

Model 4180M

180mm Multipoint Chart Recorder

Technical Manual



invensys

EUROTHERM

© 2004 Eurotherm Limited

All rights are strictly reserved. No part of this document may be reproduced, stored in a retrieval system or transmitted in any form, by any means, without the prior, written permission of the copyright owner.

Eurotherm Limited reserves the right to alter the specification of its products from time to time without prior notice. Although every effort has been made to ensure the accuracy of the information contained in this manual, it is not warranted or represented by Eurotherm Limited to be a complete or up-to-date description of the product.

180mm RECORDER TECHNICAL MANUAL

CONTENTS LIST

Section	Page
SAFETY NOTES	i - 5
STATIC ELECTRICITY	i - 6
TERMINOLOGY	i - 6
Antistatic	i - 6
Static safe	i - 6
SECTION 1 OVERVIEW	1 - 1
1.1 INTRODUCTION	1 - 1
1.1.1 Manual Layout	1 - 1
1.2 SPECIFICATION	1 - 1
1.2.1 General specification	1 - 2
1.2.1 GENERAL SPECIFICATION (Cont.)	1 - 3
1.2.2 Universal 8-channel input board specification	1 - 4
1.2.3 DC input board specification	1 - 6
1.2.4 Relay output board specification	1 - 7
1.2.5 Analogue output specification	1 - 7
1.3 THE 180 MM RECORDERS	1 - 8
1.3.1 General description	1 - 8
DISPLAY / KEYBOARD	1 - 8
WRITING SYSTEM	1 - 8
INPUT/OUTPUT	1 - 8
1.3.2 Recorder functions	1 - 9
MEASUREMENT AND DISPLAY OF PROCESS VARIABLES	1 - 9
TRACING	1 - 10
LOG PRINTING	1 - 11
MESSAGE PRINTING	1 - 11
PRINT MODES	1 - 11
ALARMS	1 - 12
JOBS	1 - 12
INTERNAL EVENTS	1 - 12
GROUPS	1 - 12
MATHS PACK	1 - 14
TCT (TOTALISERS/ COUNTERS / TIMERS)	1 - 15
OPERATOR ACCESS PERMISSION	1 - 15
SECTION 2 DAY-TO-DAY SERVICE	2 - 1
2.1 CHART REPLACEMENT	2 - 1
2.2 PRINT CARTRIDGE REPLACEMENT	2 - 4
2.3 PREVENTIVE MAINTENANCE	2 - 4
SECTION 3 FAULT FINDING AND DIAGNOSTICS	3 - 1
3.1 FAULT FINDING GUIDE	3 - 1
3.1.1 Recorder completely inoperative	3 - 1
3.1.2 Chart drive not working correctly (rest of recorder operating properly)	3 - 2
3.1.3 Printhead carriage not moving properly	3 - 2
3.1.4 Traces not appearing	3 - 4
IF NO TRACES APPEAR:	3 - 4
TRACE MISSING	3 - 4
3.1.5 Display not operating (rest of recorder operating normally)	3 - 4
3.1.6 Process variables outside specified tolerance	3 - 4
3.1.7 Chart illumination switching on and off regularly.	3 - 5

List of contents (Cont.)

Section	Page
3.2 CALIBRATION	3 - 6
3.2.1 DC Inputs (8- channel input board)	3 - 6
EQUIPMENT REQUIRED	3 - 6
CALIBRATION CHECK	3 - 6
3.2.2 DC inputs (16 channel board)	3 - 8
3.2.3 Internal cold junction compensation (CJC) checking	3 - 8
3.2.4 Resistance inputs (8 channel board only)	3 - 9
EQUIPMENT REQUIRED	3 - 9
CALIBRATION CHECK	3 - 9
3.3 DIAGNOSTICS	3 - 10
3.3.1 SBC	3 - 10
3.3.2 BOARD	3 - 10
3.3.3 PENS	3 - 10
3.3.4 RELAYS	3 - 10
3.3.5 OUTPUT	3 - 10
3.3.6 CJ TEMP	3 - 10
3.3.7 COMMS	3 - 13
TALK	3 - 13
LISTEN	3 - 13
LOOP BACK	3 - 13
3.3.8 DEFAULT	3 - 13
3.3.9 MCARD	3 - 13
TEST	3 - 13
VERSION	3 - 13
3.3.10 Display	3 - 13
3.4 ADJUST	3 - 14
3.4.1 Input adjust	3 - 14
APPLY	3 - 14
REMOVE	3 - 15
VIEW	3 - 15
3.4.2 Output adjust	3 - 16
3.4.3 Chart adjust	3 - 16
3.4.4 CALIB softkey (8 channel input board only)	3 - 17
CJC CALIBRATION	3 - 18
RESTORE FACTORY CONFIGURATION	3 - 18
VIEW	3 - 19
3.5 RECORDER MESSAGES	3 - 19
BAD REMOTE COLD JUNCTION TEMPERATURE	3 - 19
BATTERY BACKED RAM CLEARED	3 - 19
BATTERY FAILURE	3 - 19
CLOCK FAILURE	3 - 20
CONFIGURATION ACCESS DISABLED BY COMMS	3 - 20
CONFIGURATION TOO COMPLEX - CHANGE LOST	3 - 20
CONFIGURATION TOO COMPLEX - DEFAULTING	3 - 20
DATABASE CORRUPTED	3 - 20
EEPROM DATA BASE CORRUPTED	3 - 20
FAILURE TO ADJUST	3 - 21
FAILURE TO CALIBRATE	3 - 21
FAILURE TO REMOVE ADJUSTMENT OR CALIBRATION	3 - 21
INVALID INDEX	3 - 22
INVALID CONFIGURATION	3 - 22
PRINTER MUST BE OFF LINE	3 - 22
PRINTER MUST BE ON LINE	3 - 22

List of contents (Cont.)

Section	Page
3.5 RECORDER MESSAGES (CONT..)	
UPGRADING DATABASE	3 - 22
WRITING SYSTEM FAILURE	3 - 22
> RANGE	3 - 23
< RANGE	3 - 23
BAD RNG	3 - 23
BAD LIN	3 - 23
CHANNEL NN FAILURE	3 - 23
DERIVED VARIABLE NN RUN TIME ERROR	3 - 23
ERROR	3 - 23
OFF	3 - 23
O FLOW	3 - 23
NO ANALOGUE CHANNELS CONFIGURED	3 - 23
NO DATA	3 - 23
RANGING	3 - 23
SECTION 4 REPLACEMENT PROCEDURES	4 - 1
4.1 INTRODUCTION	4 - 1
4.1.1 Print configuration	4 - 1
4.1.2 Configuration transfer	4 - 2
4.1.3 Memory card	4 - 3
CONFIGURATION SAVE	4 - 3
CONFIGURATION RESTORE	4 - 3
4.2 REMOVAL OF THE WRITING SYSTEM	4 - 3
4.3 PEN TRAY SERVICING	4 - 4
4.3.1 Printhead drive belt replacement	4 - 4
4.3.2 Removing the pen tray	4 - 5
4.3.3 Re-fitting the pen tray	4 - 6
4.4 PAPER TRANSPORT SYSTEM SERVICING	4 - 7
4.4.1 Drive belt replacement	4 - 7
4.4.2 Cassette removal	4 - 7
4.4.3 Chart drive motor replacement	4 - 8
4.4.4 Replacement of plastic paper guide	4 - 8
4.4.5 Re-fitting the cassette	4 - 8
4.5 BATTERY PACK REPLACEMENT	4 - 9
4.6 DOOR SERVICING (NON-GRAPHICS RECORDERS)	4 - 9
4.6.1 Chart illumination lamp replacement	4 - 9
4.6.2 Display board access	4 - 10
DISPLAY BOARD	4 - 10
CHART ILLUMINATION PLATE	4 - 10
4.6.3 Keyboard replacement	4 - 11
4.6.4 Door removal	4 - 11
4.7 MEMORY CARD RETROFIT KIT	4 - 12
4.7.1 Introduction	4 - 12
4.7.2 Kit contents	4 - 12
4.7.3 Installation procedure	4 - 12
4.8 COMMUNICATIONS RETROFIT KIT	4 - 15
4.8.1 Kit contents	4 - 15
4.8.2 Installation procedure	4 - 15
4.9 CHART ILLUMINATION RETROFIT KIT	4 - 17
4.9.1 Kit contents	4 - 17
4.9.2 Procedure	4 - 17

List of contents (Cont.)

Section	Page
4.10 BACKLIGHT REPLACEMENT PROCEDURE	4 - 19
SAFETY PRECAUTIONS	4 - 19
QUALITY CONSIDERATIONS	4 - 19
4.10.1 Door removal	4 - 20
4.10.2 Removal of the display unit assembly	4 - 21
4.10.3 Illumination tube replacement	4 - 22
4.10.4 Re-assembly	4 - 23
RECALIBRATION	4 - 23
SECTION 5 SPARE PARTS	5 - 1
SECTION 6 CIRCUIT DIAGRAMS	6 - 1
ANNEX A : REPLECEMENT PROCEDURES	
FOR NON-CURRENT RECORDERS	A - 1
A1 BACKLIGHT REPLACEMENT INSTRUCTIONS	A - 1
A1.1 INTRODUCTION	A - 1
A1.2 REPLACEMENT PROCEDURE	A - 1
A1.2.1 Door removal	A - 1
A1.2.2 Removal of the display unit assembly	A - 2
A1.2.3 Backlighting unit removal	A - 3
A1.2.4 Replacement	A - 4
RECALIBRATION	A - 4

ASSOCIATED DOCUMENTS

- HA246958 Communications Manual.
- HA247652 Installation and Operation Manual (Continuous-trace recorders).
- HA247645 Installation and Operation Manual (Multi-point recorders).
- HA247733 Manual supplement for graphics recorders.
- HA247361 Memory Card Instruction Manual.

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.

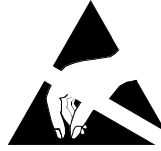
4. Where conductive pollution (e.g. condensation, carbon dust) is likely, adequate air conditioning/filtering/sealing etc. must be installed in the recorder enclosure.
5. This unit contains one or more batteries which must be treated and disposed of with care. In particular, batteries must not be shorted 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



STATIC ELECTRICITY

High voltages (tens of kilovolts) 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 of the recorder circuit boards.

