the two parts of the connector apart

CAUTION

The movable part of the connector must be kept as nearly parallel with the fixed part as possible, in order to avoid bending the connector pins.

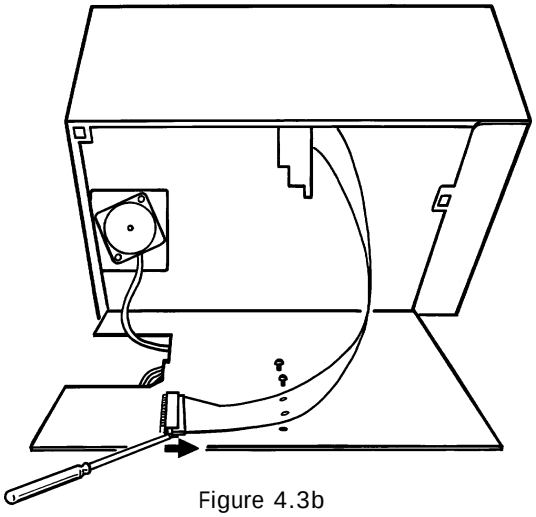

Figure 4.3b
Flexi-cable connector release

Remove the screws securing the writing system top plate to the remainder of the chassis.

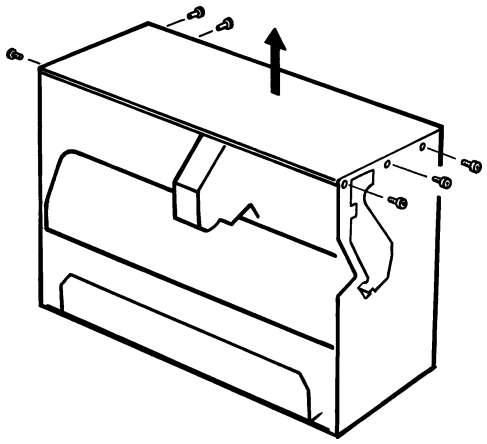

Figure 4.3c
Writing system top plate removal

4.3 PRINTHEAD CARRIAGE REMOVAL (CONT.)

Slip the toothed belt off the left-most pinion (A in figure 4.3d).

Remove the three pan-head screws (B in figure 4.3d) (not the two countersunk screws), whilst holding the guide bar assembly in place.

Whilst carrying out the next step it is advised that you observe the arrangement of the paper-out detector (located towards the right hand side of the chassis) to aid later re-assembly.

Whilst holding the ribbon carriage, slide the guide bar assembly out to the right (C in the figure), ENSURING THAT THE PRINTHEAD ASSEMBLY DOES NOT DAMAGE THE FEED BACK STRIP. As soon as the guide bars emerge from the printhead, lift the printhead up and out (D in the figure).

This now allows access to the ribbon drive motor, the ribbon drive belt, the opto feedback and edge detectors and the printhead mechanism itself.

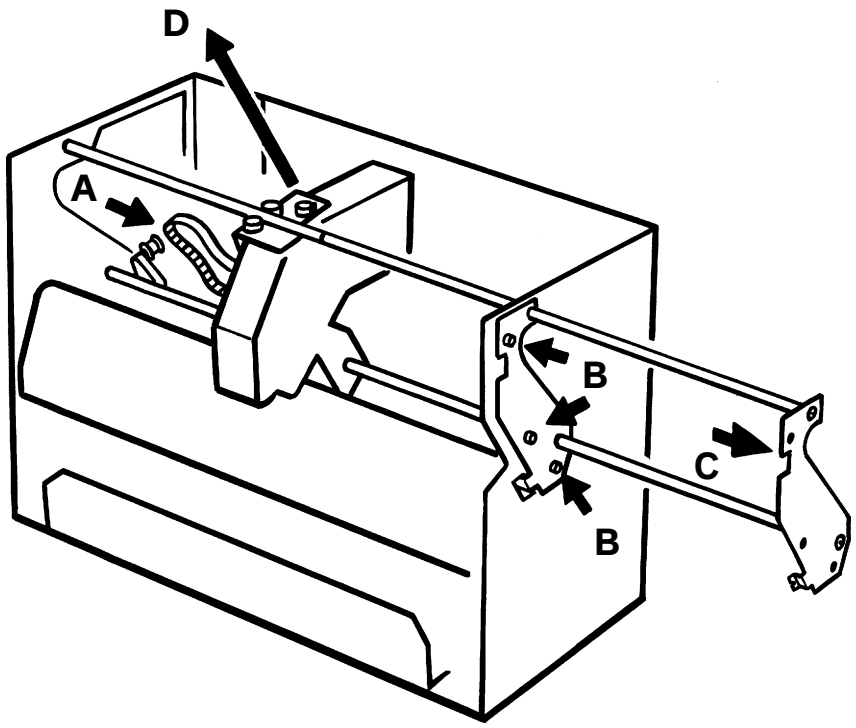

Figure 4.3d Printhead carriage removal

4.4 RIBBON DRIVE BELT / MOTOR REPLACEMENT

Remove the printhead carriage assembly as described in section 4.3 above.

4.4.1 Ribbon drive belt replacement

Remove the circlip (A in figure 4.4a) from the 'cartridge' pinion. This releases the pinion allowing the belt to be removed.

Loosen the motor securing screws (B in figure 4.4b) sufficiently to allow it just to move. Fit the new belt over the motor and cartridge pinions. Re-fit the cartridge pinion and secure it using the circlip previously removed.

Use a Correx type gauge to apply a force of 450 to 550 cN (gm) to the motor pinion in a direction directly away from the cartridge pinion and, whilst maintaining this force, fully tighten the motor securing screws.

4.4.2 Ribbon drive motor replacement

Remove the drive belt as described in 4.4.1 above.

Carefully pull the flexi connector out of the motor connector (C in figure 4.4a). The motor can now be replaced by undoing its securing screws (B in figure 4.4b).

When fitting the new motor, leave the screws untightened, until the belt has been refitted and tensioned as described above.

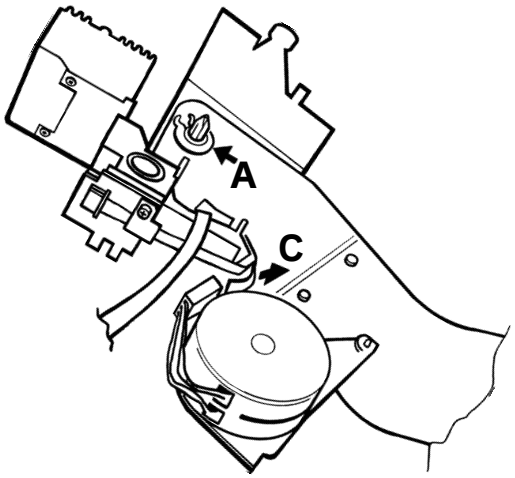

Figure 4.4a Cartridge pinion and motor flexi

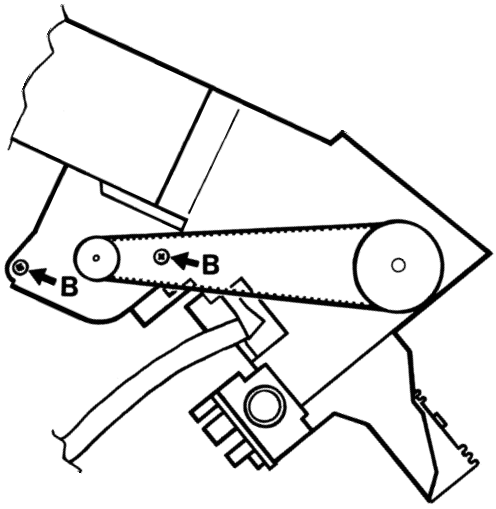

Figure 4.4b Ribbon motor securing screws

4.5 OPTO BOARD REPLACEMENT

Remove the printhead carriage as described in section 4.3
Remove the screw (A in figure 4.5) and plate securing the flexi-cable to the opto board.

Using the 'ears' of the connector (B in the figure), gently slide the movable part of the flexi cable connector away from the fixed part. Pull the end of the flexi cable (C in the figure), out of the connector.

Remove the opto board by undoing its securing screw.

Fit the new board, using the securing screw previously removed.

With the 'ears' of the connector fully forward, carefully introduce the end of the flexi-cable into the connector, ensuring that it slides fully home.

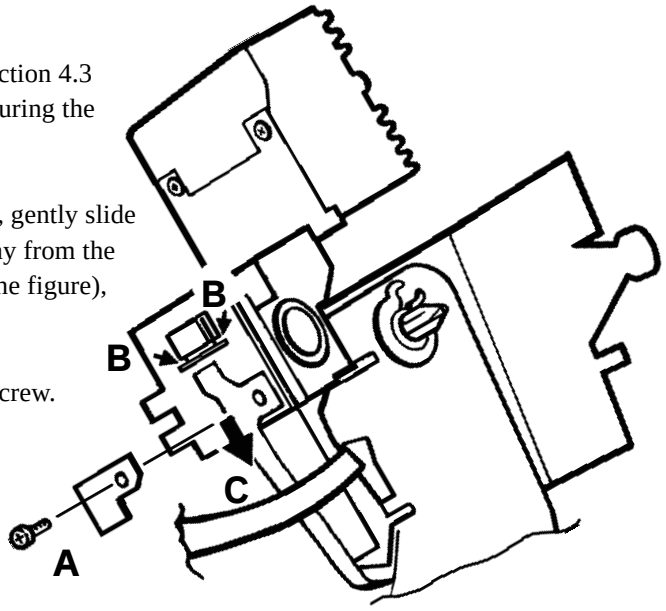

Figure 4.5 Opto board replacement

When correctly positioned, the securing hole in the flexi-cable is aligned with the hole in the supporting metalwork.

Slide the moving part of the connector back into the fixed part, to clamp the end of the flexi. Secure the assembly using the screw and plate (A in figure 4.5).

4.6 PRINTHEAD REPLACEMENT

Remove the printhead assembly as described in section 4.3.
Remove the circlip (A in figure 4.6), taking care not to lose either the cartridge pinion or the belt.

Remove the opto board flexi cable end as described in section 4.5 above.

Carefully remove the end of the motor flexi (B in the figure) from the motor connector.

Remove the two plastic rivets (C in the figure) which secure the flexi cable to the assembly. The printhead can now be removed by undoing the two securing screws D.

When re-assembling, ensure that all the flexi-ends are correctly mated with their respective components.

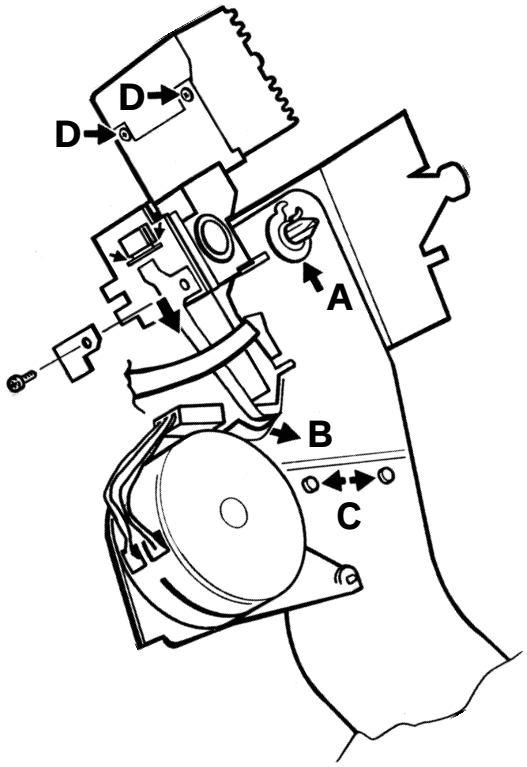

Figure 4.6 Printhead replacement

4.7 PRINTHEAD MOTOR/BELT REPLACEMENT

4.7.1 Drive motor

Remove the writing system from the case as described in section 4.2.

Release the writing system board as shown in figure 4.7.1a

Disconnect the drive motor from the circuit board.

The motor can now be removed by undoing its two securing screws.

On re-assembly, ensure that the motor pinion engages with the toothed drive belt. Check the tension in the belt and adjust if necessary (section 4.7.2).

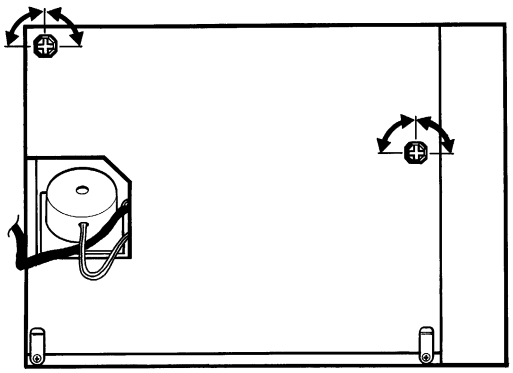

Figure 4.7.1 Writing system circuit board release

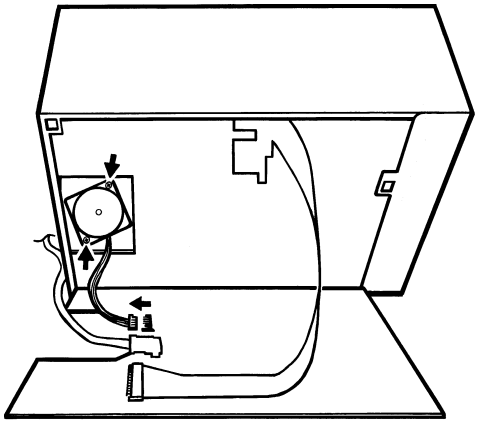

Figure 4.7.1b Printhead carriage motor

4.7.2 Belt replacement

Remove the printhead carriage assembly as described in section 4.3.

Undo the screw holding the belt ends to the carriage; remove the belt and discard it. Check the stickiness of the double-sided tape remaining on the grooved block, and if necessary, replace it. (This is non-essential, used purely as an aid to assembly).

Ensuring there are no twists in the replacement belt, position the ends over the grooves in the block and re-fit the clamp using the screw previously removed.

Return the printhead to the writing system, and position it at the extreme left hand end of its travel.

At a point midway between the carriage and the right-hand end of travel, use a Correx gauge to deflect the belt through 1 cm. The reading should lie between 100 and 200 cN (gm)

If necessary, adjust the tension , by adjusting the position of the motor bracket using the two securing screws on the right-hand side of the chassis.

4.8 PRINTHEAD ASSEMBLY REFITTING HINTS

It is recommended that advantage be taken of the disassembly of the recorder to remove any dust and dirt which may have accumulated during use.

Generally speaking, the refitting of the printhead assembly to the chassis is the reverse of the disassembly procedure described in section 4.3 above. There are, however, a number of non-obvious points as follows:

When re-fitting the carriage to the guide bar assembly, push the spring-loaded bearing to one side to allow easier passage of the bar (figure 4.8a).

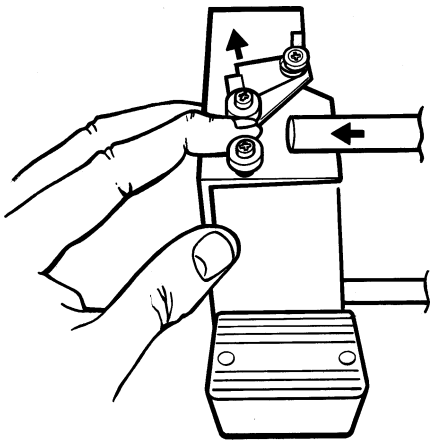

Figure 4.8a Guide bar insertion

It must be ensured that the printhead carriage is not allowed to damage the feedback strip (figure 4.8b) or the edge detect finger.

As the guide rail assembly is pushed home, ensure that the paper-out detector is correctly positioned above its stop (figure 4.8c).

Once the printhead carriage is re-installed, move it gently from side to side ensuring that the feedback strip and edge detect finger pass through the opto slots without fouling.