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 the recorder should be placed into a static-safe bag, initially at the recorder chassis potential, for storage. Before refitting 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.

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 Manuals have been repeated here. In case of any discrepancy, the manual with the later 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, pen cartridges etc.

Section 3 contains a fault-finding guide, calibration procedures and diagnostics information.

Section 4 consists of procedures for the replacing of belts, motors, circuit boards etc.

Section 5 lists spare parts available for the recorders

Section 6 contains circuit diagrams for the circuit boards associated with the recorders.

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	8-channel universal input; 16-channel dc input.
Output	8-channel relay output, 4 channel analogue output (multipoint only), 8 channel analogue output (multipoint only).
Max number of I/O boards per type	3 off 8-channel input, 3 off relay output; 3 off 16-channel input; 3 off analogue output.
Max number of inputs	48 dc inputs*; 24 resistance inputs; 39 contact closure.
Max number of outputs	Relays: 8 x no of free slots.
	Analogue outputs: 8 (multipoint recorders only - the analogue o/p board is not supported by continuous-trace recorders.)
Maximum number of traced channels	Multipoint: 24 total input/derived. Continuous: 6 total input/derived.

Environmental Performance

General	To BS2011: 1981
Temperature limits	Operation: 0 to + 50 °C Storage: -20 to +70 °C
Humidity limits	Operation: 5 to 80% RH; non-condensing Storage: 5 to 90% RH; non-condensing
Max. 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.

Electromagnetic compatibility (EMC)

Emissions	BS EN50081-2
Immunity	BS EN50082-2

Electrical Safety

To BS EN61010: 1990 Class 1.

Physical

Bezel size	288 mm. high x 288 mm. wide x 45 mm. deep.
Panel cutout size	281 mm high x 281 mm. wide. (+ 1.4 mm. - 0 mm.)
Depth behind bezel rear face	304 mm. (inc. rear cover); 275 mm. (no rear cover)
Weight (Eight-channel instrument)	12.5 kg. max.
Panel mounting angle	Up to $\pm 30^\circ$ from vertical.

Performance (Multipoint recorders)

Maximum scan and update rate	All parameters in 1 second
Maximum print rate (trending)	24 channels in 3 seconds
Maximum chart speed	1500 mm/hr.
Clock accuracy	Better than 60 ppm.

Performance (Continuous-trace recorders)

Maximum scan and update rate	All parameters in 1/4 second
Maximum print rate (trending)	6 channels in 3 seconds
Maximum chart speed	1500 mm/hr.
Clock accuracy	Better than 60 ppm.

(Continued)

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

1.2.1 GENERAL SPECIFICATION (Cont.)**Printing system**

Method	Printhead with 6 coloured dotting nibs
Colours	Black, brown, red, green, blue, violet
Printhead life	Multipoint: > 1.5 million dots per colour (recorder continuously powered*) Continuous-trace: >700 metres line length. >1.5 million dots annotation (recorder continuously powered*).
Dot diameter	0.35 to 0.6 mm.
Dot spacing (vertical)	0.25 mm. (chart speed <300 mm/hr.); 0.5 mm (600 mm/hr); 1 mm. (1200 mm/hr.); 1.25 mm (1500 mm/hr)
Dot spacing (horizontal)	0.39 mm.
Characters per line	77
Noise level	55 dBA max. (door closed).
Maximum trending rate	24 channels in 3 seconds.

Paper transport

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.).
Chart width	224 mm. overall; 180 mm. calibrated.
Pen-to-paper accuracy	0.25% of calibrated chart width.
Transport accuracy	Better than 10 mm. in 22 meters.

Power requirements

Line voltage (45 to 65 Hertz)	90 to 132 Volts or 180 to 264 Volts (User selectable).
Maximum power	70 W
Fuse type	Ceramic 20 mm. 3.15 Amp. Fast blow.
Interrupt protection	100 ms at 50% load.

Memory protection

	EEPROM (for configuration)
	Battery-backed 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.

* To prolong pen life, it is recommended that the printhead assembly be removed from the recorder if it is to be left unpowered for extended periods.

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 (multipoint); All channels in 1/4 second (continuous-trace)
Step response to within resolution	2 seconds (multipoint); <1 second (continuous-trace)
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 1 - 2 for definitions) 300 V channel-to-channel (double isolation) and channel-to-ground (basic isolation)
Dielectric strength	2350 V ac for 1 minute (channel-channel); 1350V ac (channel-ground)
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.); 10 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 +10V (100V with attenuator)
Temperature performance (worst case)	
-10 to 40 mV	80ppm/°C of reading + 27.9ppm/°C of range
-50 to -200mV	80ppm/°C of reading + 12.4ppm/°C of range
-0.5 to +1V	80ppm/°C of reading + 2.1ppm/°C of range
-5 to +10V	272ppm/°C of reading + 4.7ppm/°C of range
Shunt/Attenuator	Fitting method: Resistor modules mounted on user's terminal block(s) 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 linearisation instead of NiMoNiCo.

1.2.2 UNIVERSAL 8-CHANNEL 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.

Types and ranges

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	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	$\sqrt{\text{value}}$; $(\text{value})^{3/2}$; $(\text{value})^{5/2}$; User defined table(s)
------------------	---

Contact closure (switch) inputs

Type	Volt-free contact
Wetting voltage	2.5 Volts nominal
Minimum latched pulse width	125ms (multipoint); 10 ms (continuous)
De-bounce	Inherent 1 second (multipoint); inherent 1/4 second (continuous).

1.2.3 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 1 - 2 for definitions) 300 V channel-to-channel (double isolation) and channel-to-ground (basic isolation)
Dielectric strength	2350 V ac continuous (channel-channel); 1350V ac (channel-ground).
Input impedance	> 10 M Ω (68.8k Ω for 5V range)
Over-voltage protection	60 Volts peak, 500 V through 50 k Ω resistor
Open cct. detection (85 mV range only)	65 nA current (max.); 8 seconds recognition time (max.); 40 M Ω 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 + 12.9ppm/°C of range
-1 to +5V	272ppm/°C of reading + 7.8ppm/°C of range
Shunt	Externally mounted resistor modules
Additional error due to shunt	0.1%.

Range	Resolution	Performance (worst case) in instrument at 20°C
-15 mV to + 85 mV - 1.0V to + 5 V	$\pm 5.5 \mu\text{V}$ $\pm 280\mu\text{V}$	0.072% reading + 0.071% range 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

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 linearisation instead of NiMoNiCo.

* Maximum of eight different linearisations (seven + linear) allowed per board.

Contact closure inputs not available on channels 1, 8 and 16

1.2.3 DC INPUT BOARD SPECIFICATION (Cont.)

Other linearisations

Tables available $\sqrt{\quad}$ value; (value)^{3/2}; (value)^{5/2}; User defined tables (up to 2 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) 250V ac channel-to-channel (double isolation) and channel-to-ground (basic isolation)
Dielectric strength	1350V ac for 1 min. (contact to contact) 2350V ac for 1 min. (channel to channel) 1350V ac for 1 min. (channel to ground)

* With resistive loads. Derate with reactive or inductive loads according to figure 1.2.4 in which:

F1 = measured on representative samples

F2 = typical values (according to experience)

Contact life = resistive life x Reduction factor

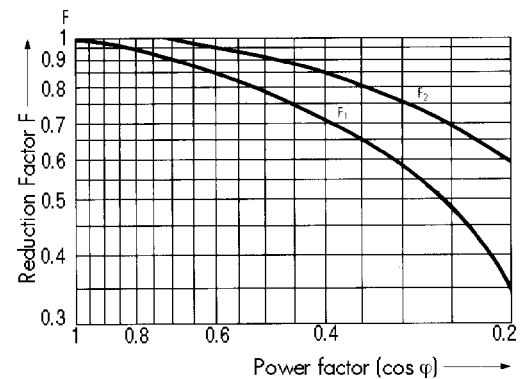


Figure 1.2.4 derating curves

1.2.5 Analogue output specification

Applies to multipoint recorders only

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	250 msec 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: 250V RMS or dc (double isolation)
	Channel-to-ground: 250V RMS or dc (basic isolation)
Dielectric strength (BS EN61010)	(1 minute type tests)
	Channel to channel: 2350 V ac
	Channel to ground: 1350V ac

1.3 THE 180 MM RECORDERS

Both the multipoint and continuous recorders are powerful self-contained data acquisition and recording instruments, capable of acquiring data from 48 (32) dc inputs (including thermocouples), 24 resistance inputs or 39 (26) contact closures (figures in parentheses are for the continuous-trace recorder). The instrument can then carry out a wide number of actions on the acquired data, including the following:

1. Scan the inputs for alarm conditions, annunciate them as and when they occur, and if required, initiate complex actions (jobs).
2. Process the data to derive other parameters (Maths Pack options)
3. Display results on the integral display
4. Trace results onto the chart
5. Log data to the chart or to a data card (Memory card option)
6. Allow access to the results to a host computer (Communications option)
7. For multipoint recorders, input and derived channel values can be output using an analogue output board channel

1.3.1 General description

DISPLAY / KEYBOARD

All data and status information, as well as Operator and Configuration 'Pages' are displayed on a vacuum fluorescent display consisting of two lines of 40 characters, each of which has an underline character beneath it. The underline can be used:

1. To display values in analogue (bar-graph) format (rather than as a digital value)
2. As a cursor when using the operator or configuration pages

The keyboard contains a numeric key pad, 'Enter', 'Home' and 'Cancel' keys, as well as five softkeys whose functions depend on the particular operation being carried out.

WRITING SYSTEM

With multipoint recorders, up to 24 variables can be traced on the chart in any combination of the six available colours. (For continuous recorders, up to 6 variables can be traced, one per colour.) Alarm on / off messages and logs can also be printed and other powerful features include 'Line thickening' to put an extra-wide trace on the chart as an aid to long distance viewing, and for the multipoint version, 'Adaptive recording' and 'Interpolation' are available. These are described in section 1.3.2 below (TRACING)

INPUT/OUTPUT

Measurements of the input signals are carried out by one or more high-performance input boards. These boards are easily configurable to accept voltage, thermocouple, contact closure and resistance inputs (not the 16-channel dc input board).