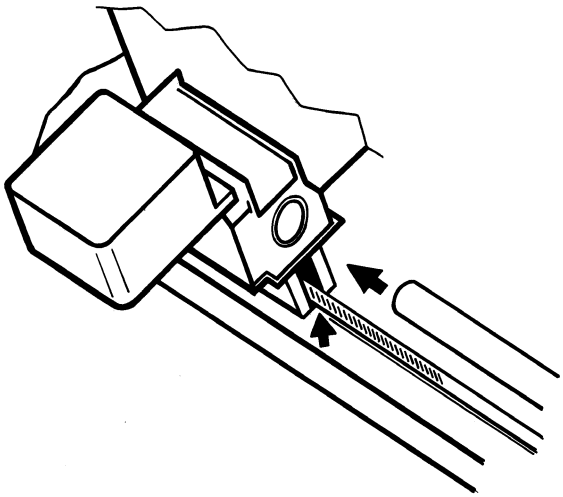

Figure 4.8b Feedback strip

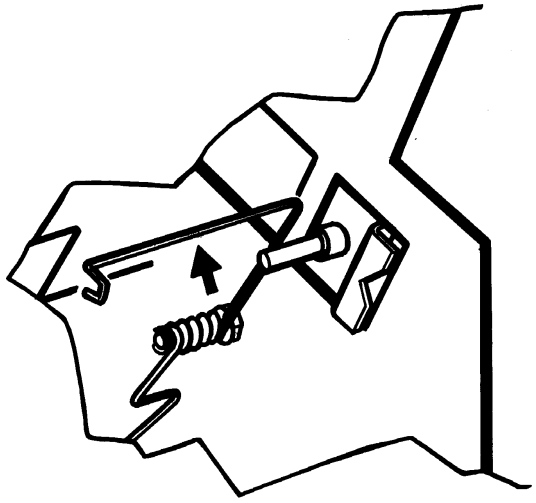

Figure 4.8c Paper-out detector actuator

If, when the instrument is returned to service, the print is to light or too heavy, the printhead-to-platen gap can be adjusted as described in section 3.3.3 above.

4.9 PAPER TRANSPORT SYSTEM

This section describes how to gain access to the chart drive motor and the toothed drive belt connecting the motor to the chart drive pin belts (the tractor belts which engage with the holes in the chart.) **Because of the difficulty of the realignment process, THE PIN BELTS themselves ARE NOT USER SERVICEABLE.** Any attempt by unauthorized personnel to remove or replace these belts will invalidate the recorder warranty.

Remove the writing system as described in section 4.2 above.

At the rear of the writing system, release the two 1/4 turn fasteners securing the circuit board to the writing system chassis (figure 4.9a).

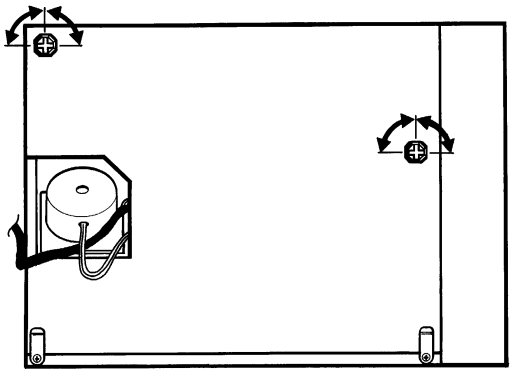

Figure 4.9a Writing system circuit board release

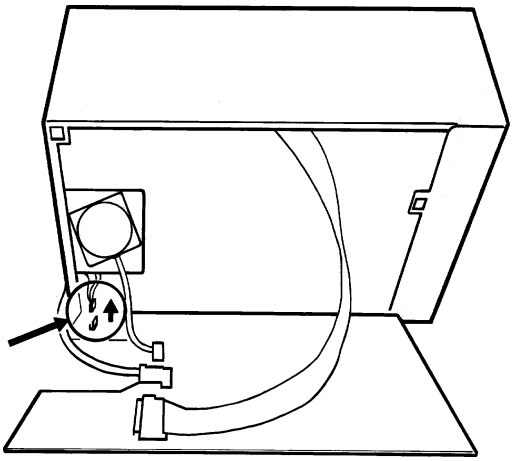

Figure 4.9b Chart drive motor disconnection

Disconnect the chart drive motor from the writing system board (figure 4.9b). The circuit board may now be re-secured for convenience.

Remove the two screws (A in figure 4.9c) which secure the right hand paper tray bracket in place.

Unlatch the cassette and swing it downwards until it can be lifted out (figure 4.9d).

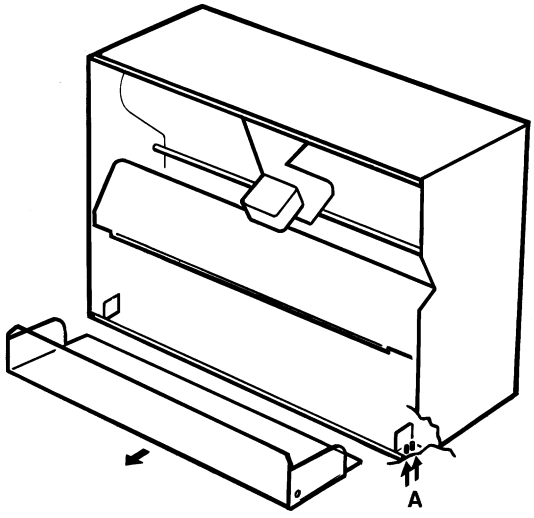

Figure 4.9c Lower paper tray removal

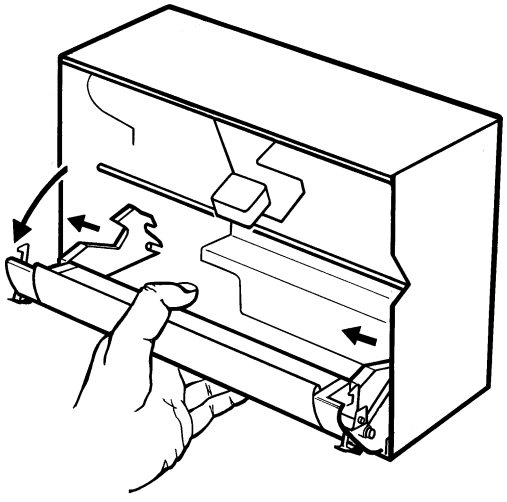

Figure 4.9d Cassette removal

4.10 CHART DRIVE MOTOR/BELT

Remove the chart cassette as described in section 4.8 above

As shown in figure 4.10, slide the drive belt off the pinion (A). This allows the motor to be replaced by removing the two screws (B in the figure).

After replacing the motor, or when fitting a new belt, re-fit the belt over the pinions, starting with the motor pinion.

With the motor screws released such that the motor can just move, use a Correx gauge to apply a force of 1330 to 1630 cN (gms) to the motor pinion in a direction directly away from the chart pinion. Whilst maintaining this force, tighten the motor screws.

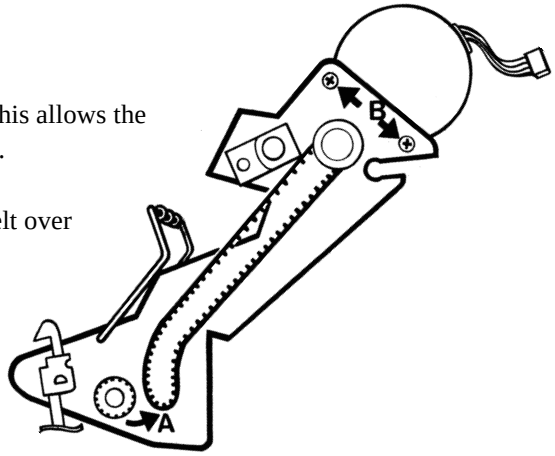

Figure 4.10 Chart motor / drive belt replacement

4.11 I/O BOARD, SBC, PSU AND ON-OFF SWITCH REPLACEMENT

CAUTION

All the circuit boards associated with the recorder contain components which are susceptible to discharge of static electricity. Refer to the advice at the front of the manual before removing any circuit board.

Remove the circuit board retainer as described in section 4.2 above.

4.11.1 I/O Board removal

Disconnect the I/O board ribbon cable connector from the PSU (A in figure 4.11.1).

Disconnect the ribbon cable connector (B) from the I/O boards in turn, until you reach the board that is to be removed.

Once the ribbon cable has been disconnected, the board can be removed using the card eject ears (C) at the top and bottom of the boards.

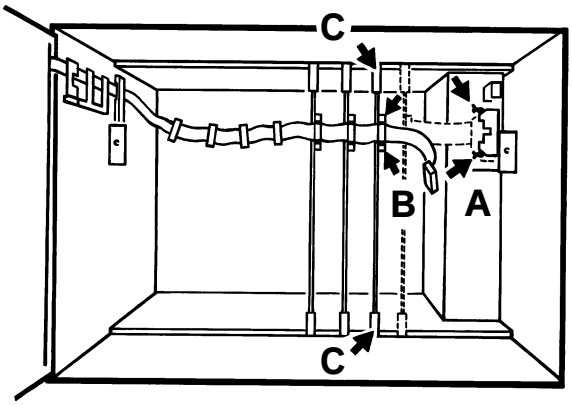

Figure 4.11.1
I/O board ribbon cable connector

4.11.2 Single board computer (SBC) removal

Note: Because this procedure involves the disconnection of the SBC from the battery pack, all volatile data (e.g. averaging values) will be lost. The real time clock will also have to be reset when the SBC is refitted. Apart from such volatile values, the remainder of the instrument's configuration will remain intact in an EEPROM on the SBC. For extra security, or when the SBC is being replaced or the software is being upgraded, it is recommended that the configuration be saved using one of the methods outlined in section 4.1

Disconnect the I/O board ribbon cable from the power supply unit (PSU) as shown in figure 4.11.2.

Disconnect the SBC ribbon cable from the power supply

Carefully disconnect the battery connector from the SBC

Remove the SBC using the card eject levers at top and bottom

If the SBC is to be replaced, remove any option keys, and the ribbon cable, and fit them to the replacement board.

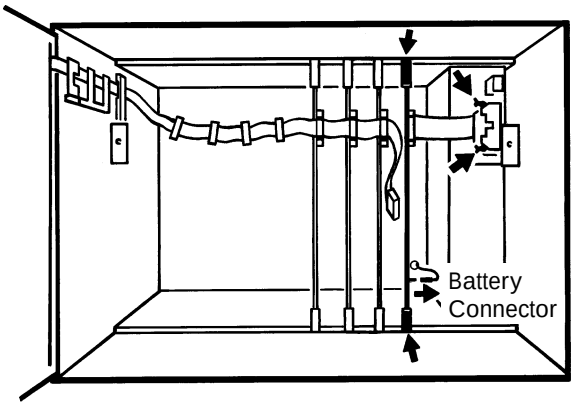

Figure 4.11.2
SBC ribbon cable and batter y connectors.

4.11.3 Power supply (PSU) removal

WARNING!

Ensure that supply power to the recorder is isolated, and remove the power lead from the rear of the recorder.

At the rear of the recorder, ensure that the power cord is removed, then disconnect the chassis safety earth at the PSU end (figure 4.11.3a).

With the writing system removed (section 4.2), disconnect the PSU from the I/O board and SBC ribbon cables. Remove the three nuts (A in figure 4.11.3b) securing the PSU to the case, and if necessary, remove the on-off switch pusher assembly as described below. Remove the PSU from the case.

When refitting the power supply, **ENSURE THAT THE EARTH LINK IS REMADE.**

WARNING!

The Earth link to the PSU must be remade securely. Failure to connect the Earth link correctly may, under certain fault conditions, render the instrument harmful to the user. The Manufacturer will accept no responsibility for damage or harm caused in this way.

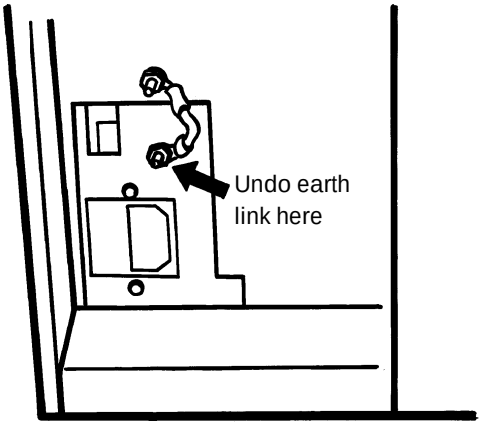

Figure 4.11.3a Earth link

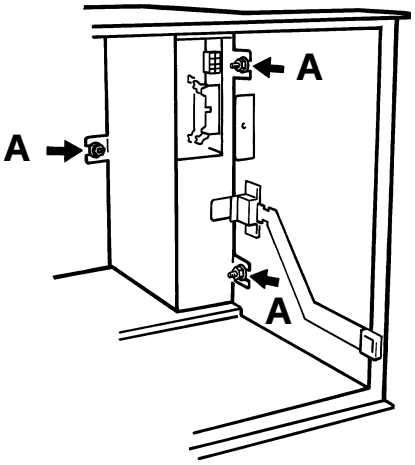

Figure 4.11.3b PSU removal

4.11.4 ON-OFF Switch replacement

Taking care not to lose the shake-proof washers, use a nut-runner to remove the two M3 nuts securing the on-off switch pusher to the side of the case.

The slider can now be swung upwards and pushed forwards, until it can be removed from the bearing.

Care should be taken not to lose the small coil spring located inside the securing bracket.

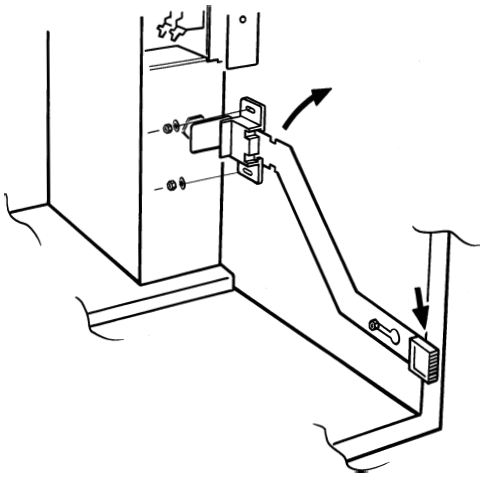

Figure 4.11.4 On-off switch removal

4.12 DOOR SERVICING (STANDARD RECORDER)

4.12.1 Lamp replacement

WARNING!

The recorder must be isolated from line power before any attempt is made to replace either of the fluorescent tubes used for chart illumination or lower keyboard illumination.

WARNING!

Exhausted tubes must be disposed of carefully. Should a tube break, inhalation of the powdery substance within the tube should be avoided.

CHART ILLUMINATION LAMP

Isolate the recorder from line power. Open the recorder door and remove the plastic cover/reflector, covering the lamp.

As shown in figure 4.12.1a, rotate the tube 90˚, then carefully pull it out of its connectors and dispose of safely.

Orient the replacement tube such that its pins will enter the end connectors. Carefully push the tube home AND ROTATE THROUGH 90˚*

Spring the cover/reflector back into place.

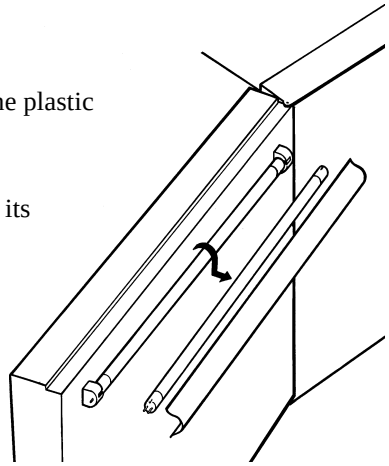

Figure 4.12.1a
Chart illumination lamp replacement

LOWER KEYBOARD LAMP REPLACEMENT

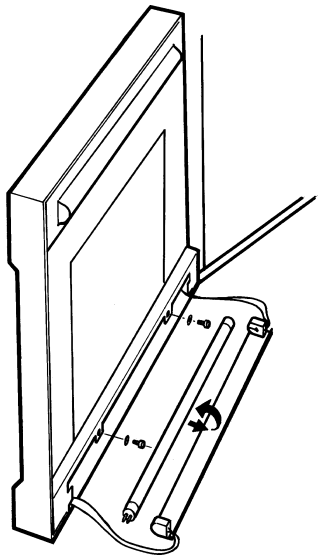

Figure 4.12.1b
Lower keyboard lamp replacement

With the recorder door open, undo the two screws which secure the lower lamp unit to the inside of the door. Remove the lamp unit. Rotate the tube through 90˚ and carefully pull it out of its connectors. Dispose of the tube safely.

Orient the replacement tube such that its pins will enter the end connectors. Carefully push the tube home AND ROTATE THROUGH 90˚*

Return the lamp unit to the door and secure it using the two screws previously removed.

* CAUTION

The tube must be rotated through 90˚, otherwise a heater circuit will not be completed, leading to premature aging of the new tube.