A rugged 8-channel relay board is available to provide contact closure outputs for alarms, events etc.

Note: These relays are energised under normal operating conditions (Common and Normally open contacts shorted). Under alarm or power off conditions, the relays are de-energised (common shorted to the normally closed contact) providing fail-safe operation should power to the recorder fail.

For multipoint recorders only, an analogue output board is available for providing a voltage or current signal proportional to a selected input or derived channel. This board can be used as a transmitter power supply, if so configured.

Signal wiring to the input / output boards is terminated by the user at terminal blocks located under the rear terminal cover. See the relevant installation and operation manual for full details.

1.3.2 Recorder functions

MEASUREMENT AND DISPLAY OF PROCESS VARIABLES

The term 'Process Variable' is used to mean any input or derived channel, totaliser, counter or timer value.

The following maximum numbers of inputs are supported depending on the card mix:

Multipoint recorder

48 Thermocouple, dc Volts, dc mV, dc mA inputs
24 Resistance inputs including 2 or 3-wire RTDs (8 channel boards only)
39 Contact closure inputs (8 per 8-channel board, 13 per 16-channel board)
8 Analogue output channels

Continuous recorder

32 Thermocouple, dc Volts, dc mV, dc mA inputs
24 Resistance inputs including 2 or 3-wire RTDs (8 channel boards only)
26 Contact closure inputs (8 per 8-channel board, 13 per 16-channel board)

For example, if a multipoint recorder is fitted with one 16-channel board and two 8-channel input boards, it can support 32 dc inputs or 20 dc inputs and 12 RTD inputs or 16 dc inputs and 6 contact closures and 10 RTDs etc.

Further to the external inputs, the maths pack option supports 24 derived channels (8 for continuous-trace recorders) and the TCT option supports 12 each Timers, Counters and Totalisers (6 each for continuous-trace recorders).

I/O channels are displayed using up to five digits with a user configurable decimal point position. Derived (maths pack) channels can be displayed in any of the following ways, as appropriate:

1. Five digits with configurable decimal point position
2. Seven digits with configurable decimal point position
3. Eight digit integer (no decimal)
4. Scientific (X.XXX+ee) e.g. 12345 would be expressed as 1.235+04; 0.000012345 would be 1.235-05
5. Time as HH:MM:SS (Time part of Time Stamp function)
6. Date as DD/MM/YY or MM/DD/YY according to date configuration in Instrument Configuration (CLOCK) (Date part of time stamp function).
7. Elapsed time as HH:MM:SS. If the elapsed time exceeds 100 hours, the format changes to HHHH:MM.

Totaliser and counter values are displayed as 7- or 8-character values according to configuration.

1.3.2 RECORDER FUNCTIONS (Cont.)

TRACING

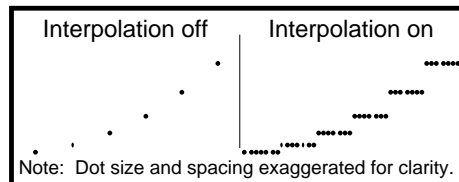
The recorder traces the first 24 (6 for continuous recorders) variables that are configured to be 'trace on'. Input channels are traced in preference to derived channels, so if derived channels are to be traced, there must be fewer than 24 (6) input channels being traced. This can be important when input channels are configured to be conditionally 'ON' (i.e. the channel is traced as the result of a 'job' becoming active).

Each trace can be allocated a chart zone, so that its full scale is less than the full width of the chart. This can be used, for example, to reduce confusion if large numbers of channels are being traced. Each trace can be allocated two colours (A and B) which can be switched either by 'job' or by operator action. It is thus possible, for example, to change the trace colour when the channel goes into alarm.

Jobs are actions taken when initiated by a channel going into alarm, a totaliser or counter value being exceeded, a softkey being pressed etc. See the Installation and Operation Manual for full details.

INTERPOLATION (MULTIPOINT RECORDERS ONLY)

The normal scanning of the dotting head 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 (Chart Configuration) a horizontal line is drawn between consecutive dot positions, making the trace easier to interpret. When enabled, interpolation applies to all traces. The figure below shows the effects of interpolation (exaggerated for clarity).



AND ADAPTIVE RECORDING (MULTIPOINT RECORDERS ONLY)

Under normal conditions, the trace is updated each time the chart position is incremented. This means that at the lowest chart speeds, transients or other rapid changes in input could be missed. With ADAPTIVE RECORDING enabled (Chart configuration) the print head places one or more extra dots on the chart, between chart increments if necessary. When enabled, adaptive recording applies to all channels.

LINE THICKENING

A part of each channel's configuration, Line thickening provides an extra wide trace as an aid to long distance viewing. Trace resolution is reduced, but the displayed value is not affected.

1.3.2 RECORDER FUNCTIONS (Cont.)

LOG PRINTING

Logs are alpha-numeric reports showing the current values of a user-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 the Group Configuration. Logs can be printed on the chart, or if the relevant memory card option is fitted, they can be directed to a data card. Log destination (chart or memory card) is set up as a part of the log configuration.

Logs can be initiated by operator action, by job, or for log 1, automatically at one of two user selectable Log Intervals (part of chart configuration). If the relevant Memory card option is fitted, log 2 can also be printed (or saved to the memory card) automatically at one of two user-selectable Archive intervals set up as a part of memory Card Configuration.

Logs are printed on the chart in black, except for any channel in alarm, which is printed in red.

MESSAGE PRINTING

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

1. Trace tags. Channel tags (up to seven characters set up in Channel configuration: Ident) are printed adjacent to the trace in the same colour as the trace.
2. Cyclic messages. Scales with tags, descriptors and engineering units, chart speed, log interval, time and date are printed at a rate sufficient to ensure that one such message is visible to the operator at any time.
3. Demand messages. Alarm, event and change messages are generated asynchronously. 10 user entered messages can also be printed as the result of 'job' action. Configuration of these messages can be simplified if appropriate by embedding times, dates, process variable values etc. in them as described in the Installation and Operation Manual.

PRINT MODES

At chart speeds up to 900 mm/hr (600 mm/hr for continuous-trace recorders), the recorder can operate in any one of three modes when printing on the chart:

1. **Trace Priority**. All message types can be printed, but the trace is not interrupted. All demand messages are queued until printed. If the print queue overflows, 'Message Lost' is printed on the chart.
2. **Text Priority**. Demand messages are printed in 'trace priority' mode (i.e. the traces are not interrupted) as long as the print queue is less than 70% full. Otherwise, message printing takes priority, and the traces are broken. When logging traces are always broken. If the queue overflows, 'Message Lost' is printed on the chart.
3. **Text Only**. All cyclic messages are inhibited. Only logs and demand messages are output. This mode is intended for report generation and alarm logging. If the print queue overflows, 'Message Lost' is printed on the chart.

At chart speeds above 900 mm/hr (600 mm/hr), all messages are lost if the recorder is in Trace Priority mode. In text priority mode, logs always break the trace and are printed as required; demand messages are held until the print queue is 70% full when they are printed on the chart in break trace mode; cyclic messages are lost. Text only mode is independent of chart speed and is therefore not affected.

1.3.2 RECORDER FUNCTIONS (Cont.)

ALARMS

Each I/O channel can have up to 4 alarms associated with it, of the following types:

1. Absolute high / Absolute low
2. Deviation in / Deviation out
3. Rate-of-change rising / Rate-of-change falling
4. Digital high / Digital low

Each of the above types can be defined as being:

1. Off
2. Trigger - Once active, the alarm stays active until the alarm source returns to a non-alarm state. Any continuous jobs (e.g. change chart speed) will remain active for the duration of the alarm state. Trigger alarms are not announced in any way (e.g. no flashing LED) and do not appear in history lists.
3. Latching – Once active, the alarm remains active until it is both acknowledged AND the alarm has returned to a non-alarm state. Any continuous jobs (e.g. change chart speed) remain active for the duration of the alarm state.
4. Non-latching – Remains active until the alarm source returns to a non-alarm state. Any continuous jobs (e.g. change chart speed) remain active for the duration of the alarm state.

All of the above attributes are set up as a part of the Channel Configuration: Alarm, as described in the Installation and Operation Manual. Alarm setpoints (thresholds) are also set up in the channel Alarm Configuration, but can also be set up by the operator if allowed by the Operator Access setup.

Each alarm can trigger up to 2 jobs.

JOBS

A 'job' is an action that can be initiated by an alarm, timer, counter etc. Jobs can be configured to be active continuously for as long as the initiating source is active (or inactive) (e.g. Select chart speed B), or to carry out a particular task (e.g. increment totaliser N° 3) as the result of a single trigger going active or inactive. Up to two jobs can be initiated by each trigger as shown in figure 1.3.2 below.

INTERNAL EVENTS

Internal events fulfil two functions:

1. They allow internal instrument sources (e.g. configurable operator keys) to initiate jobs.
 2. They allow any instrument source to be ANDed or ORed with any other (including another event) to initiate jobs.
- For a full list of internal events, refer to the Event Configuration section of the Installation and Operation Manual.

GROUPS

This feature allows a number of otherwise unrelated process variables to be acted upon together (e.g. log the channels in a group, instead of logging every single variable). The measured values of those items included in the group currently selected by the operator appear at the recorder display; remaining channels' values do not appear.

Which channels, totalisers etc. which are to be included in each group is set up as a part of the Group Configuration. Which one of the six available groups is currently displayed is selected by the operator using the DISPLAY softkey, then the MODE softkey to call the relevant page.

1.3.2 RECORDER FUNCTIONS (Cont.)

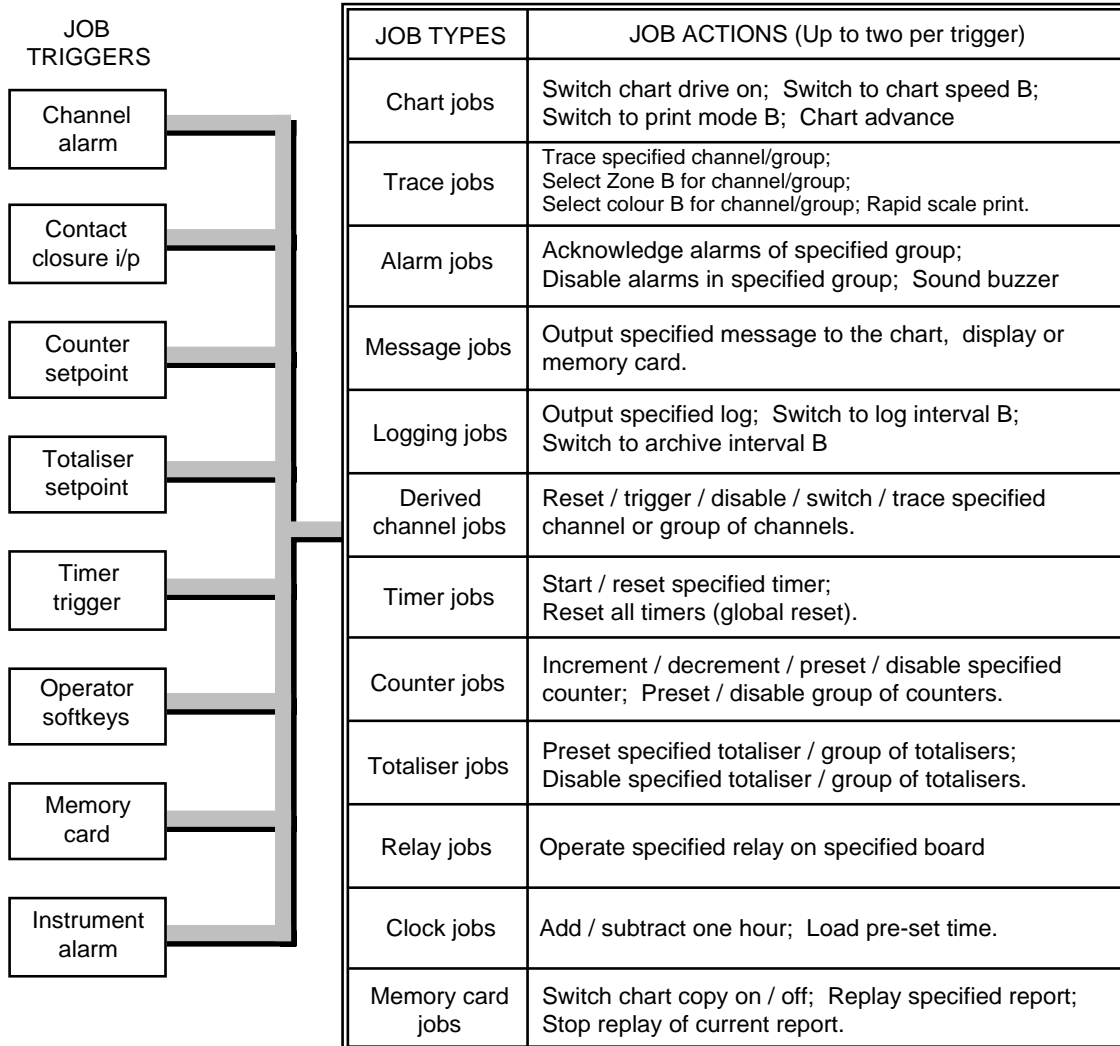


Figure 1.3.2 Recorder Jobs (triggers and actions)

1.3.2 RECORDER FUNCTIONS (Cont.)

MATHS PACK

The maths pack option comes in two versions called level 1 and level 2, both of which support 24 derived channels (multipoint) or 6 derived channels (continuous-trace), and differ only in the number of functions available. When the source channel is being selected, the default input channel can be changed to a derived channel (prefixed with a 'D') using the \pm key.

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	Continuous min/max
Channel / Group / Rolling averages	Polynomial
e^x	Relative humidity
$\log_e x$	Fvalue
10^x	Mass flow (linear and square root)
Rate of change	Zirconia probe
Sample and hold	Switch inputs
Channel min/max	Stopwatch
Latching min/max	Time stamp

CEM

Continuous emissions monitoring (CEM) combines maths pack level 2 option with the totalisers/counters/timers (TCT) option (described below).

1.3.2 RECORDER FUNCTIONS (Cont.)

TCT (TOTALISERS/ COUNTERS / TIMERS)

This option offers either 12 each (multipoint) or six each (continuous-trace) totalisers, counters and timers.

Totalisers. Each eight-bit totaliser function integrates a given input or derived channel's input, providing that it is above a low cut-off point AND below a high cut-off point AND the value is within the channel's range.

A setpoint value can be entered, and when this value is exceeded, up to two jobs can be triggered.

Counters. Each eight-character counter is controlled by other recorder functions via job lists:

1. Increment specified counter
2. Decrement specified counter
3. Pre-set specified counter or group of counters
4. Disable specified counter or group of counters

A setpoint value can be set up so that each counter can itself become a trigger when its value lies above (Limit high) or below (Limit low) the setpoint value.

A pre-set value can be entered using the numeric keys, and this value is loaded into the counter on the 'Pre-set specified counter' and / or 'Preset specified group of counters' trigger, according to configuration.

Counter values are held in battery supported memory. To maintain values, power must be maintained to the recorder whilst batteries are being changed.

Timers. Each timer can be configured to start at a specific time and date (using the real-time clock in the recorder). The timer will then run for a configurable time period (called its duration) and will repeat at a configurable rate. Alternatively, the timer can be initiated by a job, and it will then repeat at the configured repetition rate. Once initiated the timer function will continue until it is disabled.

Each timer can have up to two jobs allocated to it. The jobs are active for the timer duration.

Timer values are held in battery supported memory. To maintain values, power must be maintained to the recorder whilst batteries are being changed.

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	Counter pre-setting
Selection of log interval A/B	Totaliser presetting
Selection of Mode A/B	Timer control
Printer on/off -line selection	Memory card formatting
Alarm setpoint adjustment	Save / Restore configuration to/from memory card
Display group selection	Archive interval selection
Log initiation	Memory card on-off-line selection
Reset of derived channels	Memory card status / directory display

This page is deliberately left blank

SECTION 2 DAY-TO-DAY SERVICE

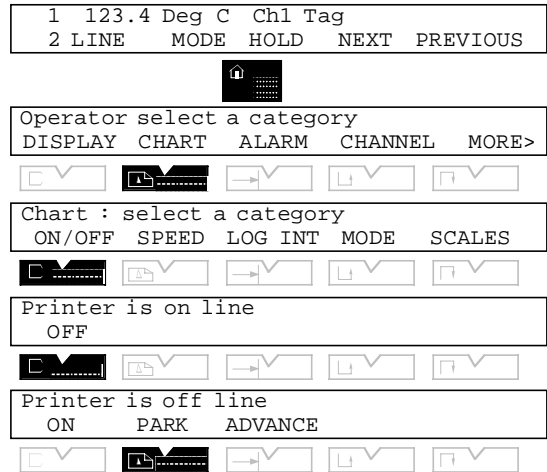
This section deals with chart and printhead cartridge replacement, and with simple preventive maintenance.

2.1 CHART REPLACEMENT

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 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.



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.

* To free the paper it may occasionally be necessary to release the platen, by lifting the latches as shown in figure 2.1b

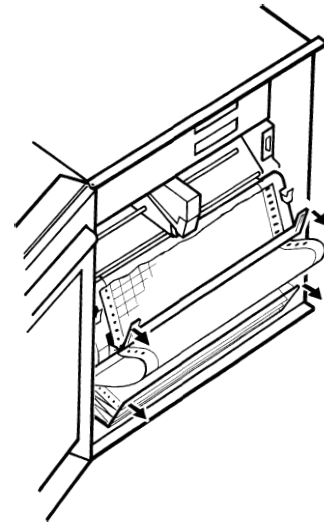


Figure 2.1a Chart removal

2.1 CHART REPLACEMENT (Cont.)

Release the platen by pushing upwards on 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 guide bar is clean and shiny. Check that the drive belt and flexi-cable for the printhead are in good condition.

If not, carry out remedial action as described in section 2.3 (guide bar) and 4.3 (pen tray).

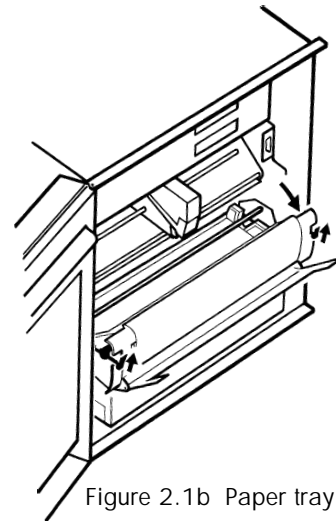


Figure 2.1b Paper tray access

Remove the new chart from its packing and fan (as shown in figure 2.1c) 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).

Load the chart into the upper tray (passing it under the tie-rod).

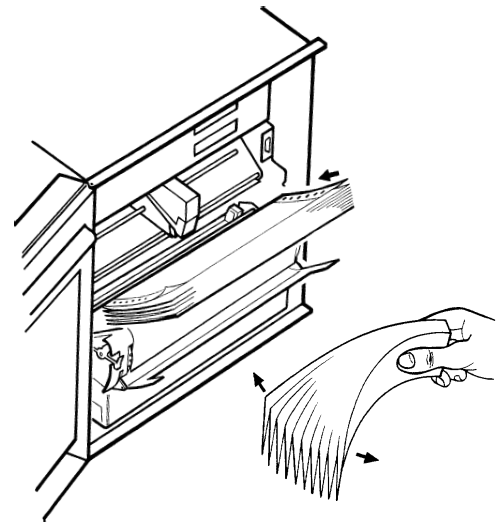


Figure 2.1c Chart loading (1)

Unfold the top two or three leaves, and pull them forwards under the tie rod as shown figure 2.1d.