4.12.2 Removal of door inner cover

Remove the chart illumination lamp and the lower keyboard lamp as described in section 4.12.1 above, and place them to one side in a safe place.

Remove the two screws 'A' in figure 4.12.2 in the top of the door.

Remove the two countersunk-head screws ('B' in the figure) near the bottom of the door and the 4 pan-head screws ('C') and associated shake-proof washers.

Disconnect the transfer port (nine-way D-type connector) loom from the display board.

This allows access to the lower keyboard connector, and thus allows the removal of the front window. Removal of the high-voltage board, as described below, gives easier access.

Re-fitting of the door inner cover is the reverse of the above removal procedure

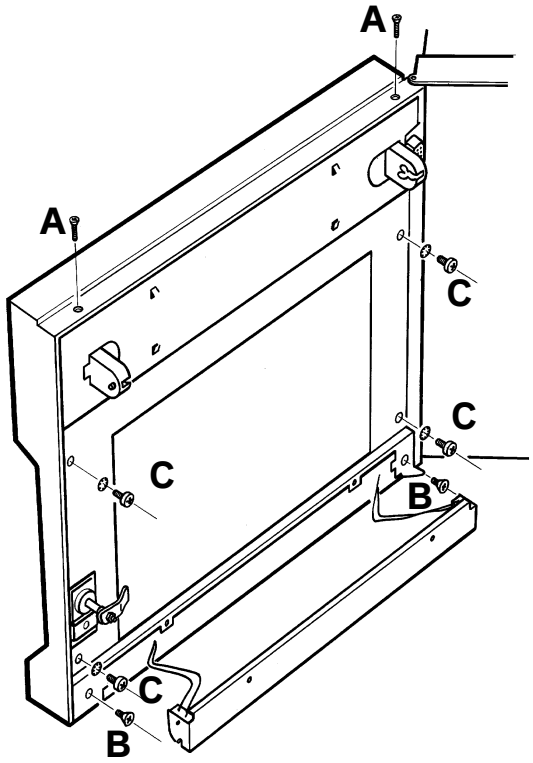

Figure 4.12.2 Inner door cover removal

4.12.3 High-voltage board removal

Before any attempt is made to remove this board, appropriate static prevention measures should be taken. Refer to section i at the beginning of this manual for details.

With the door inner cover removed as described in 4.12.2 above, access can be gained to the 'High Voltage' board. The board is physically held to its mother board (display board) by three plastic standoff pillars ('A', 'B' and 'C' in figure 4.12.3a) and connected to it electrically, by a row of seven pins soldered to the high-voltage board and connecting with a single-in-line (SIL) socket on the display board. Care must be taken when removing the board, to pull it away in a direction perpendicular to the display board without bending or twisting these pins (figure 4.12.3b).

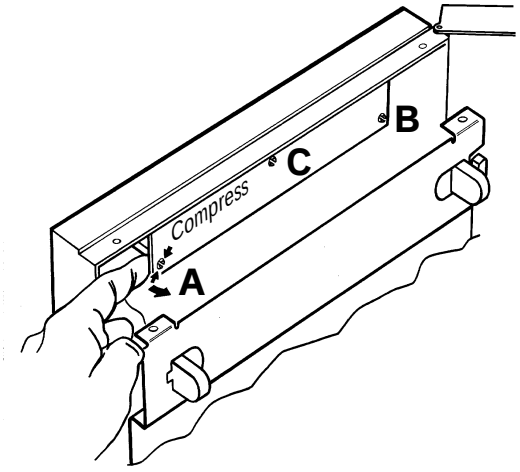

Figure 4.12.3a High-voltage board release

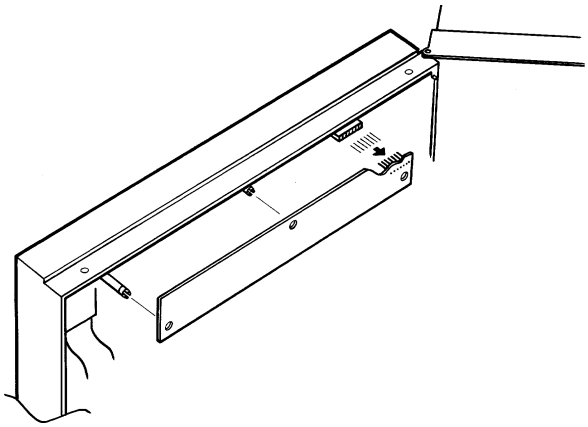

Figure 4.12.3b Electrical connections

4.12.3 HIGH-VOLTAGE BOARD REMOVAL (CONT.)

To remove the board, the split ends of each standoff should be compressed, whilst a slight pull is applied to the edge of the board. It is recommended that the standoffs near the ends of the board (A and B) are dealt with first, then the one near the top of the board (C).

When re-fitting the board, care must be taken to ensure that all seven of the connecting pins are correctly mated with the SIL socket on the display board, otherwise the holes in the board will not line-up with the standoffs and damage will be done to the pins if force is used.

4.12.4 Lower keyboard replacement

With the door inner cover and the 'High Voltage' board removed as described above, the lower (secret-'til-lit') keyboard can be replaced as follows:

Disconnect the keyboard connector from the display board (A in figure 4.12.4). The window can now be removed by gentle pressure applied from the outside of the door (B in the figure).

The replacement should first be aligned with the connector at top left (as viewed from the inside of the door). The window should then be located on to the pegs in the door moulding, and gently pressed home.

The connector should now be re-made and the door re-assembled.

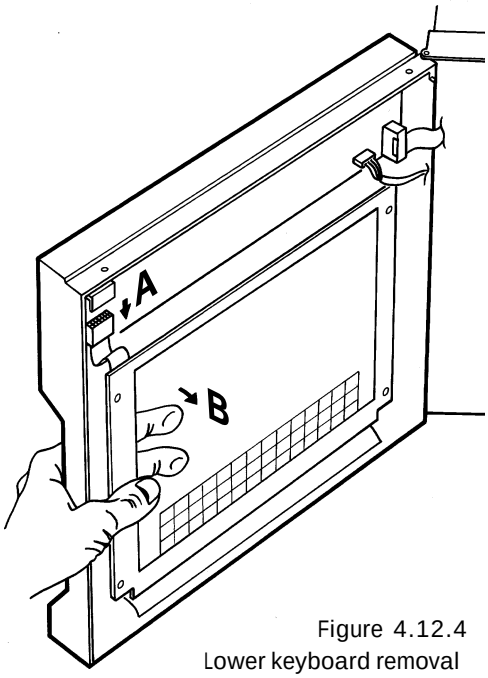

Figure 4.12.4
Lower keyboard removal

4.12.5 Display board replacement

Remove the inner door cover and High-Voltage board as described in 4.12.1 and 4.12.2 above.

Disconnecting the remaining connectors from the display board, allows the board to be prised gently away from its standoffs, using a suitably shaped tool such as an Allen key. If the board is to be replaced, remove the High Voltage board standoffs for eventual use on the replacement board.

To replace the board (taking adequate precautions against damage due to static discharge, and ensuring that none of the flying lead connectors gets trapped), locate the new display board over its standoffs and press home. Fit the High-Voltage board standoffs and remake all relevant connections.

Fit the High-Voltage board, and re-assemble the door.

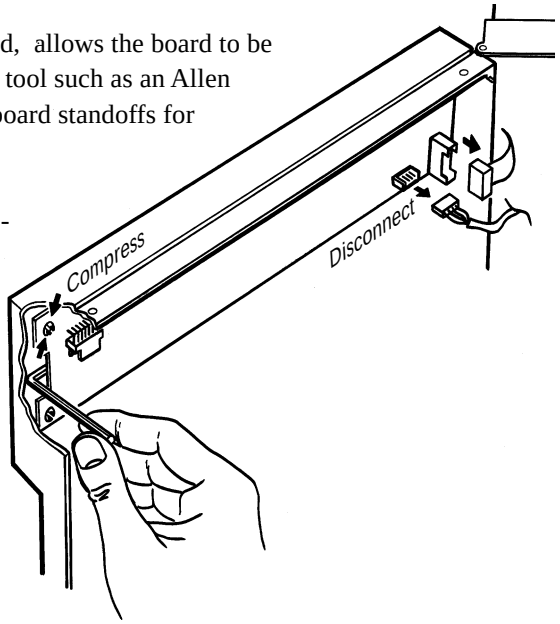

Figure 4.12.5 Display board removal

4.12.6 Door replacement

WARNING!

The door is held in place by a sprung pin. This pin can be ejected with some force if it is not firmly held in place whilst the door is being removed or re-fitted. It is recommended that eye protection be used whilst carrying out door removal/re-fitting.

Replacement doors come complete with looms to communicate with the SBC and for earth continuity.

Disconnect the earth loom linking the door to the inside of the case, at the case end.

Disconnect all ribbon cable connections between the PSU and the door, as indicated in figure 4.11.1

Lift the ribbon cable out of its retainer.

Using a suitable tool, press down on the hinge pin (figure 4.12.6), and slowly ease the top of the door away from the case, ENSURING THAT THE PIN AND SPRING ARE NOT EJECTED.

Once the door has been detached from the case, remove the hinge pin and associated spring, for use with the replacement door.

To fit the new door, insert the spring and hinge pin into the relevant aperture in the top of the door.

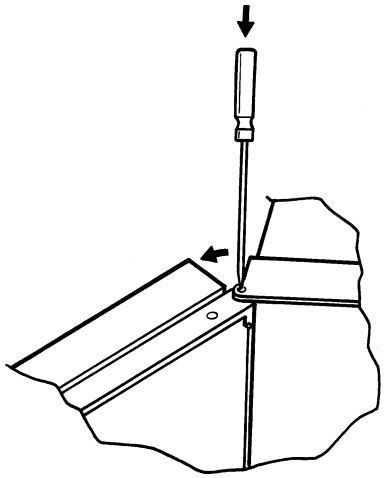

Figure 4.12.6 Door removal

Locate the door onto the lower hinge pin at the bottom left hand corner of the case. Swing the door into place, and engage the spring-loaded upper hinge-pin into the aperture at the top left-hand corner of the case.

Slide the ribbon cable down into the retainer, and secure the new earthing loom. Ensure that the ribbon cable slides easily backwards-and-forwards through the retainer.

Run the ribbon cable across the front of the I/O boards, and mate the PSU connector at the end of the cable. Make the ribbon cable connections with such I/O boards as are fitted.

Open and close the door several times, ensuring that the ribbon cable slides smoothly in its retainer.

4.13 DOOR SERVICING (GRAPHICS RECORDERS)

4.13.1 Backlight replacement

These instructions are intended for use with recorders/display units with status levels equal to or higher (later) than those shown in table 4.13.1. (The status level is the last section of the recorder's serial number and takes the form of a letter followed by one or two numbers e.g. B1, C11). For units with status levels prior to those shown, see Annex C to this manual

Model	Status level
Graphics display units Graphics recorders	G6 O12

Table 4.13.1 Status levels

Notes:

It is recommended that the display unit be returned for the manufacturer for service. Users should consider the following before attempting to follow the procedure below:

1. Users who replace the backlight do so at their own risk. The manufacturer will not assume any liability for modules, and will not warrant any modules which have been modified by the user, including the replacement of the backlight using the procedure below. If it becomes necessary to return the module to the manufacturer after an attempted repair, the cost of repairs will be charged to the user.
2. The work can cause a lowering of quality (performance). The manufacturers do not guarantee that full quality will be obtained even if the procedure below is followed exactly.
3. Even the smallest particle of dust can cause shadowing, giving non-uniform brightness across the area of the display. It is recommended that a clean-room or clean bench (at class C level) be used.
4. To prevent damage caused by electro-static discharge the use of an 'ion shower' ioniser is recommended.

WARNING!

Replacement of the backlight involves the handling of high voltage circuits. If replacement is not carried out correctly, the module can present a shock, fire or other hazard, both during and after replacement.

SAFETY PRECAUTIONS

Ensure that the recorder is isolated from line power for at least 10 minutes before starting work. This will allow the high voltages associated with the inverter to dissipate safely. Such a time period also allows the fluorescent tube and high voltage circuitry to cool down after use, although the user should be aware that areas of high temperature might still exist even after this period has expired.

In the case where the tube is physically damaged, adequate care must be taken to avoid personal injury. It is also likely that pieces of broken tube will not be extricable, resulting in lighting evenness quality problems once the new tube is installed.

QUALITY CONSIDERATIONS

The display can be damaged by discharge of static electricity. Ensure that all suitable precautions are taken.

Finger contact with connectors may cause bad electrical contact to develop. It is recommended that finger cots or plastic or latex gloves are used when carrying out this procedure.

DOOR REMOVAL

a Open the recorder door
b Remove the earth lead and the cover (figure 4.13.1a), retaining the fixings for later re-assembly.
c Disconnect the ribbon cable headers.
d Using a small screwdriver, or similar, press down on the sprung pin at the top of the door as shown in figure 4.13.1b.
e Carefully, ensuring that the sprung pin is not ejected, ease the top of the door outwards, and lift the door away from the case.

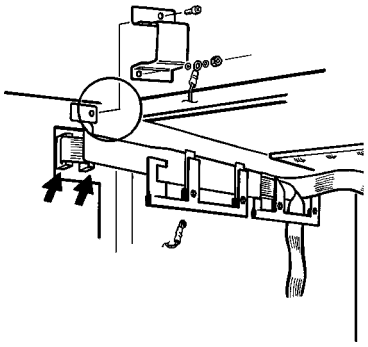

Figure 4.13.1a Earth lead and ribbon cable connectors

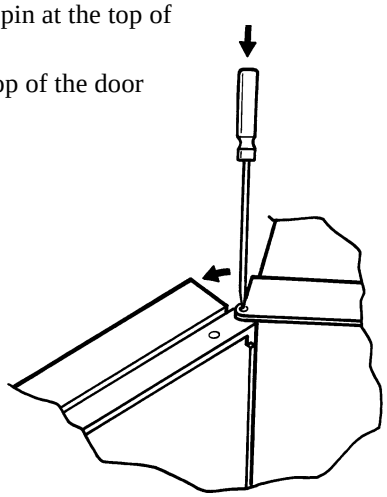

Figure 4.13.1b Door hinge pin location

REMOVAL OF THE DISPLAY UNIT ASSEMBLY

a Release the door inner cover by undoing and removing the fixing screws ('A' in figure 4.13.1c). Remove the plastic door guide if fitted ('B') and keep safely for later re-assembly.
b Carefully remove the door inner cover, by lifting the cover and disconnecting the connector as it become accessible (figure 4.13.1d). swing the cover over to reveal the display unit (figure 4.13.1e).
c Remove the four display unit securing screws ('C' in figure 4.13.1e) and lift the display unit out and layit on the inner cover (figure 4.13.1f).

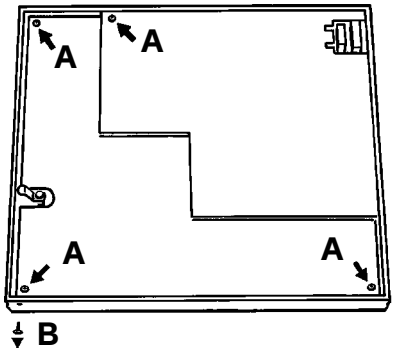

Figure 4.13.1c
Remove inner cover securing screws

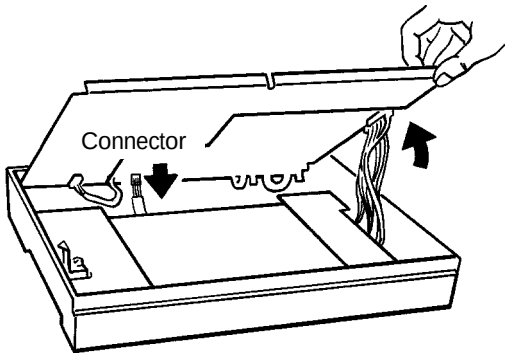

Figure 4.13.1d Lift inner cover and release connector

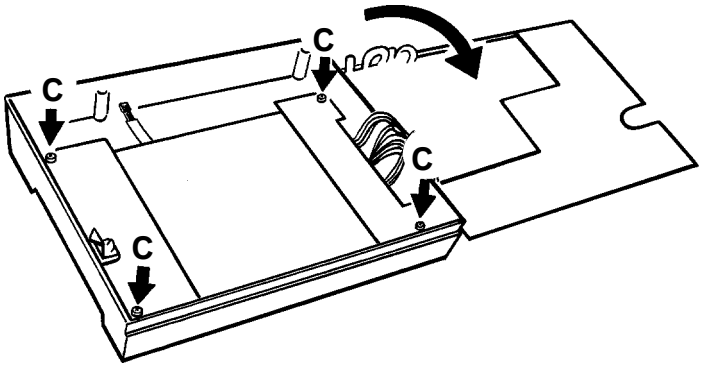

Figure 4.13.1e Open cover

REMOVAL OF THE DISPLAY UNIT ASSEMBLY (CONT.)