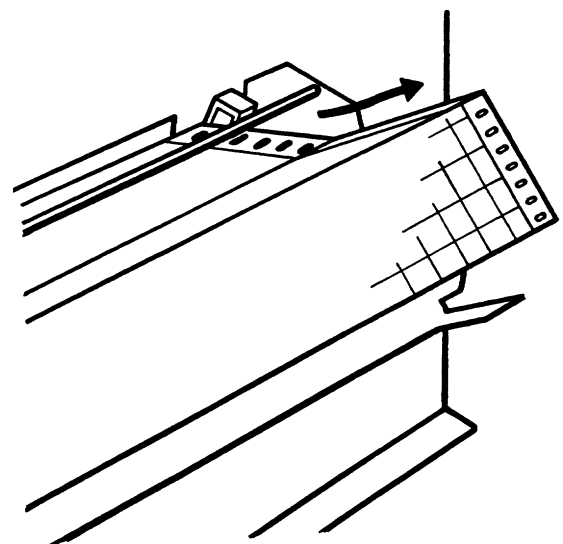


Figure 2.1d Chart loading (2)

2.1 CHART REPLACEMENT (Cont.)

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

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, with no red line showing.

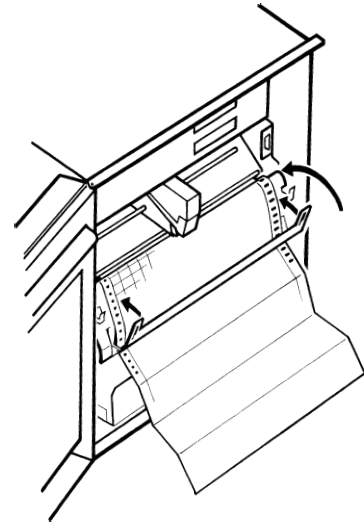


Figure 2.1e Chart loading (3)

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.

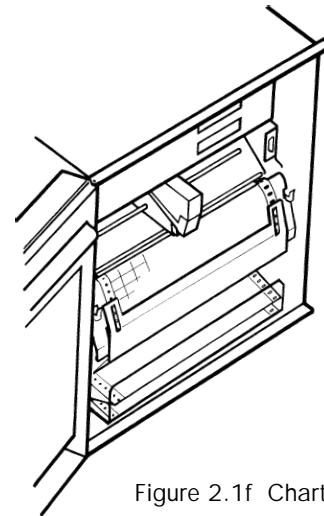


Figure 2.1f Chart loading (4)

2.2 PRINT CARTRIDGE REPLACEMENT

CAUTION

BEFORE ATTEMPTING TO CHANGE THE PRINTHEAD IT IS ESSENTIAL TO ENSURE

1. THE RECORDER IS NOT POWERED, OR
2. THE PRINTHEAD IS PARKED.

It is assumed that the replacement will take place with power applied. If not, carry out only points 2, 3 and 5 of the following:

1. Switch the printer off-line, and park the printhead as described in section 2.1 above.
2. Open the recorder door. Pull the print cartridge forwards to remove it.
3. Unpack the new cartridge and push it onto the carriage as shown in figure 2.2b. Ensure that it is pushed fully home.
4. Ensure that the pen lift bar (fig 2.2a) is pushed fully back. If not, gently push it back, or turn the recorder off then on again.
5. Close the door and return the recorder to service.

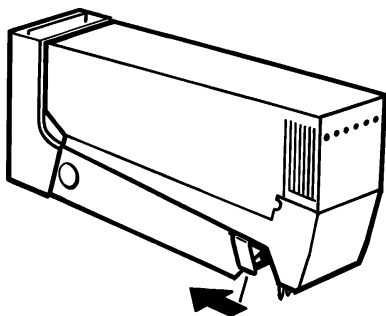


Figure 2.2a Pen lift bar

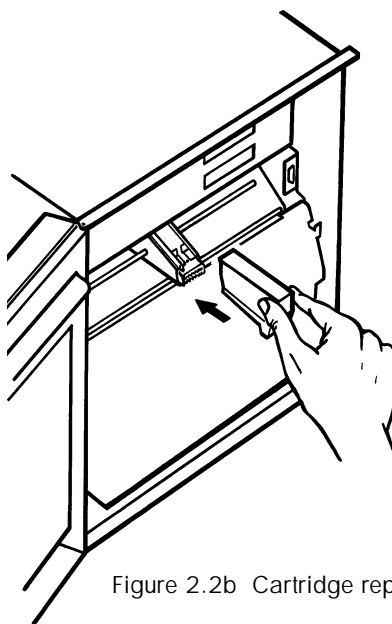


Figure 2.2b Cartridge replacement

2.3 PREVENTIVE MAINTENANCE

The recorder is generally maintenance-free. It is recommended, however, that each time the chart is replaced, any accumulations of paper dust are removed.

Should the guide bars appear to be dirty, clean them with a lint-free cloth moistened with a small amount of iso-propyl alcohol. Lubrication with oils or greases should be avoided, since this will lead to accumulations of paper dust building up on the guide bars, to the detriment of the printhead movement.

Cleaning of the case and door should be undertaken using a damp cloth and any non-abrasive, proprietary, surfactant cleaner. Particular care should be taken not to scratch the display window.

SECTION 3 FAULT FINDING AND DIAGNOSTICS

3.1 FAULT FINDING GUIDE

3.1.1 Recorder completely inoperative

- Loss of power
1. Check that the recorder is switched on ('A' in figure 3.1.1a)
 2. Check the supply voltage and its wiring to the rear of the recorder (figure 3.1.1b)
 3. Check the supply voltage fuse (figure 3.1.1b)
 4. Open the recorder door, and undo the two writing system retaining screws ('B' in figure 3.1.1a). With power off, pull the writing system forwards and check the integrity of the power and I/O connectors (figure 3.1.1c). Switch the recorder on and check if the green LED immediately to the right of the I/O connector is on (steadily or flashing). If not - check the power supply loom and replace if faulty. If the loom is OK, replace the power supply. If it is flashing, the micro-processor system is operating incorrectly; - replace the control board.

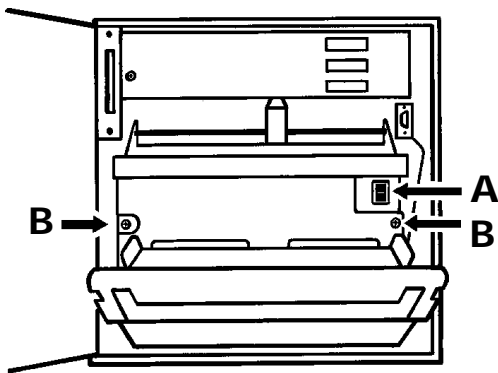


Figure 3.1.1a
On-off switch and retaining screws

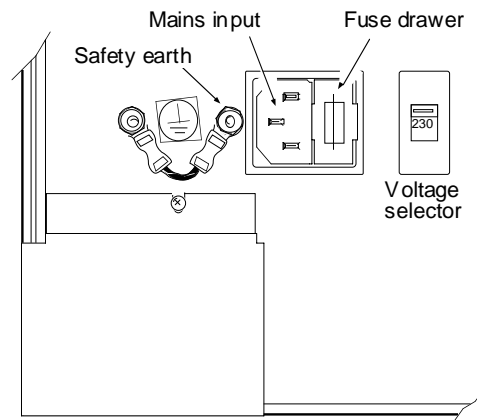


Figure 3.1.1b Supply voltage components
(at rear of recorder)

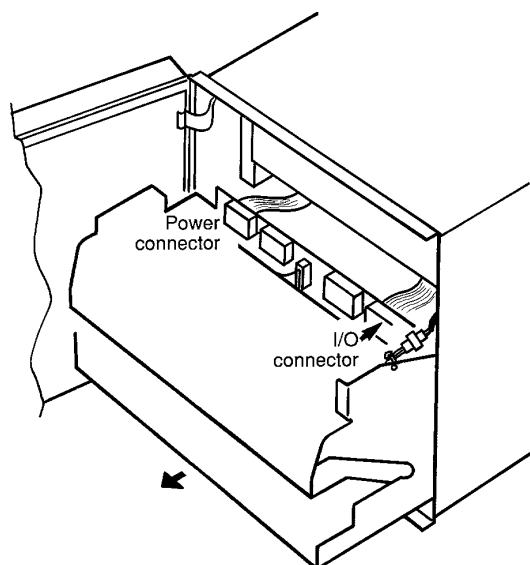


Figure 3.1.1c Power and I/O connectors

3.1.2 Chart drive not working correctly (rest of recorder operating properly)

Printer off-line	Use the operator menu to set the printer on-line.
Channel config.	All channels set to trace OFF, or Trace Conditional (chart controlled by job action). Use Channel Configuration : Trace, to reconfigure if required.
Paper problem	Paper incorrectly aligned with sprocket holes, or folding incorrectly into the take-up tray. Refer to the Chart Replacement section for guidance.
Drive problem	With the recorder door open, observe the 'Watchdog' LED on the control board (figure 3.1.2). If this is flashing, replace the drive board. If the LED is on, switch the printer off-line and remove the chart. Press the chart ADVANCE softkey. The chart drive sprockets should wind rapidly forwards for about five seconds. If not, check the drive belt (located at the right-hand side of the cassette). Switch the recorder off. Check that the motor loom is undamaged and that it is properly connected into the writing system circuit board (CON 8). If so, release the circuit board, and taking the relevant static precautions, inspect the motor driver (IC3) for damage. If there is damage, check the resistance between pins 1 and 2 and between pins 3 and 4 of the motor connector. If either of these measurements lies outside the range 5 to 15 Ohms, replace both the control board and the drive motor. If there is no apparent damage to IC3, carry out the resistance measurements just described. If the resistances lie outside the range, replace the motor. If the resistance measurements are correct, replace the control board.

3.1.3 Printhead carriage not moving properly

Printer off-line	Use the operator CHART menu to set the printer on-line.
Pen parked	Use the operator CHART menu to release the printhead.
Drive problem	Open the recorder door and check the printhead drive belt condition (including whether the printhead is correctly attached to it). See section 4.3 for details. If so, observe the 'Watchdog' LED on the control board (figure 3.1.2). If this is flashing, replace the drive board. If the LED is on, switch the recorder off. Check that the motor loom is undamaged and that it is properly connected into the writing system circuit board (CON 7). If so, release the circuit board, and taking the relevant static precautions, inspect the motor driver (IC2) for damage. If there is damage, check the resistance between pins 1 and 2 and between pins 3 and 4 of the motor connector. If either of these measurements lies outside the range 5 to 15 Ohms, replace both the control board and the drive motor. If there is no apparent damage to IC3, carry out the resistance measurements just described. If the resistances lie outside the range, replace the motor. If the resistance measurements are correct, replace the control board.
Hall effect device	The printhead has a datum position defined by a Hall-effect device being operated by a magnet associated with the print head. If the device is not being switched, or if the printhead flexible cable carrying the signal is damaged, the printhead will drive to the left hand mechanical limit and oscillate up against it before trying to print. Because it has no datum position the printing is not correctly positioned. This 'buzzing' up against the side wall, followed by inaccurate printing is repeated until power is removed and the fault repaired by replacing the pen tray or control board.