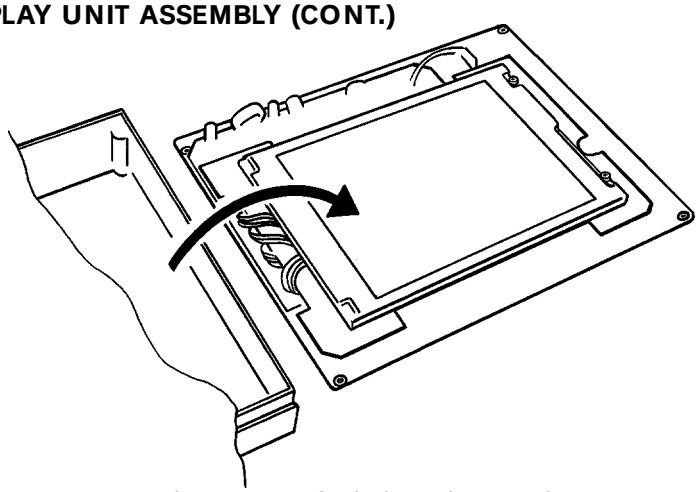

Figure 4.13.1 f Display unit removal

ILLUMINATION TUBE ACCESS

a Remove securing screws ('D' in figure 4.13.1g) and turn the display unit over to reveal the circuit board (figure 4.13.1h).

b Gently lift the wires out of their channels (E in figure 4.13.1h), remove the flexi-cable ('F') and remove the circuit board retaining screws ('G').

c. Taking all necessary precautions against static discharge, gently work the circuit board out, carefully avoiding damaging any of its components. Disconnect the illumination tube connector (figure 4.13.1j).

d. Undo the tube securing screw ('H' in figure 4.13.1k) and carefully extract the lamp.

e. Carefully fit the new tube, ensuring absolute cleanliness.

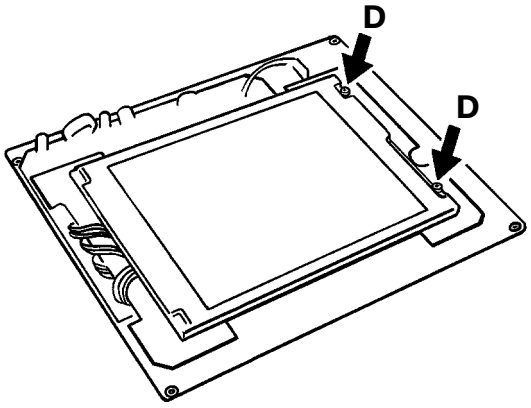

Figure 4.13.1g Remove securing screws

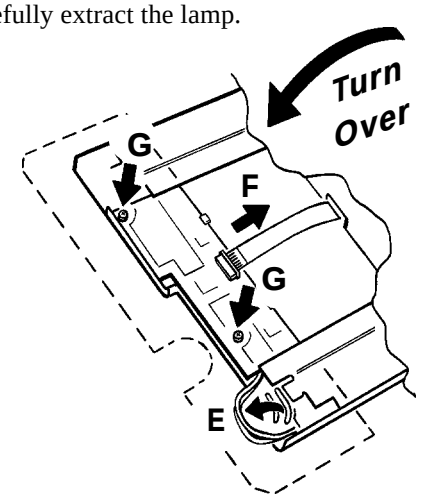

Figure 4.13.1h Circuit board removal (1)

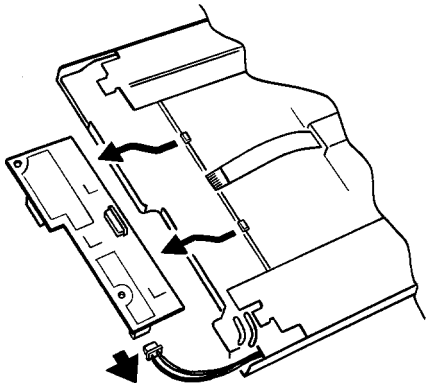

Figure 4.13.1j Circuit board removal (2)

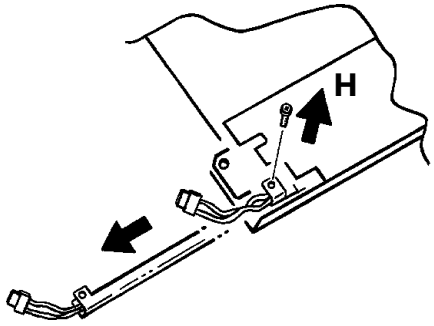

Figure 4.13.1k Tube removal

RE-ASSEMBLY

Reassembly is the reverse of the above process. When re-fitting the circuit board, ensure that the wires lie neatly in their channels ('E' in figure 4.13.1h above) or early failure will result.

RECALIBRATION

This process ensures that the image is centred on the display screen.

At switch on, continuously hold a finger somewhere on the display screen until the calibration display appears (approximately 30 secs) as depicted in figure 4.13.1m

Using a small diameter item (e.g. a fine pencil point) which will not damage the display screen, touch the intersection of the top left crosshairs, as requested by the display.

Once the top left target has been accepted, touch the bottom right target as requested by the screen.

Once both targets have been entered, initialisation continues as normal.

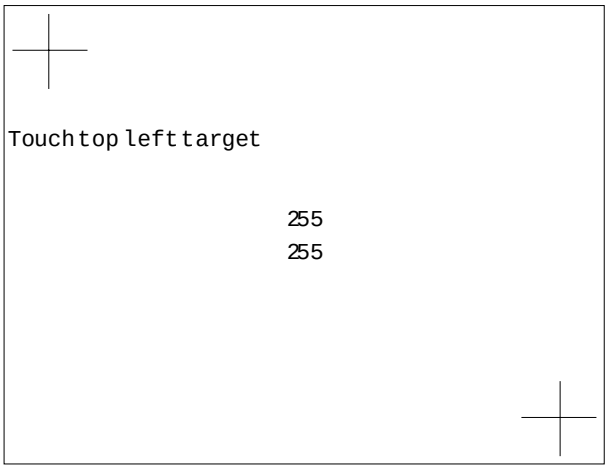

Figure 4.13.1m Calibration display

4.13.2 Door loom replacement

For units with status levels prior to S13, see annex C to this manual. (The status level forms the last part of the recorder's serial number, and takes the form of a letter followed by one or two numbers).

CAUTION

This replacement procedure involves the handling of circuit boards whose components are sensitive to static electrical discharge. All relevant personnel must be aware of static handling procedures. If in doubt, reference should be made to the recommendations near the beginning of this manual.

Note: This procedure involves the removal of the Single Board Computer (SBC) from the recorder. This will result in the loss of any volatile data such as totaliser values and real-time clock.

Remove all I/O boards and the SBC as described in section 4.11 above. It is recommended that you make a note of the I/O board addresses (rotary switch settings) or to identify them in some other way, so that they can be returned to their correct slots on re-assembly.

Disconnect the comms. connector (A in figure 4.13.2a)

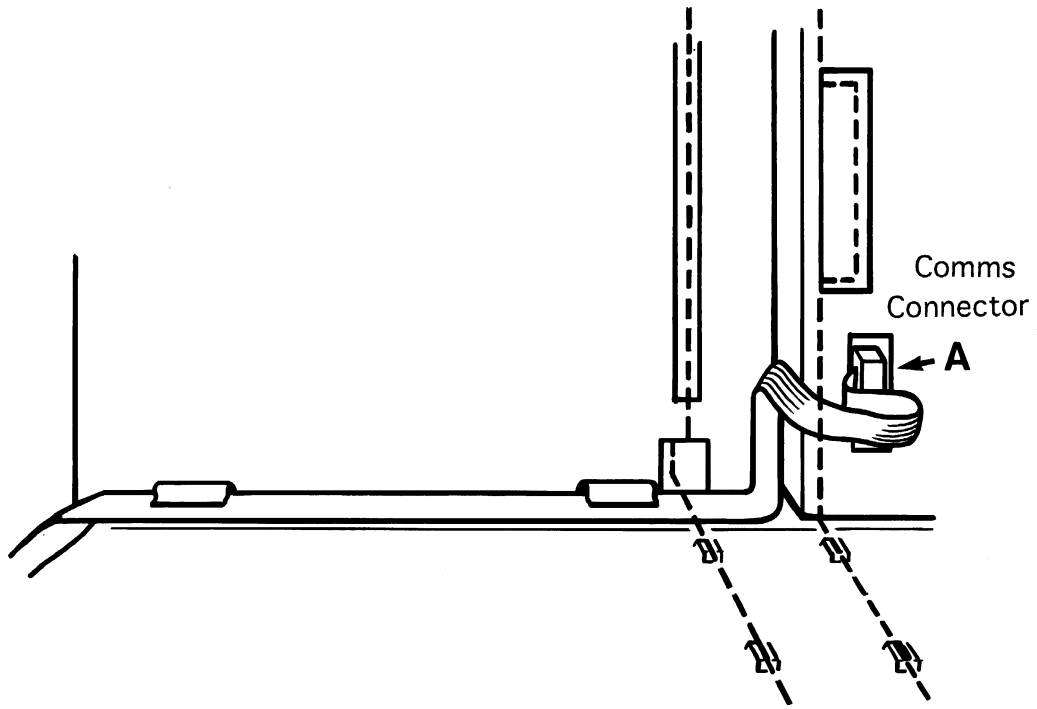

Figure 4.13.2a Comms connector location (view on inside of case)

4.13.2 DOOR LOOM REPLACEMENT (CONT.)

At the top right of the inside of the door, remove the connector cover by removing the earth–link securing nut (B in figure 4.13.2b) and securing screw (C in figure 4.13.2b). Disconnect both ribbon cable connectors.

Remove the rear loom retainer by undoing the screws and nuts (D in figure 4.13.2b). Remove the loom and discard it, retaining the fixings for later use.

Take the new loom, and plug the two connectors into their receptacles in the door. Fit the cover, ensuring that the loom guide is secured by the screw 'C' and that the earth strap is retained by nut 'B'.

Fit the loom behind the front retainer, then secure it using the rear retainer. Ensure that the ribbon cables are folded as shown in figure 4.13.2a (otherwise the comms connection will be made more difficult) and that the loom guide slides easily when opening and closing the door (otherwise it can buckle and damage the new loom).

Run the comms loom (the one without the daisy chain connectors) as shown in figures 4.13.2a and 4.13.2b and re-make the connection. Ensure that the ribbon cable is routed such that it will be clear of the SBC and I/O boards when these are re-fitted.

Re-fit the SBC, ensuring that it does not foul the ribbon cable. (Note: the component side of the board faces right.) Refit the SBC ribbon cable to the PSU.

Re-fit the I/O boards, ensuring that the cards are returned to their correct slots, and connect the new loom.

Re-fit the circuit board retainer.

Re-fit the writing system, remaking the connector first.

Apply power and autoconfigure the recorder. Re-set the system time (referring to section 4 of the Installation and Operation Manual as necessary).

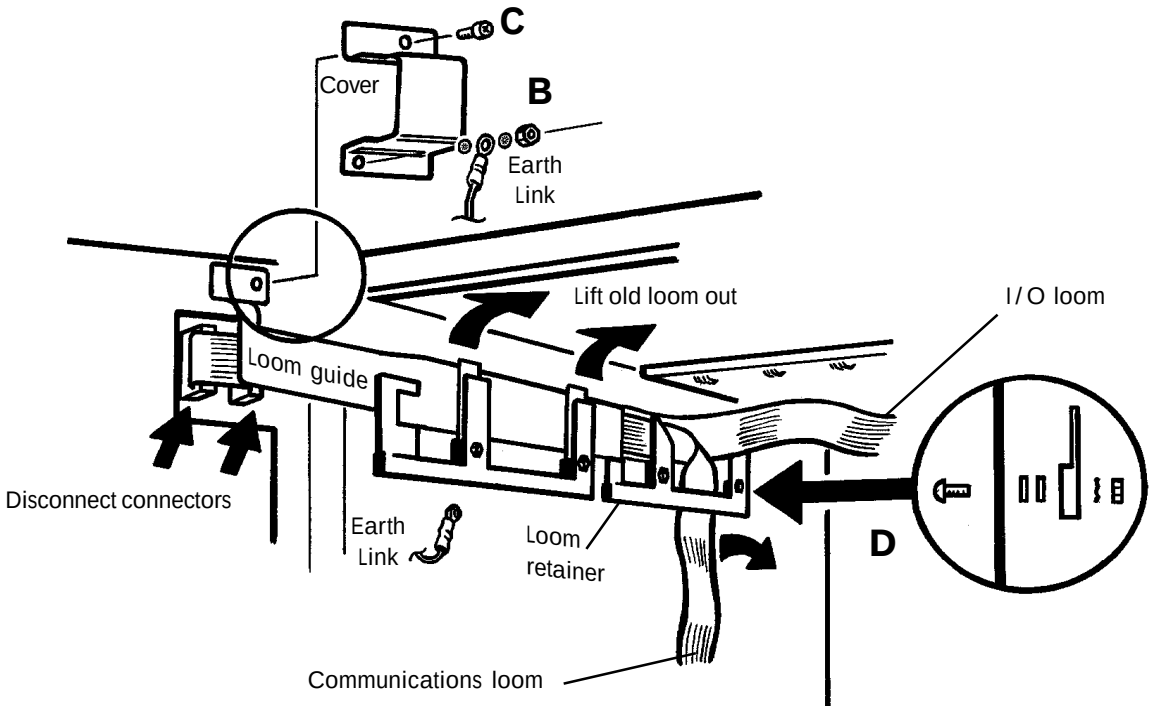

Figure 4.13.2b Loom replacement

4.14 REAR CONNECTOR FITTING

Refer to figures 4.14a, 4.14b and 4.14c as required.

Remove the rear terminal cover, by undoing the two M4 captive screws.

Determine which slot is to have the connectors fitted, and remove the associated cover plates.

Note: Slots are numbered 1 to 7, from left to right as viewed from the rear of the recorder.
Slot 1 may not have a relay output board fitted.

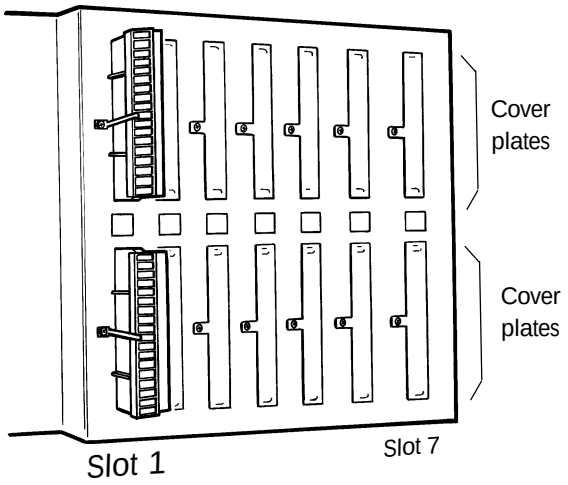

Figure 4.14a Rear view with ter minal cover removed

FITTING THE RFI GROUNDING TABS

Take the earth tabs supplied with the kit and, using the screws just removed, or the spare ones supplied with the kit, secure them to the chassis using the cover plate holes. Ensure that the free ends of the earth tabs are perpendicular to the edge of the cutout.

Carefully bend the earth tabs away from the chassis through just over 90˚.