3.1 FAULT FINDING GUIDE (CONT.)

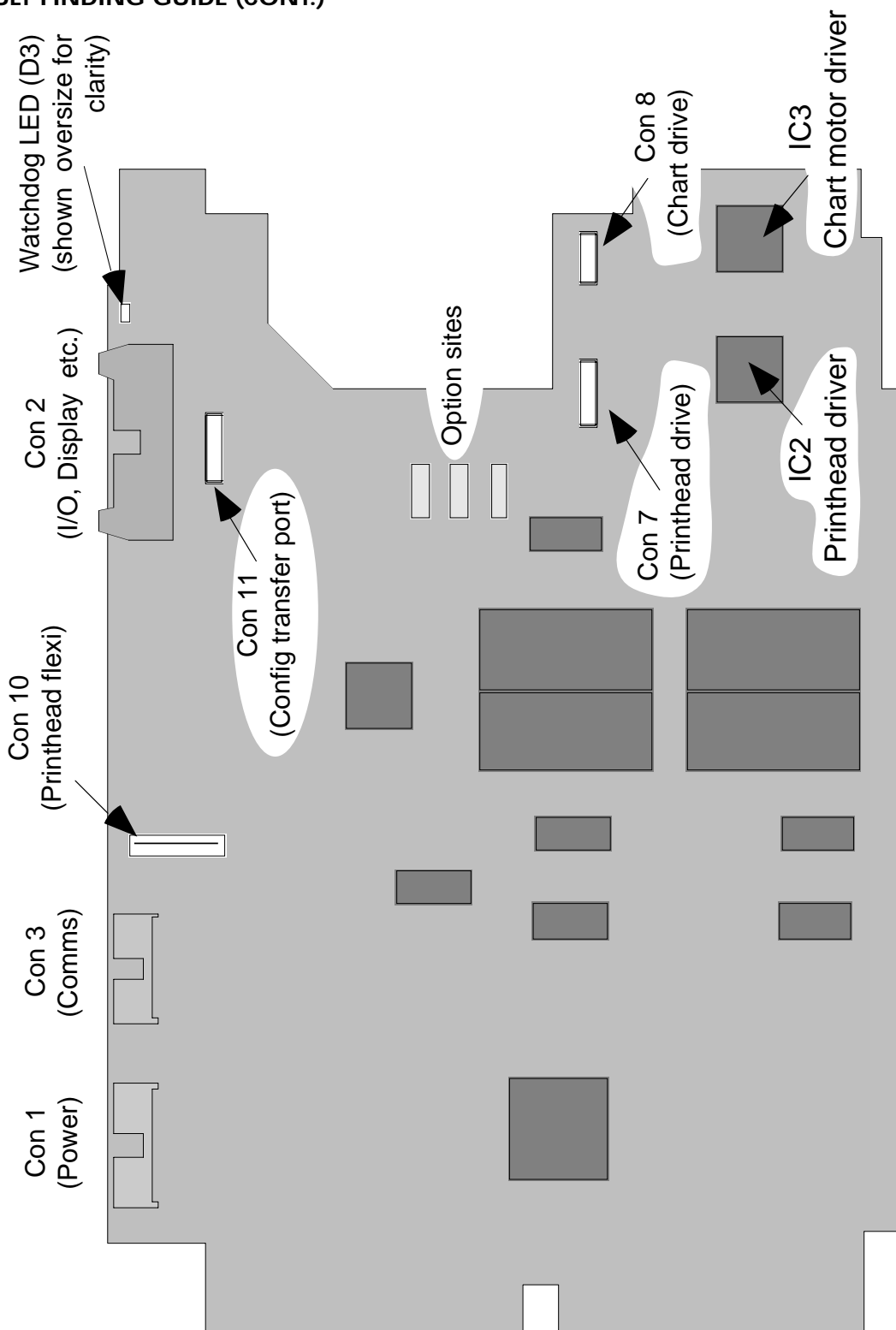


Figure 3.1.2 Connector and LED locations

3.1.4 Traces not appearing

IF NO TRACES APPEAR:

Printer off-line	Use the operator CHART menu to set the printer on-line.
Pen parked	Use the operator CHART menu to release the printhead.
Cartridge	Cartridge not fitted or not pushed fully home.
Pen lift bar	To prevent blotting when power is off, the pen tips are lifted off the chart by a solenoid operated 'bar' which is pulled out of the way by a voltage pulse during switch-on. Once the solenoid has 'pulled in', the voltage across it is reduced to a holding voltage in order to reduce power drain. Whilst replacing the pen cartridge, it is possible inadvertently to pull the bar forward with the fingers. As the holding voltage is insufficient to pull the bar back, when the cartridge is pushed into place, all the nibs are held off the chart. Either switch the recorder off, then on again, or gently push the bar back, until it pulls into place.
Configuration	Channel traces switched off or conditionally off. Check Channel Configuration TRACE.

TRACE MISSING

Go into diagnostics (Section 3.3) and operate the PENS softkey. The recorder prints six lines of TgTgTgTgTgTgTg across the full width of the chart in violet, followed by six lines in blue, then green, brown, red and finally black. If any of the colours fails to print, replace the colour cartridge. If this fails to solve the problem, replace the printhead mechanism.

If all the colours print correctly, check channel configuration (TRACE) for the problem channel(s).

If configuration is OK, replace the input board.

3.1.5 Display not operating (rest of recorder operating normally)

Board / loom problem	If the keyboard operations 'beep', but the display is not operating, replace the display board. If keyboard operations do not 'beep' and the display is not operating, check the status LED, visible through a small aperture in the inside of the door (central, just below the chart illumination lamp cover). If this LED is continuously on, check the harness between the display board and the control board (CON2) If the loom is undamaged, replace the display board and if this fails to cure the problem, the membrane keypanel. If the LED is flashing, replace the display board If the LED is off, check the harness between the door and the Control board. Replace if necessary.
----------------------	--

3.1.6 Process variables outside specified tolerance

Input open circuit	Check sensor leads and terminations
Configuration	Check that input ranges, scales, printing zones etc. are as required. For thermocouples, check wiring polarisation and CJ type and setting.
Environment	Check that ambient temperature and humidity are within specification limits.
Faulty input board	May affect one or more channels - Replace the board.

3.1.7 Chart illumination switching on and off regularly.

5 V power 'shorted'. Successively disconnect all the ribbon cable connectors, starting at the door, then the I/O boards, then CON 2 on the control board*. If the LED (D3) on the control board is not now illuminated continuously, sequentially disconnect CON7 (printhead), then CON 8 (chart drive). If none of this results in the continuous illumination of D3, replace the control board, and if this does not solve the problem, replace the power supply unit.

* For Control board component locations see figure 3.1.2

3.2 CALIBRATION

This section describes a means by which the calibration of I/O 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 in 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 multi-point 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 (IC4) 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 mV)
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 set-up 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.)

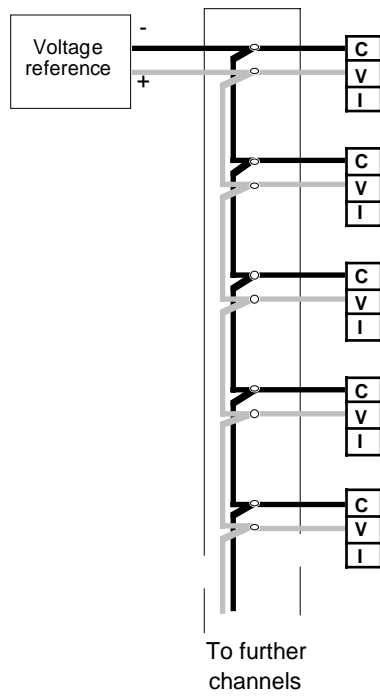


Figure 3.2.1
DC calibration check wiring (8 channel board)

Input range (mv)	Check points (mv)										Max tol. (± mV)
	1	2	3	4	5	6	7	8	9	10	
-10 to + 40 mV	-10	-4.4	1.1	6.7	12.2	17.8	23.3	28.9	34.4	40	0.06
-50 to + 200 mV	-50	-22.2	5.5	33.3	61.1	88.9	116.7	144.4	172.2	200	0.33
-500 to +1000 mV	-500	-333	-167	0	167	333	500	667	833	1000	1.18
-5000 to +10000 mV	-5000	-3333	-1667	0	1667	3333	5000	6667	8333	10000	27.4

Table 3.2.1 DC 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.

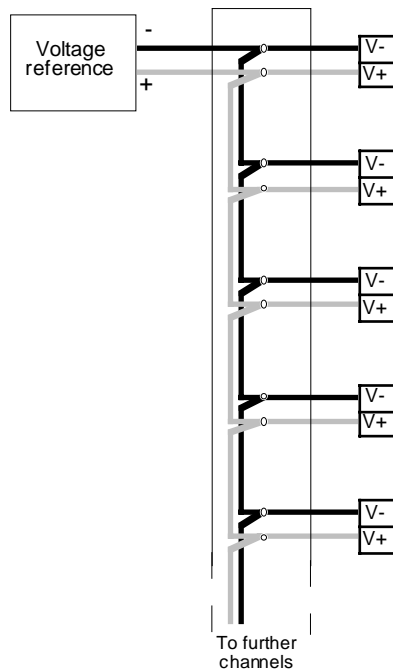


Figure 3.2.2 DC calibration check wiring (16 channel board)

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	0.13
-1500 to + 5000 mV	-1500	-780	60	670	1390	2110	2830	3560	4280	5000	14.7

Table 3.2.2 DC 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 $1.3^\circ \pm$ 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 k Ω (Absolute accuracy: 5 m Ω)

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.

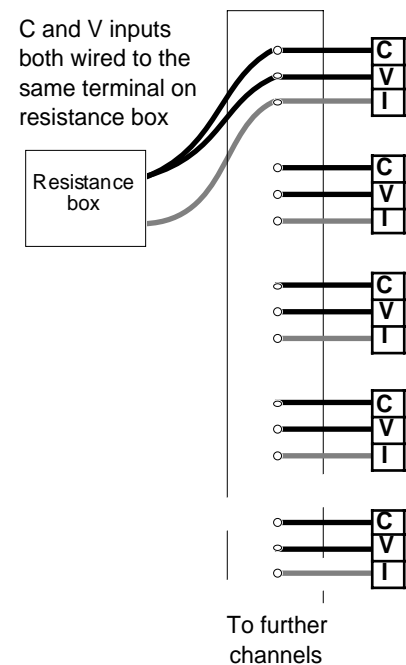


Figure 3.2.4 Resistance wiring

* 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. ($\pm \Omega$)
	1	2	3	4	5	6	7	8	9	10	
0 to 180 Ω	0	20	40	60	80	100	120	140	160	180	0.185
0 to 1800 Ω	0	200	400	600	800	1000	1200	1400	1600	1800	1.33
0 to 10k Ω	0	1120	2240	3360	4480	5600	6720	7840	8960	10000	5.7

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 information 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 PENS

Operation of this softkey causes lines of TgTgTgTg to be printed across the width of the chart in violet. Other pens are selected for test using the softkeys.

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

Note: This softkey does not appear with continuous-trace recorders

This softkey allows two analogue channels to be exercised so that their actual outputs can be compared with their required outputs. All other analogue output channels on the board are set to their 'On error' status (see section 4.4.2 of the Installation and Operation manual).

```
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 using the page keys, the next slot fitted, will appear. When all the AO channels have been scrolled through, the first AO board is returned to.
n	Channel number	Pairs of channels which can be scrolled-through using the Page keys
±DDDDD.DD	Control value	User entered control value in engineering units (UUUUU).
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).

3.3.6 CJ TEMP

Operation of this softkey causes the temperatures being measured by the cold junctions associated with the first relevant I/) 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.

3.3 DIAGNOSTICS (Cont.)

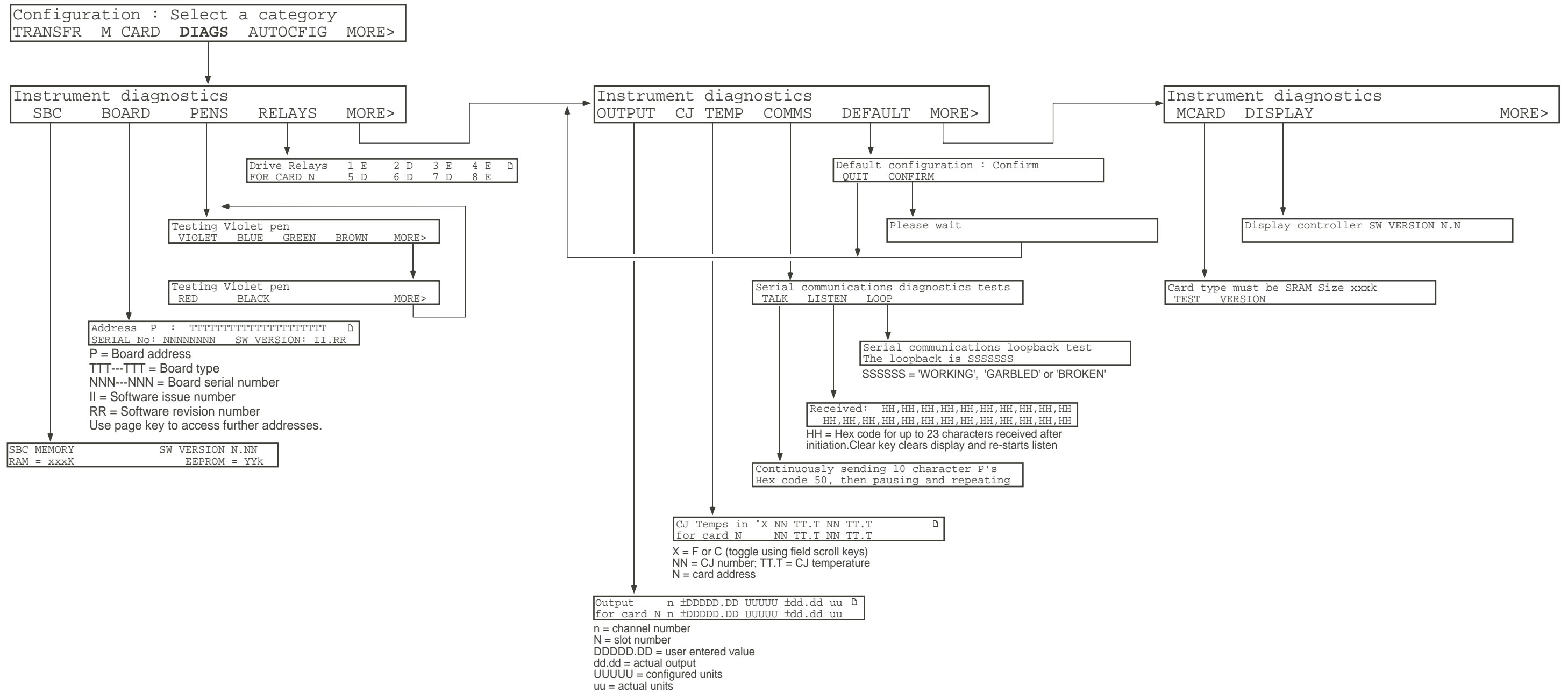


Figure 3.3 Diagnostics menu

This page is deliberately left blank

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 channel can be adjusted to the required range for non-standard inputs, how the print-head is aligned with the chart calibration marks, and how to calibrate input channels. The adjustments are described in Input, Output, Chart and Calibration subsections.

3.4.1 Input adjust

APPLY

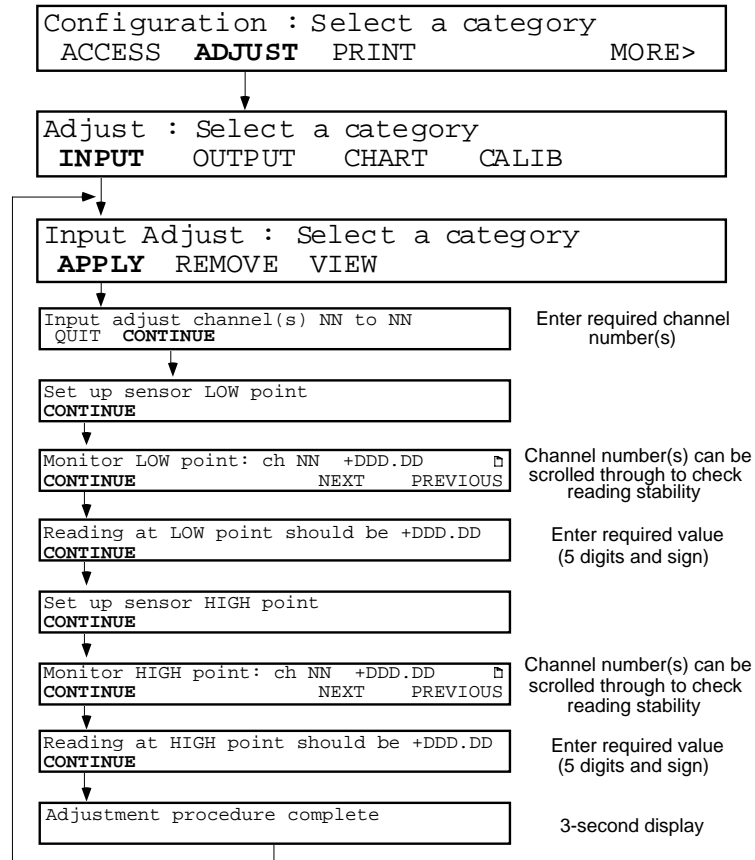


Figure 3.4.1 Channel Input Adjust menu

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 DDDDDDDDDDDDDDDDDDDDD unadjusted  D
```

```
NN DDDDDDDDDDDDDDDDDDDDD adjusted    D
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 an analogue output channel 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 step 1 for a high point.

The output board then calculates new offsets 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 way similar to that described above for input channels
3. Adjust is not available for channels with 'Constant' selected as input source.

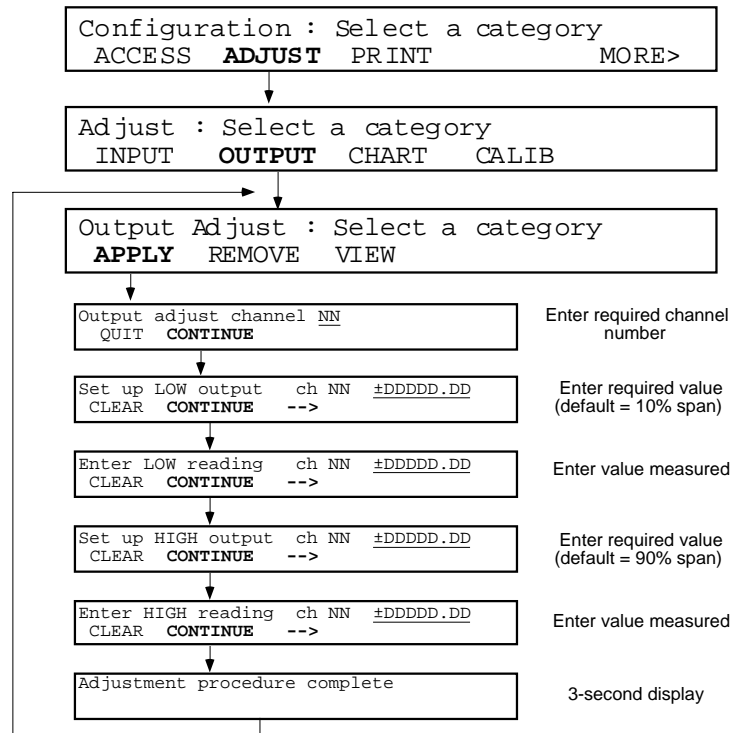


Figure 3.4.2 Output channel adjust menu

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, centre and full scale calibrations of the chart. The display changes as follows:

```

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

The ALIGN softkey is used as many times as is necessary to set the central line as straight as possible.