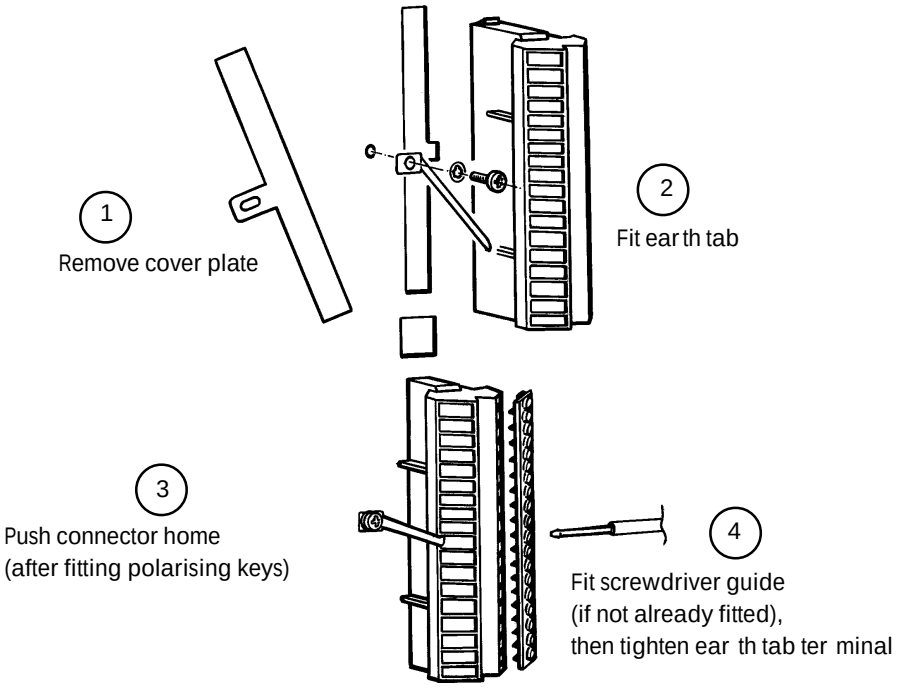

Figure 4.14b Connector installation

4.14 REAR CONNECTOR FITTING (CONT.)

POLARISING KEYS

Take the two connector blocks and polarising keys supplied with the kit. Orient the connectors such that with the circuit board slot towards you, the location lug is to the left.

Counting from the bottom of each connector, fit a polarising key between contacts 4 and 5 (relay output boards), between contacts 5 and 6 (16-channel dc input board), between contacts 13 and 14 (analogue output boards) or between contacts 15 and 16 (8-channel universal input board).

Figure 4.14d illustrates how to fit polarising keys.

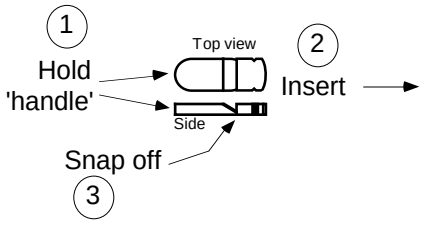

Figure 4.14d Polarising key fitting

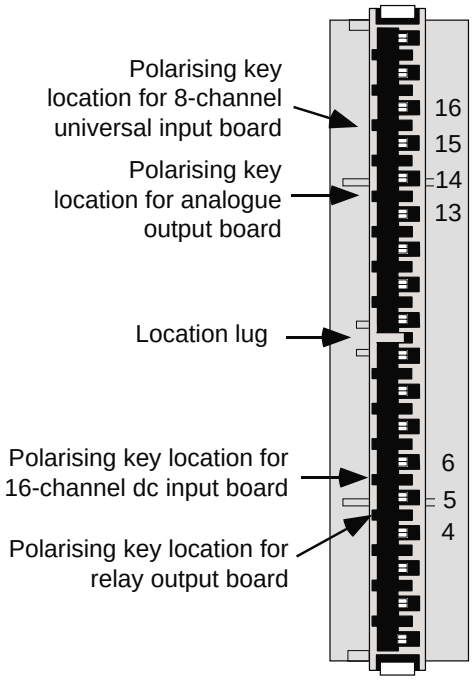

Figure 4.14c Polarising key locations

FITTING THE CONNECTOR

Offer each connector up to the panel, and press home such that the connector block passes through its cutout and its latches click into place, securing the connector to the panel

Make a further bend in each earth tab, such that the free end locates into the ninth terminal from the bottom.

If the screwdriver guide is not fitted, click it into place now and tighten the earth tab screw.

Take the relevant pair of self-adhesive labels, remove the backing paper and apply one label to each terminal block. The earth symbol should align with the grounding tab for each connector.

Carry out signal wiring, noting that channel 1 for each I/O board is at the bottom of the recorder.

4.15 BATTERY REPLACEMENT

4.15.1 Recorder back up battery pack

Replacement battery packs are available from the recorder manufacturer.

At the rear of the recorder, remove the battery cover, and with power applied to the recorder (note 2 below), disconnect the batter pack and fit the replacement.

Refit the battery cover.

Notes:
1. The connector is polarised, so reverse connection is not possible
2. Volatile data (e.g. clock, totaliser, average values) will be lost if the battery pack is changed with the recorder powered down.

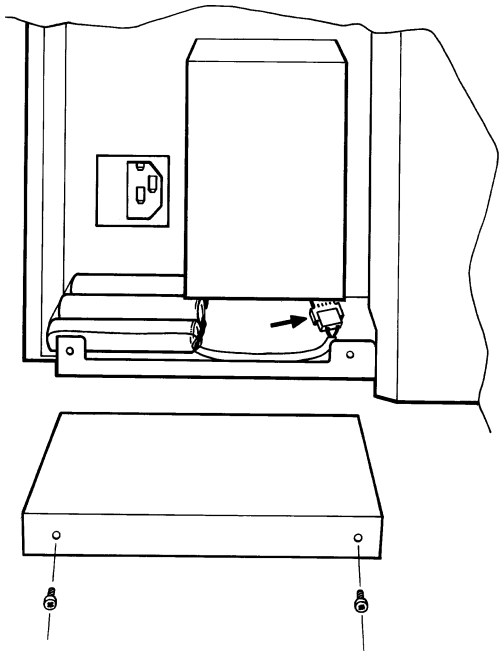

Figure 4.15.1 Recorder batter y replacement

4.15.2 Memory card batteries

Access to memory card batteries varies from manufacturer to manufacturer.

Refer to the documentation supplied with the memory card for the relevant replacement procedure.

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Inter-Company sales and service locations

Australia
Eurotherm Pty. Limited.
Unit 10.
40 Brookhollow Avenue,
Baulkham Hills,
NSW 2153

Telephone: 61 2 9634 8444
Fax: 61 2 9634 8555
Email: vincelen@eurotherm.com.au
or: vince.lendrum@eurotherm.com.au

Austria
Eurotherm Meß-und Regeltechnik GmbH
Geiereckstraße 18/1,
A1110 Wien,
Telephone: 43 1 798 76 01
Fax: 43 1 798 76 05

Belgium
Eurotherm BV,
Herentalsebaan 71-75,
B 2100 Deurne
Antwerpen
Telephone: 32 3 322 3870
Fax: 32 3 321 7363

Denmark
Eurotherm Danmark A/S
Finsensvej 86,
DK 2000 Fredriksberg,
Telephone: 45 38 871622
Fax: 45 38 872124

Finland
Eurotherm Finland,
Auragaten 12A,
FIN-20100 Åbo
Telephone: 358 22 50 60 30/1
Fax: 358 22 50 32 01

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Eurotherm Chessell
Une division d'Eurotherm Automation SA,
Parc d'affaires,
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BP55
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Eurotherm Recorders Limited,
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5F Nissay Aroma Square,
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Tokyo 144-8721
Telephone: 81 3 5714 0620
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Poongnab-Dong,
Songpa-Ku
Seoul, 138-040
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Fax: 82 2 488 8508

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Newtown Industrial Commons,
Newtown PA 18940.
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425D/G/M 400R

EUROTHERM

Technical Manual
Volume 2
(Sections 5 and 6, and Annexes)

Invensys
An Invensys company

250mm Multipoint Recorder

Technical Manual

Overall List of Contents (Volume 2)

Section

For full contents list see V olume 1

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Section 5: Spare parts

CONSUMABLES

GD244101Uxxx*	22 Metre z-fold chart
GD2441009Uxxx*	32 Meter roll chart
LA243101	Ink ribbon cartridge

*xxx = Nº of chart divisions (080,100, 120, 140, 150)

MECHANICAL COMPONENTS

LA244399	Complete z-fold writing system
LA244380	Carriage assembly
LA244790	Printhead/flexi assy.
LA244799	Print ribbon drive motor
BQ244697	Print ribbon drive belt
AH243881	Opto (feedback) PCB
LA244605	Carriage drive motor
BQ244581	Carriage drive belt
LA244307	Paper transport assembly (without motor)
LA244776	Chart drive motor
BQ244795	Chart drive belt
BD244778	Plastic front hinge plate
BT244961	Lower paper tray
LA244914	Roll spool support assembly
LA244561	Roll holder
LA244113	Take-up motor
BE244981	Motor gear
LA244224	Z-fold to roll chart conversion kit.

DOCUMENTATION

HA245000	Installation and operation manual
HA246960	Communications manual
HA247361	Memory Card instruction manual
HA247733	Graphics units installation and operation manual
HA247897	Data acquisition rack manual supplement

ELECTRONIC ASSEMBLIES

LA244319U100	Power supply module
CS246483	Power supply fuse
Upgrade/4250M/02	Single board computer type 2
Upgrade/4250M/03	Single board computer type 3
AH246463†	8-channel universal input board
AH246865†	16-channel dc input board
AH248716†	8/16 channel input board
AH246074†	Relay output board
AH250460U100†	8-channel analogue o/p board
AH250460U200†	4-channel analogue o/p board
LA244174	Connector kit for above I/O boards

†Supplied without connectors; connector kit part Nº: LA244174

LA246779UK10	100 Ohm shunt
LA246779UK25	250 Ohm shunt
LA244180	100:1 attenuator

ELECTRONIC ASSEMBLIES (Cont.)

AH242915	Writing system PCB
LA244409U100	Standard* door assembly (without memory card driver)
LA244409U200	Standard* door assembly (with memory card driver)
CJ244023	Fluorescent tube
AH242880	Display PCB
AH242939	Iinverter PCB
LA244028	Secret-'til-lit keyboard
DT244290	Operator keyboard
AH247024	Memory card PCB
LA249135	Graphics door assembly (IP65)
LA249018	Graphics door assembly (standard)
LA244469U250	Graphics display board
AH245118	Communications module PCB
DN244695	Main loom assembly
DN244647	SBC loom
PA244816	Battery pack (Nicad rechargable)

MISCELLANEOUS

LA232457	Panel bracket (recorder) (2 req'd)
LA244898	Recorder portability kit (handle and feet)
LA246774	Recorder padded carrying case
LA246843	Config tool for use with PC
BT244841	Rear terminal cover
BE238097	19 in. rack mounting-panel

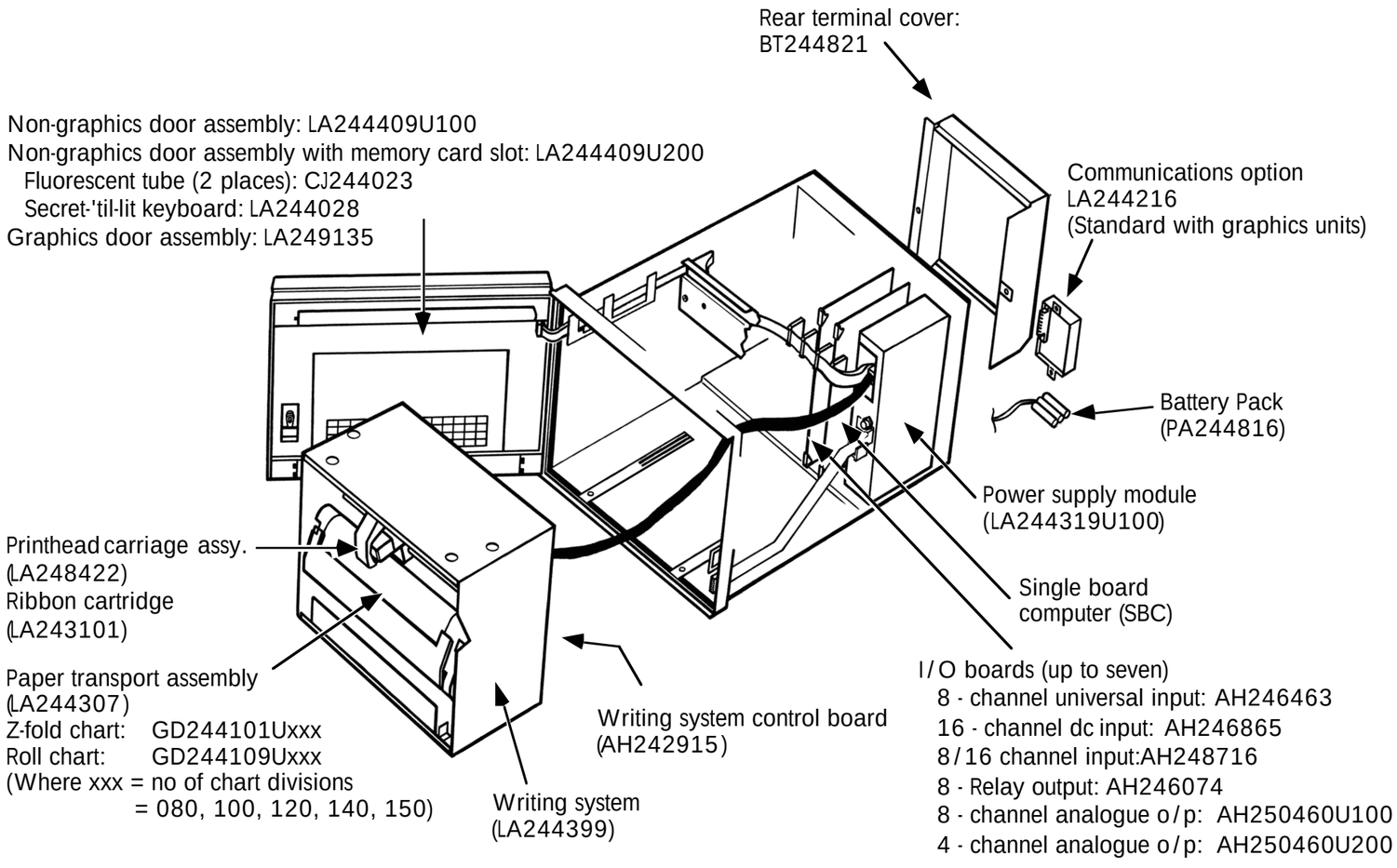
OPTIONS

LA244216	Serial communications kit
Sw.Key/4250M/015	Maths pack level 1
Sw.Key/4250M/019	Maths pack level 2
Sw.Key/4250M/043	Totalisers, Counters, Timers
Sw.Key/4250M/029	Rolling Memory
Sw.Key/4250M/003	Maths pack level 3 (CEM)
Sw.Key/4250M/021	Quality Monitoring

UPGRADE KITS

Upgrade/4250M/21	Product software type 2
Upgrade/4250M/22	Product software type 3

* Standard means 'non-graphics' in this context



Section 6

Circuit diagrams

List of contents

Section

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Annex A

Graphics Display Unit

List of contents

Annex A: Graphics Display Unit

The Graphics Display Unit is intended as a display/control unit for use with one or more peripheral recorders and I/O racks.

This Annex contains an exploded view of the unit with spare parts details, and the circuit diagram for the power supply unit. Other circuit board details appear in section 6 above.

A1 EXPLODED DISAGRAM

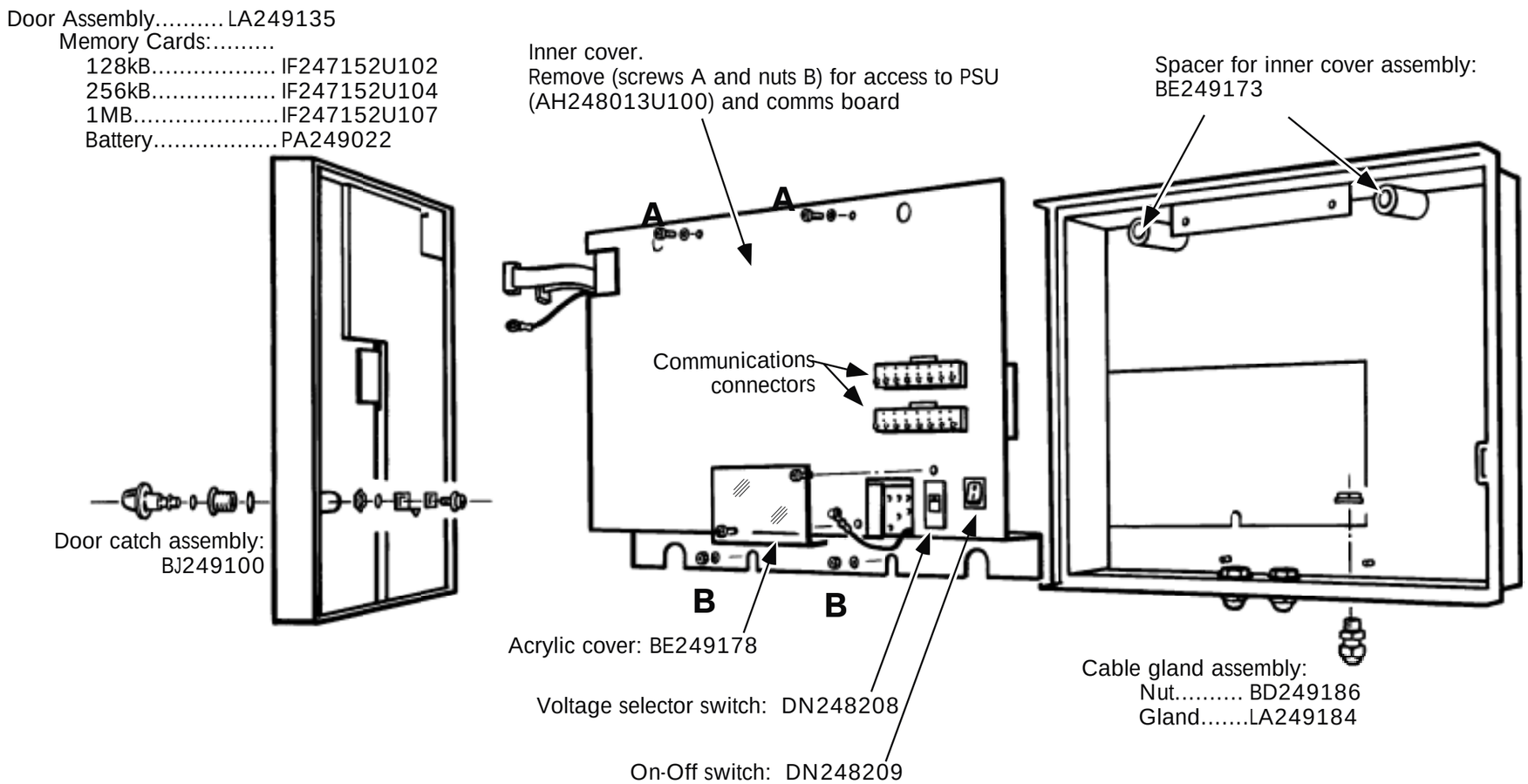


Figure A1 Graphics display Unit exploded diagram

A1.2 ACCESS TO CIRCUIT BOARDS

With the inner cover removed, the Power supply unit and the communications boards can be acceessed.

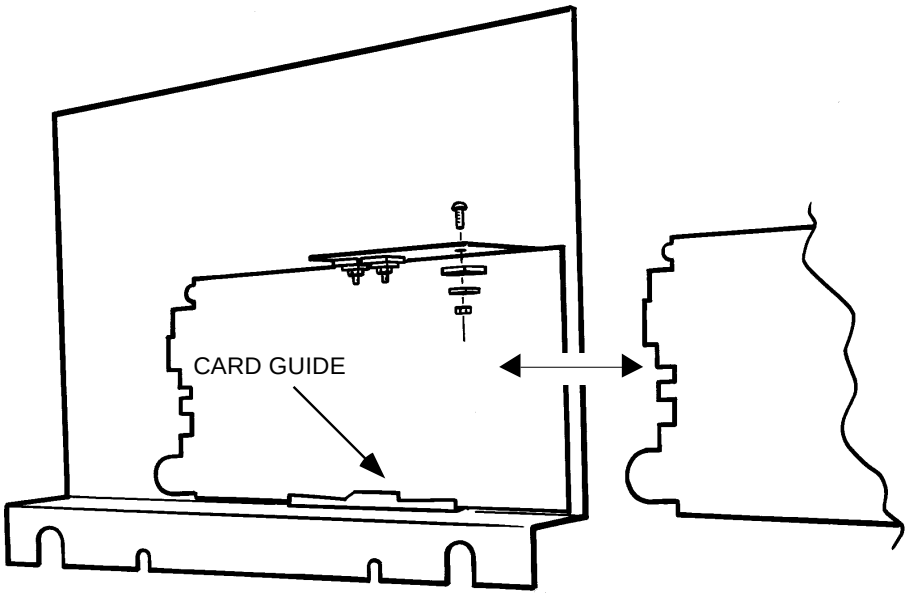


Figure A1.2a Power supply securing

With the three power devices unscrewed from the heatsink, and all the cable connectors released, the power supply board can be slid out of the card guide, and a replacement fitted.

After replacing the power supply unit, ensure that all the connections are remade, and that the ribbon cable is folded as shown below (otherwise you will not be able to plug the headers into the door connectors). Figure A1.2b shows the cable layout, and figure A1.2c shows a detailed view of the communications board, power connections to the PSU etc.

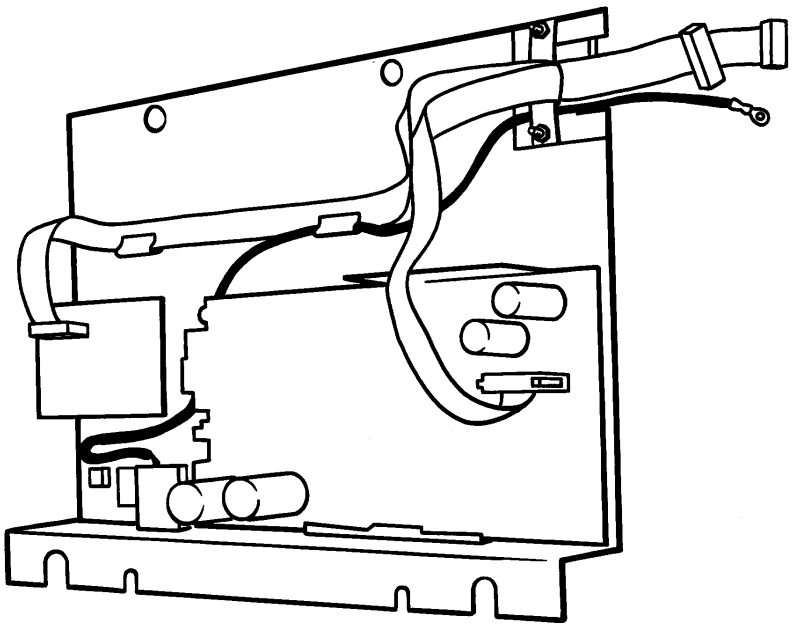


Figure A1.2b Harnesses and looms

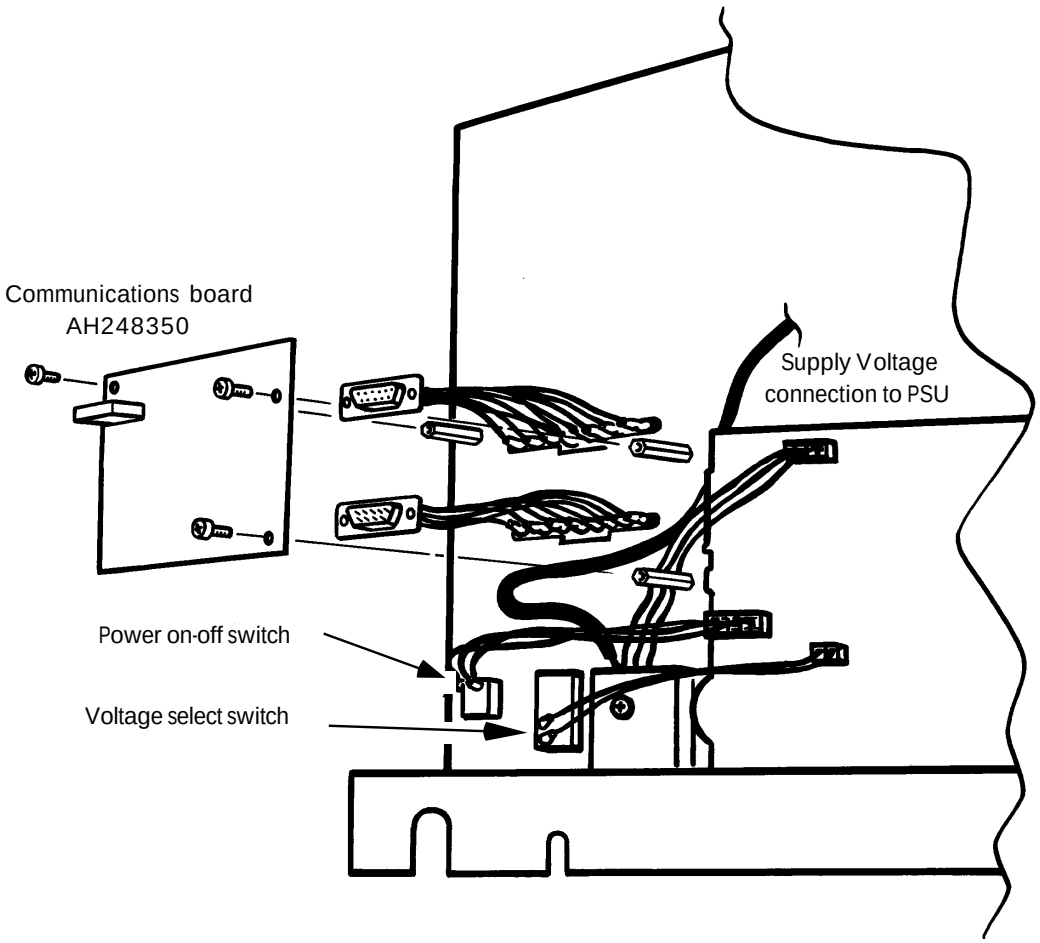


Figure A1.2c Communications board and power connections

Annex B

Data Acquisition System I/O Rack

List of contents

Annex B DATA ACQUISITION I/O RACK

This data acquisition I/O rack is intended for use either as a stand-alone unit, or as a slave to a Graphics Display Unit or graphics recorder.

The unit can be supplied without any operator interface, or with an integral or remote keyboard/display.

This Annex contains an exploded view of the unit with spare parts details, and disassembly details where necessary. The associated circuit boards are to be found in Section 6, above.

B1 EXPLODED DIAGRAM

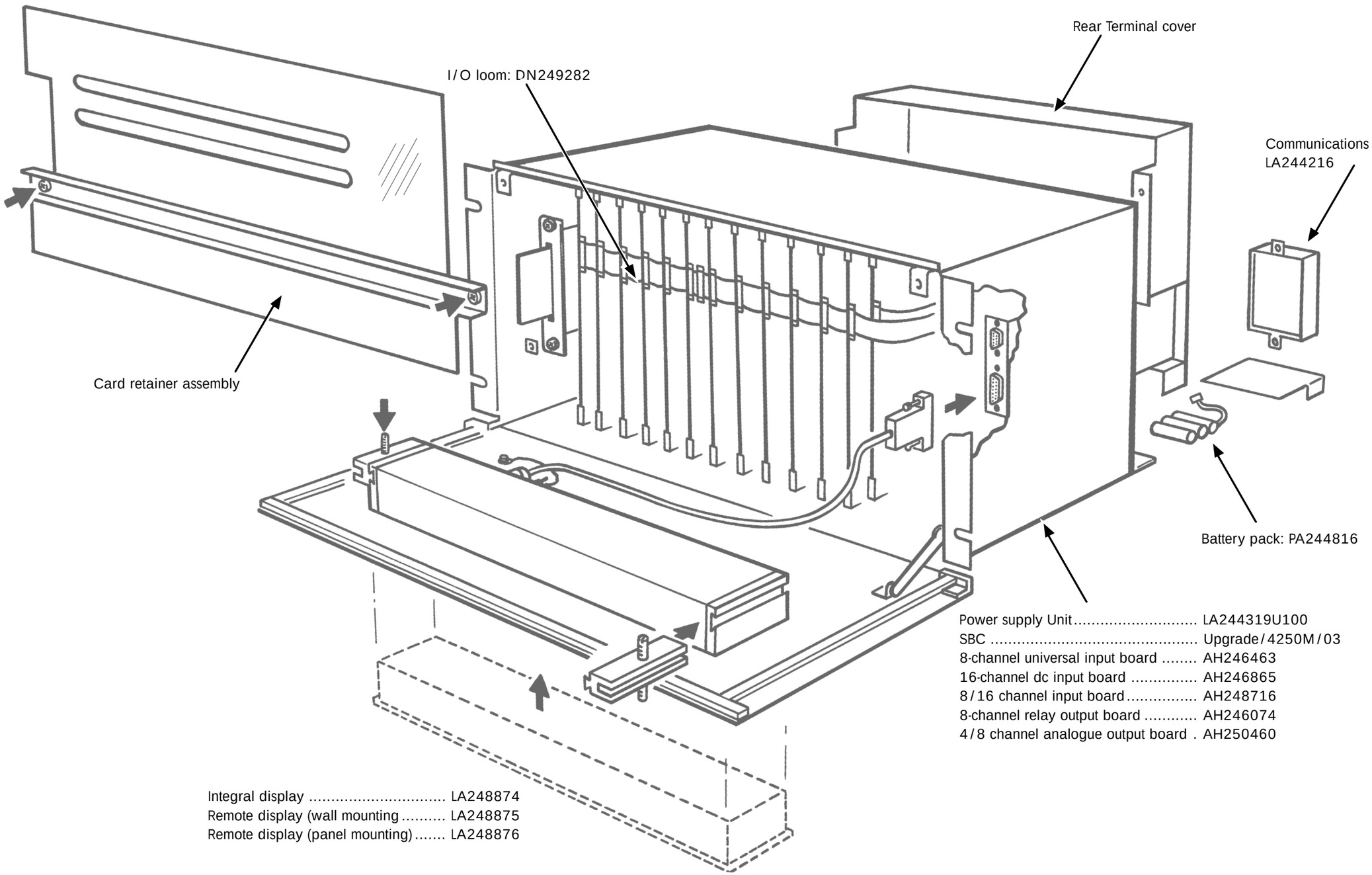


Figure B1 exploded diagram

B2 POWER SUPPLY UNIT (PSU) REMOVAL

WARNING!
Ensure that supply power to the unit is isolated, and remove the power lead from the rear of the unit.

At the rear of the instrument, ensure that the power cord is removed, then disconnect the chassis safety earth at the PSU end (figure B2a).

With reference to figure B1, remove the circuit board retainer, by undoing the two screws securing the metal channel (to which the acryllic cover is attached) to the chassis.

With reference to figure B2b, remove the two ribbon cable connectors from the PSU, and disconnect the ribbon cable connector from the Single board computer (SBC).

Disconnect the power connector from the PSU

The PSU can now be removed by undoing its securing nuts (A in figure B2b)

When refitting the power supply, **ENSURE THAT THE EARTH LINK IS REMADE.**

WARNING!
The Earth lead to the PSU MUST be remade securely. Failure to connect the link may, under certain fault conditions, render the instrument harmful to the user. The manufacturer takes no responsibility for damage or harm caused in this way.

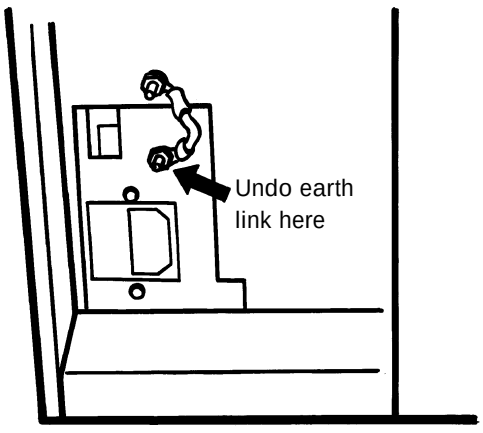


Figure B.2a Earth link

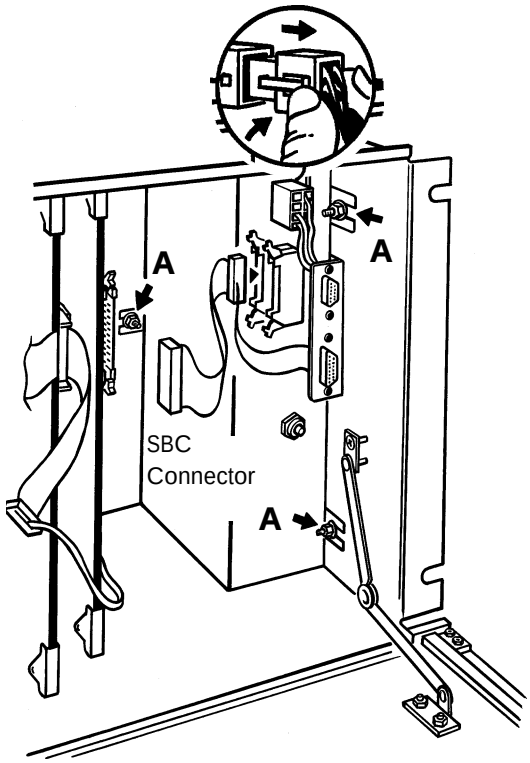


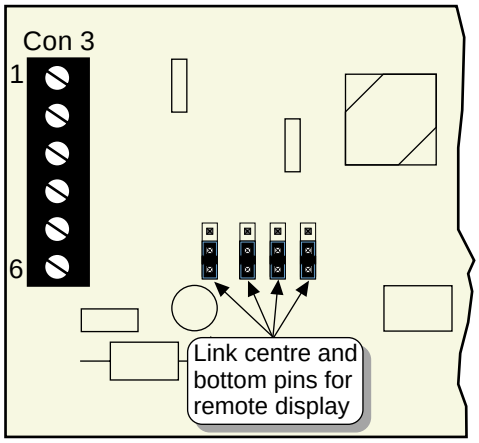
Figure B.2b Power Supply removal

B3 DISPLAY INVERTER BOARD (AH249206)

This circuit board is located behind the display board. The setup of and connections to the display board vary, depending on whether the display is integral with the rack-mounting data acquisition unit, or is remotely (panel or wall) mounted.

Figure B3 below shows link positions and wiring details for the two cases.

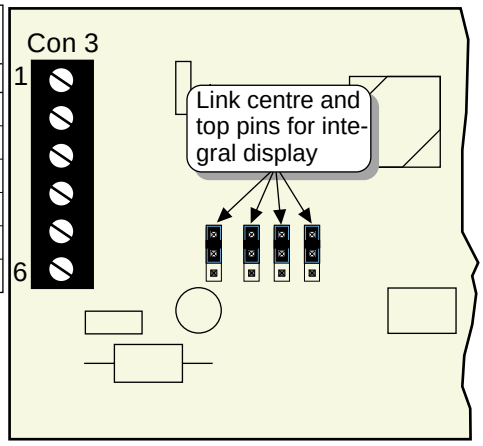
Display terminations	
Con 3	Core colour
1	White
2	Yellow
3	Blue
4	Green
5	Black
6	Red



Wall or panel mounting (remote) version

Display terminations	
Con 3	Core colour
1	N/C
2	Yellow
3	N/C
4	Green
5	Black
6	Red

N/C = No connection



4000R (Integral) version

Figure B3 Link positions and display harness connections

Annex C

Replacement procedures (non-current recorders)

List of contents

These instructions describe how to replace certain items on non-current recorders. In each case an 'effectivity' is given, which consists of one or more status numbers..The status level forms the last section of the recorder's serial number and takes the form of a letter (software status) followed by one or two numerals (hardware status). E.G. C19, J1)

C1 GRAPHICS RECORDER BACKLIGHT (Status levels < 9)

These instructions apply to graphics recorders with hardware status lower than 9. For units with hardware status levels 9, 10 or 11, see section C2 below. For units with status level 12 onwards, the backlight is not user replaceable - please contact the nearest manufacturer's service centre for advice.

WARNING!

This process involves prising the existing backlight unit away from the display panel. As both the back-lighting unit and the display panel are fragile, this process must be carried out with great care, and appropriate eye and hand protection measures should be taken.

WARNING!

The door is held in place by a sprung pin. This pan can be ejected with some force if it is not firmly held in place whilst the door is being removed or re-fitted. It is recommended that eye protection be used whilst carrying out door removal/re-fitting.

WARNING!

Isolate the recorder from all hazardous voltages before attempting to replace the backlighting unit.

Note: Because of the number of different sizes and types of screw fixing involved in this procedure, it is suggested that once an item has been removed, its securing screws are returned to their locations, and given two or three turns to hold them in place until needed for re-assembly.

C1.2 DOOR REMOVAL

Open the door by lifting the bottom of the catch, then turning it clockwise and pulling open. Return the latch to its closed position.

Remove the earth lead and the cover (A and B in figure C1.2a), retaining the fixings for later re-assembly, and dis-connect the two ribbon cable headers

Using a small screwdriver, or similar, press down on the sprung pin at the top of the door as shown in figure C1.2b. Carefully, ensuring that the sprung pin is not ejected, ease the top of the door outwards, and lift the door away from the case.

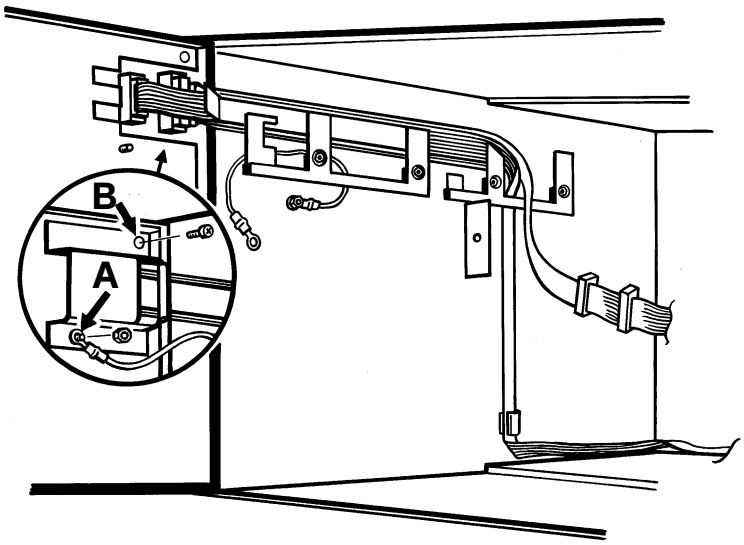


Figure C1.2a Earth lead and cover removal

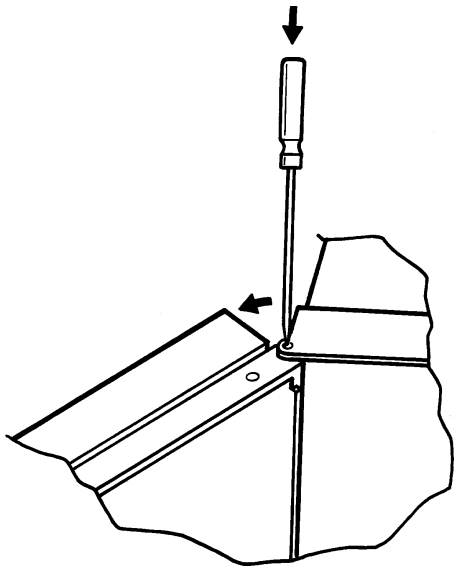


Figure C1.2b Door release

C1.3 REMOVAL OF THE DISPLAY UNIT ASSEMBLY

Release the door inner cover by undoing and removing the fixing screws as shown in figure C1.3a

Carefully remove the door inner cover, by lifting the cover and disconnecting the various connectors as they become accessible (‘A’ in figure C1.3b)

Remove the four display unit securing screws ('B' in figure C1.3b)

The display unit assembly can now be lifted out of the door and laid on a suitable static-safe work surface.

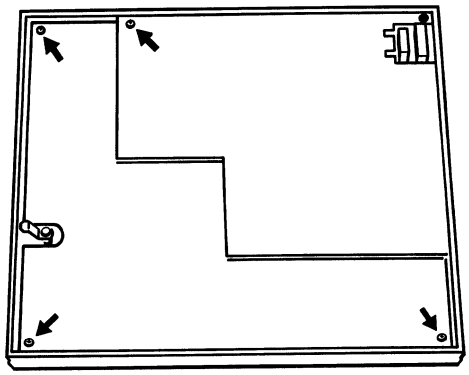


Figure C1.3a Inner cover securing screws

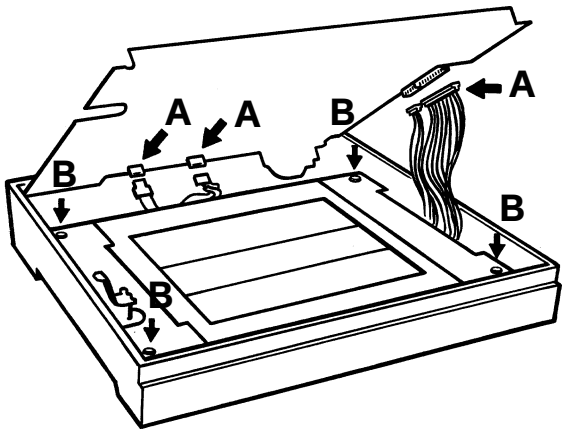


Figure C1.3b Inner cover removal

C1.4 BACKLIGHTING UNIT REMOVAL

Turn the display unit over and orient it as shown in figure C1.4a

Disconnect the backlighting connectors (‘A’ in figure C1.4a).

Undo the four securing screws (‘B’ in figure C1.4a)

Turn the unit over, and remove the securing screw (‘C’ in figure C1.4b). Straighten the three metal lugs and separate the two parts of the metal frame.

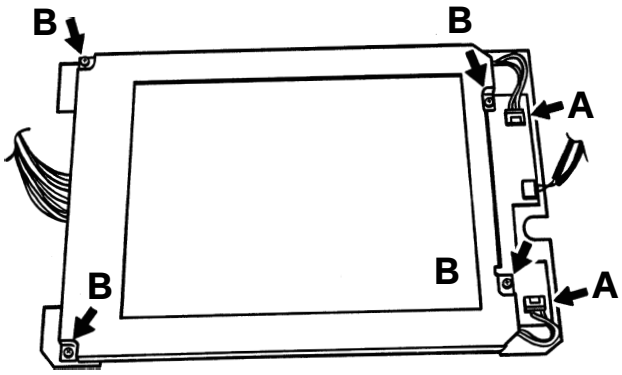


Figure C1.4a Display removal (1)

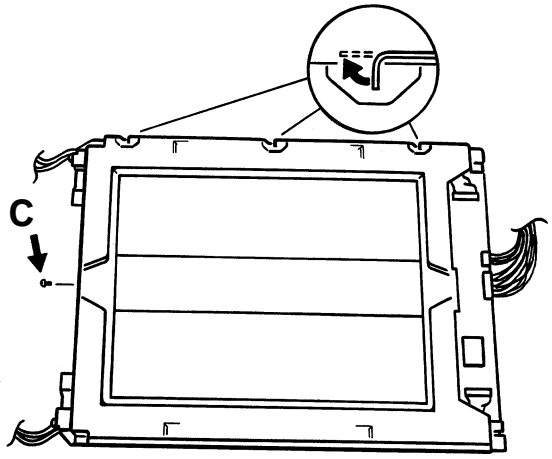


Figure C1.4b Display removal (2)

Continued

C1.4 BACKLIGHT REMOVAL (Cont.)

Referring to figure C1.4c,, turn the unit over and remove the four securing screws, then, referring to figure C1.4d,, use a small screwdriver or similar to prise the backlighting unit carefully away from the display. As the display comes away, the screwdriver should be applied at other locations until the whole unit can be removed. Take care not to contaminate the inside face of the display with fingermarks.

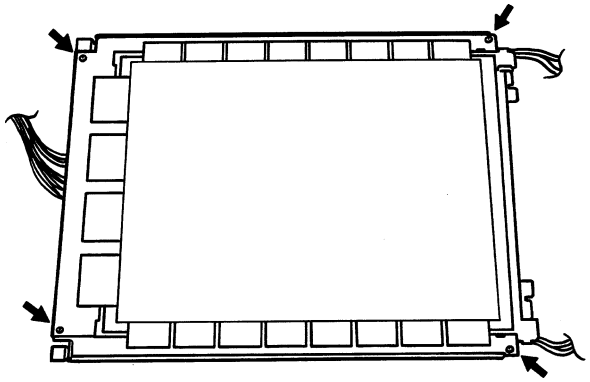


Figure C1.4c Display removal (3)

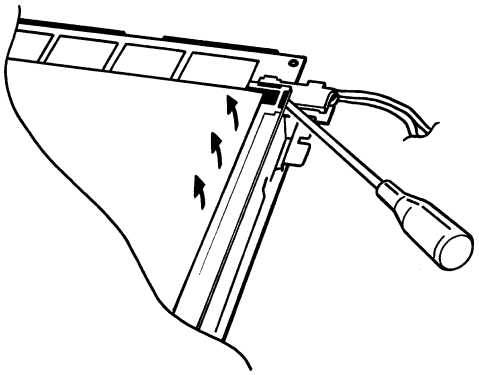


Figure C1.4d Release of backlight securing plate

Turn the lighting unit over and remove the metal securing plates by undoing the screws shown arrowed in figure C1.4e.

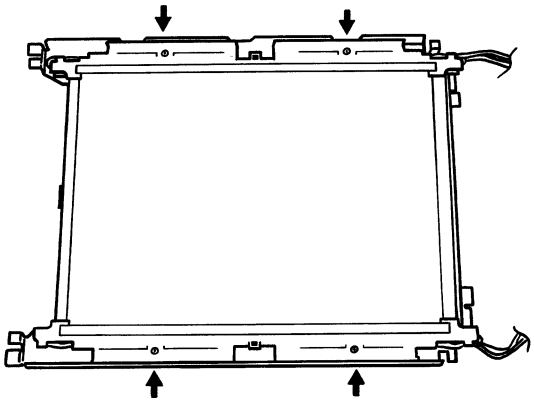


Figure C1.4e Securing plate removal

C1.5 REPLACEMENT

Fit the new backlighting unit, ensuring correct orientation. Reassemble the unit by carrying out the reverse of the dis-assembly procedure above, ensuring that the inside surface of the display is clean before securing it to the back-light.

C1.5.1 Recalibration

This process ensures that the image is centred on the display screen.

At switch on, continuously hold a finger somewhere on the display screen until the calibration display appears (approximately 30 secs).

Using a small diameter item (e.g. a fine pencil point) which will not damage the display screen, touch the intersection of the top left crosshairs, as requested by the display.

Once the top left target has been accepted, touch the bottom right target as requested by the screen.

Once both targets have been entered, initialisation continues as normal.

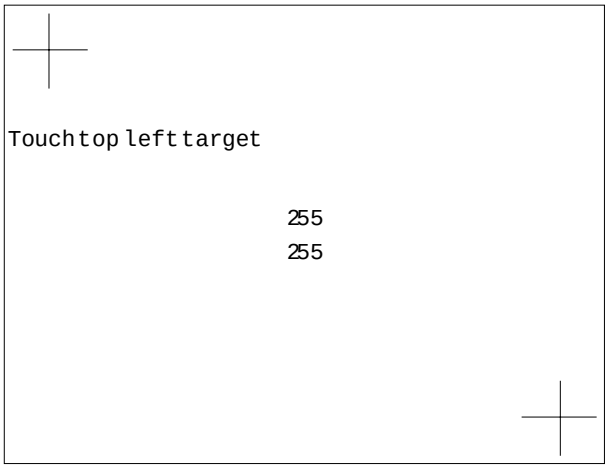


Figure C1.5.1 Calibration display

C2 GRAPHICS RECORDER BACKLIGHT (Status level 9, 10, 11)

These instructions apply to graphics recorders with hardware status 9, 10 or 11. For units with lower hardware status levels, see section C1 above. For units with status level 12 onwards, the backlight is not user replaceable - please contact the nearest manufacturer's service centre for advice.

WARNING!

The door is held in place by a sprung pin. This pan can be ejected with some force if it is not firmly held in place whilst the door is being removed or re-fitted. It is recommended that eye protection be used whilst carrying out door removal/re-fitting.

WARNING!

Isolate the recorder from all hazardous voltages before attempting to replace the backlighting unit.

CAUTION

This procedure involves the handling of components which are sensitive to static electrical discharge. All relevant personnel must be aware of static handling procedures. If in doubt, reference should be made to the recommendations near the beginning of this manual.

C2.1 DOOR REMOVAL

a Open the door by lifting the bottom of the catch, then turning it clockwise and pulling open. Return the latch to its closed position.
b Remove the earth lead and the cover (A and B in figure c2.1a), retaining the fixings for later re-assembly.
c Disconnect the two ribbon cable headers
d Using a small screwdriver, or similar, press down on the sprung pin at the top of the door as shown in figure C2.1b.
e Carefully, ensuring that the sprung pin is not ejected, ease the top of the door outwards, and lift the door away from the case.

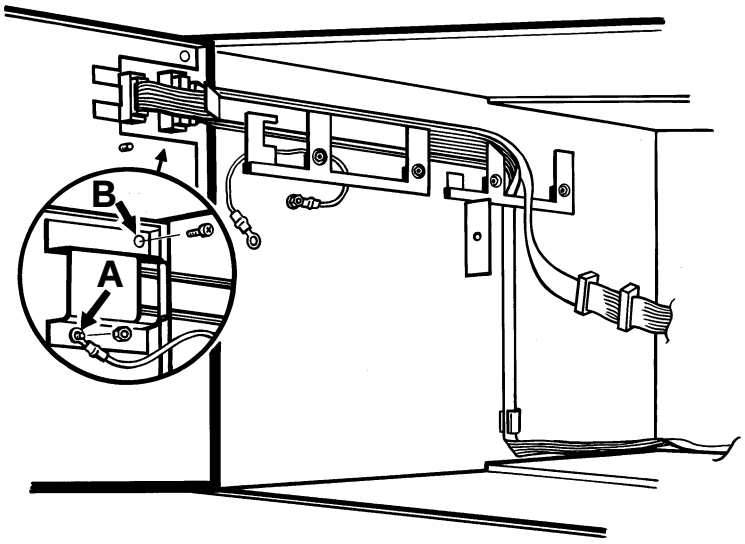


Figure c2.1a Earth lead and ribbon cable connector

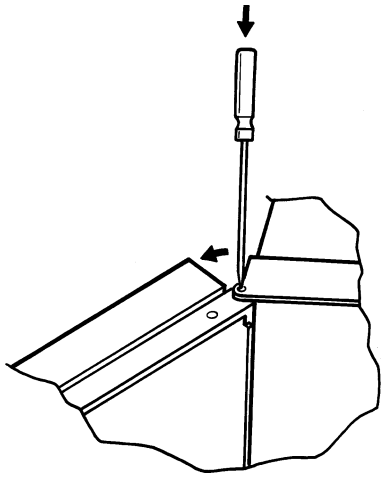


Figure c2.1b Door Hinge pin detail

C2.2 REMOVAL OF THE DISPLAY UNIT ASSEMBLY

a Release the door inner cover by undoing and removing the fixing screws ('A' in figure C2.2a). Remove the plastic door guide ('B') and keep safely for later re-assembly.
b Carefully remove the door inner cover, by lifting the cover and disconnecting the various connectors as they become accessible (C, D and E in figure C2.2b).
c Remove the four display unit securing screws arrowed in figure C2.2b

The display unit assembly can now be lifted out of the door and laid on a suitable static-safe work surface.

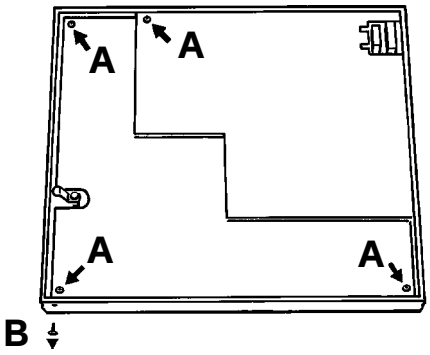


Figure C2.2a Inner cover securing screws

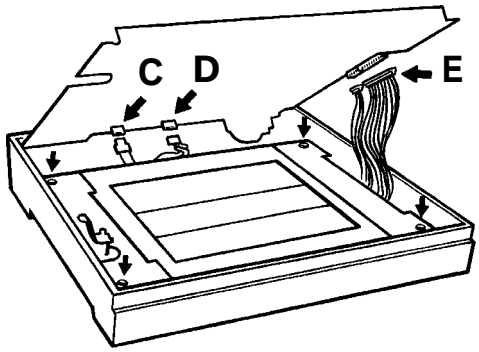


Figure C2.2b Inner cover removal

C2.3 BACKLIGHT REMOVAL/REPLACEMENT

a Turn the display unit over and orient it as shown in figure C2.3a
b Disconnect the backlighting connector ('A' in figure C2.3a).
c Undo the two securing screws ('B' in figure C2.3a)
d Turn the unit over, and remove the securing screw ('C' in figure C2.3b).
e The backlight unit can now be slid out as shown in figure C2.3c and replaced with the new unit..

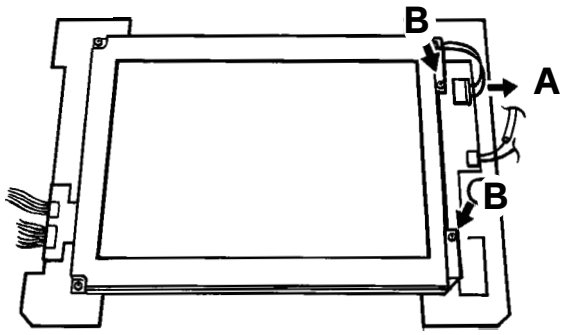


Figure C2.3a Display removal (1)

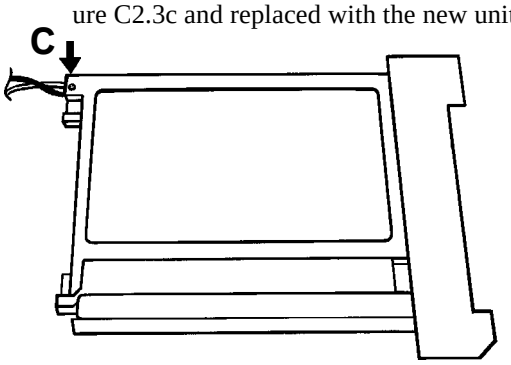


Figure C2.3b Display removal (2)

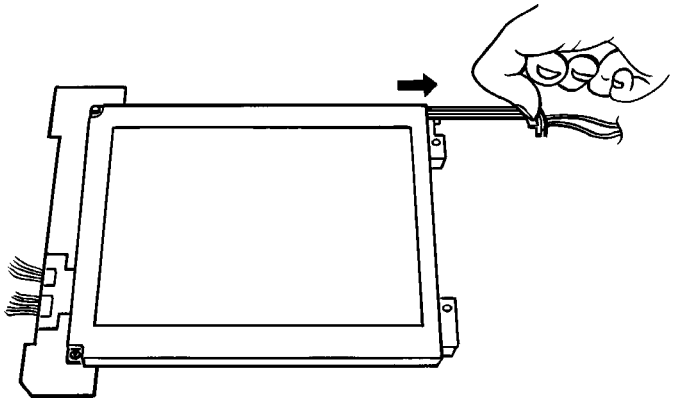


Figure C2.3c Backlight removal

C2.4 REASSEMBLY

Reassemble the unit by carrying out the reverse of the dis-assembly procedure above. Ensure, when fitting the display unit into the door, that the HT harness associated with connector 'D' emerges at the top the display as shown in figure C2.4 (not to the left as may seem natural).

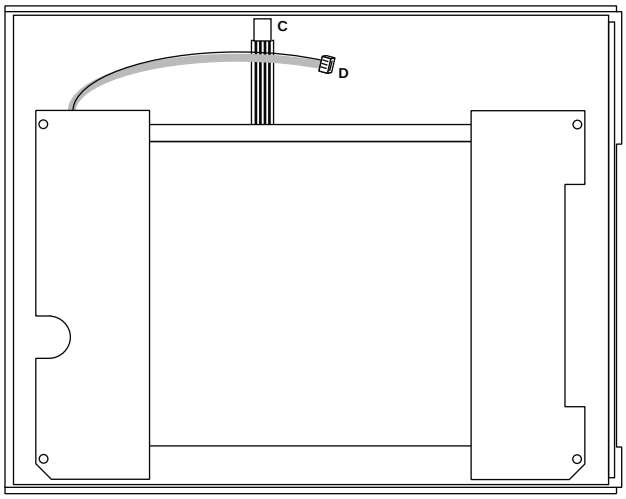


Figure C2.4 HT lead location

C2.5 RECALIBRATION

This process ensures that the image is centred on the display screen.

At switch on, continuously hold a finger somewhere on the display screen until the calibration display appears (approximately 30 secs) as depicted in figure C2..5

Using a small diameter item (e.g. a fine pencil point) which will not damage the display screen, touch the intersection of the top left crosshairs, as requested by the display. Once the top left target has been accepted, touch the bottom right target as requested by the screen.

Once both targets have been entered, initialisation continues as normal.

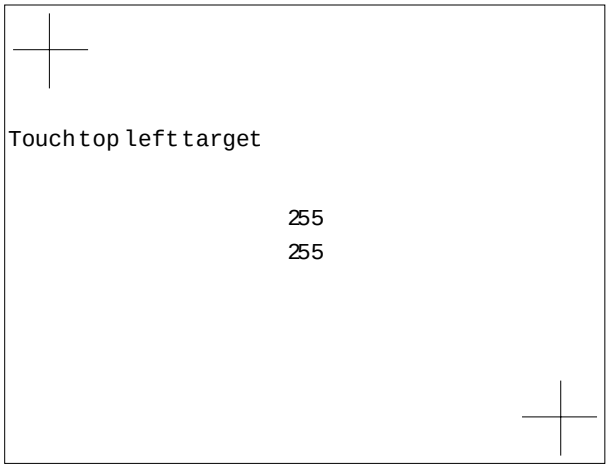


Figure C2.5 Calibration display

C3 DOOR LOOM REPLACEMENT (Status level < 11)

These instructions apply to graphics recorders with status levels 10 or less. For recorders with status levels 11 onwards, refer to section 4.13.2 above.

CAUTION

This replacement procedure involves the handling of circuit boards whose components are sensitive to static electrical discharge. All relevant personnel must be aware of static handling procedures. If in doubt, reference should be made to the recommendations near the beginning of this manual.

Note: This procedure involves the removal of the Single Board Computer (SBC) from the recorder. This will result in the loss of any volatile data such as totaliser values and real-time clock.

Remove all I/O boards and the SBC as described in section 4.11 above. It is recommended that you make a note of the I/O board addresses (rotary switch settings) or to identify them in some other way, so that they can be returned to their correct slots on re-assembly.

Disconnect the comms. connector (A in figure C3a)

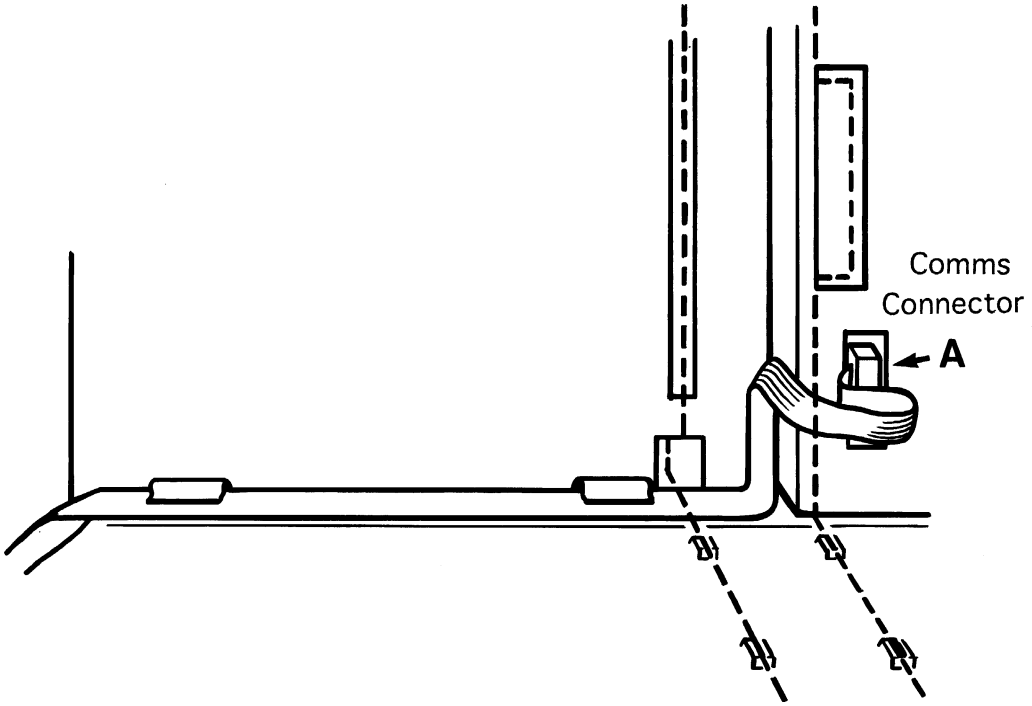


Figure C3a Comms connector location (view on inside of case)

C3 DOOR LOOM REPLACEMENT (Cont.)

At the top right of the inside of the door, remove the connector cover by removing the earth link and securing screw (B in figure C3b). Disconnect both ribbon cable connectors.

Remove the loom retainers by undoing the screws and nuts (C in figure C3b). Remove the loom and discard it.

Take the new loom, and plug the two connectors into their receptacles in the door. Secure the loom using the loom securing units. Ensure that the ribbon cables are folded as shown in figure C3b, otherwise the comms connection will be made more difficult.

Fit the connector cover, ensuring that the angled end of the loom guide is located under it, and that the safety earth connection is remade securely.

Run the comms loom (the one without the daisy chain connectors) as shown in the figures and remake the connection. Ensure that the ribbon cable is routed such that it will be clear of the SBC and I/O boards when these are re-fitted.

Re-fit the SBC, ensuring that it does not foul the ribbon cable. (Note: the component side of the board faces right.) Refit the SBC ribbon cable to the PSU.

Re-fit the I/O boards, ensuring that the cards are returned to their correct slots, and connect the new loom.

Re-fit the circuit board retainer screen.

Re-fit the writing system, remaking the connector first.

Apply power and autoconfigure the recorder. Re-set the system time (See section 4 of the Installation and Operation Manual as necessary).

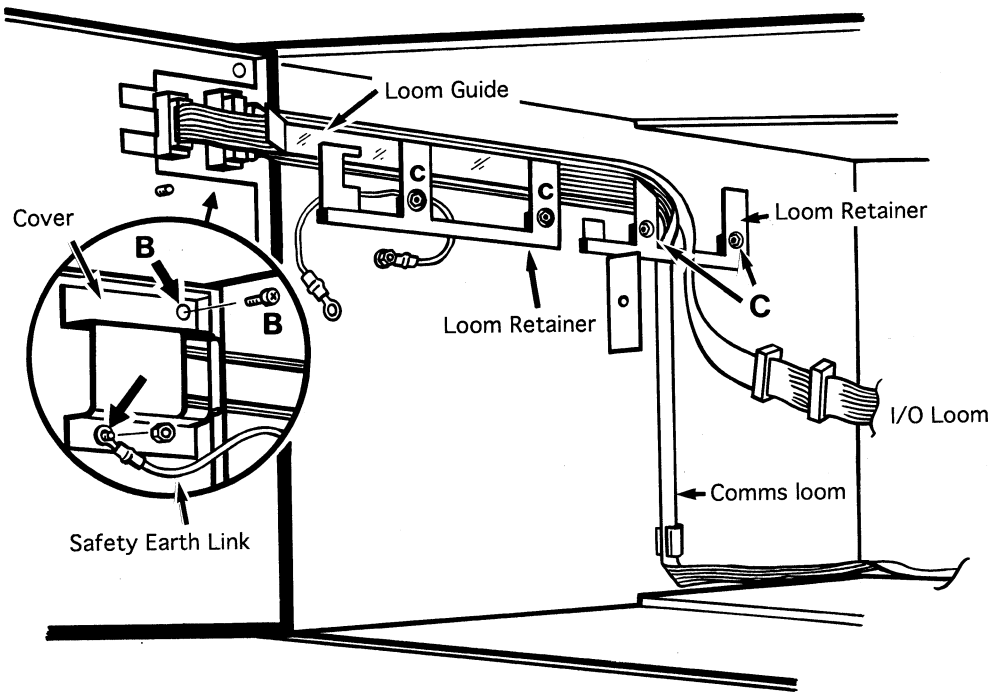


Figure C3b Loom replacement

LIST OF EFFECTIVE PAGES (VOLUME 1)

This (issue 7) manual consists of the following pages at their stated issue number.

For volume two - see overleaf

LIST OF EFFECTIVE PAGES (Volume 2)

For volume one - see previous page

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