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

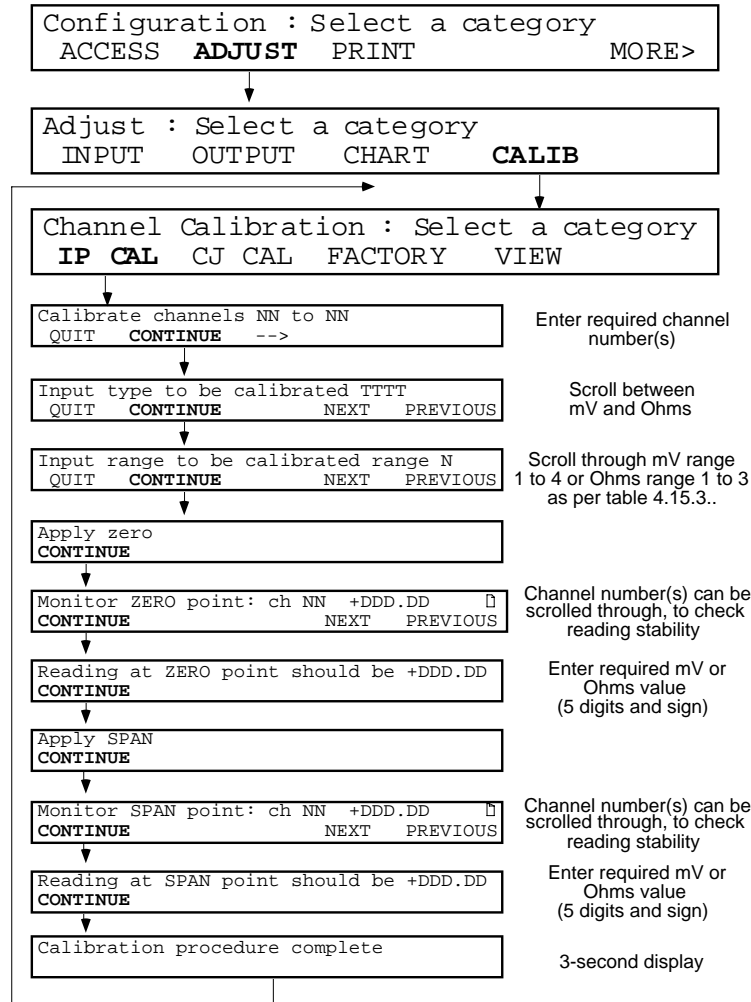


Figure 3.4.4 Input channel calibration menu

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

3.4.4 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.

3.4.3 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 DDDDDDDDDDDDDDDDD cal being used  [ ]
Input : FFFFFFFF Cold junction : FFFFFFFF
```

where NN is the channel number, DDD — DDD is the channel descriptor and FFFFFFFF 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 which should be 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 HA246958 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 available. 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 the 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 type.

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

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

3.5 RECORDER MESSAGES (CONT.)

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
```

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
```

3.5 RECORDER MESSAGES (CONT.)

> RANGE

This appears whenever the value of the input signal lies above the currently selected hardware range.

< RANGE

This appears whenever the value of the input signal lies below the currently selected hardware range.

BAD RNG

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

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.

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.

ERROR

This message appears when there is a hardware fault on the relevant input 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 ANALOGUE CHANNELS CONFIGURED

This message appears, for multipoint recorders only, when the OUTPUT diagnostics key is operated, but no analogue channels have been configured. Continuous-trace recorders do not support analogue output boards.

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 input board is processing the requested range configuration.

This page is deliberately left blank

SECTION 4 REPLACEMENT PROCEDURES

CAUTION

When removing or fitting circuit boards, looms/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) whilst power is 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 PRINT softkey in the top level configuration menu, followed by ALL, by using the configuration transfer facility or by using the memory card (if fitted).

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

4.1.1 Print configuration

This allows the instrument configuration to be printed on the chart.

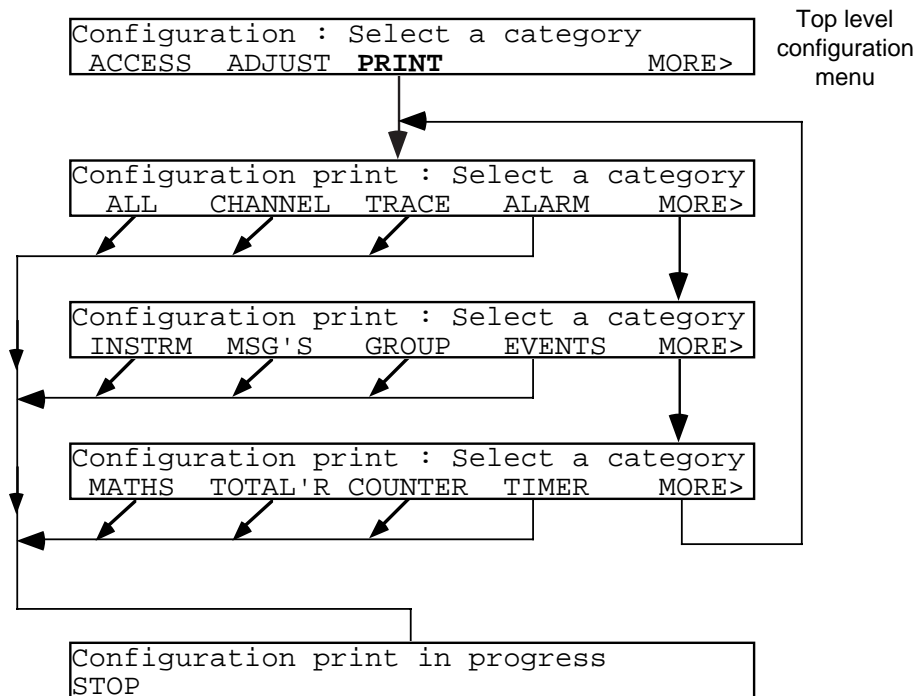


Figure 4.4.1 Configuration print

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 to the right of, and just above the chart cassette. 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

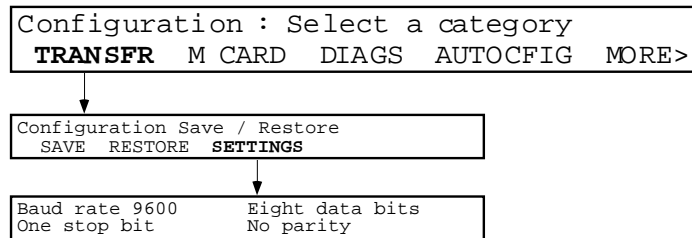


Figure 4.12 Configuration-transfer configuration

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 above the right hand end of the chart cassette. 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

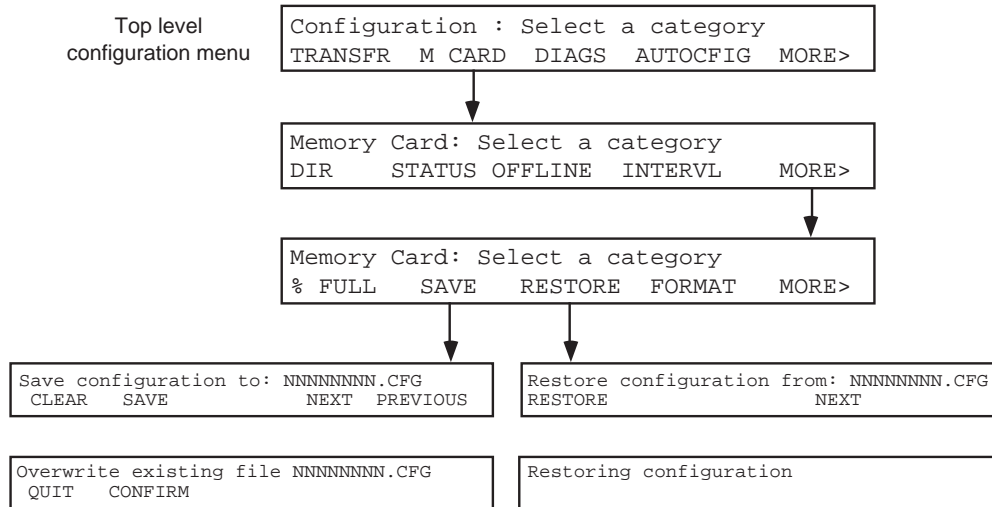


Figure 4.1.3 Memory card configuration pages

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 (or the QWERTY keyboard if this is a graphics recorder). 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 (or the field scroll keys if this is a graphics recorder) is used to scroll through the files on the card. See the Memory card manual (HA247361) 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 printhead cartridge.

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

Pull the writing system forwards until it reaches its stops. Lift the writing system out of the case, releasing any relevant connectors as they become accessible.

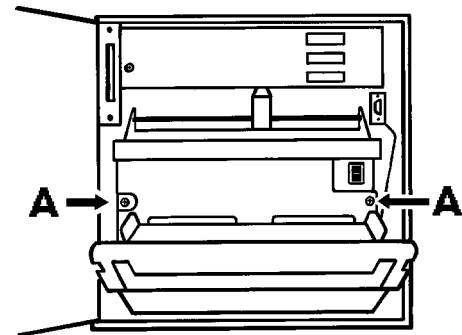


Figure 4.2 Writing system securing screw locations

4.3 PEN TRAY SERVICING

CAUTION

The printhead mechanism is susceptible to damage due to the discharge of static electricity. All relevant personnel must be aware of static handling procedures. If in doubt, reference should be made to the section entitled 'Static Electricity' in section i, at the beginning of this manual.

4.3.1 Printhead drive belt replacement

The printhead mechanism carriage has two 'teeth' on the same pitch as the drive belt. The removal of a broken or worn belt is therefore, a simple matter of sliding the remains of the belt out of mesh with the printhead.

To fit a new belt, lay it in position, ensuring that it is round the motor pinion and the idler pinion at the left end of the pen tray. Then, as shown in figure 4.3.1a, rotate the motor pinion with one finger, whilst guiding the belt round the remaining (right-hand) pulley. Once the belt is fitted correctly round all the pinions, slide the printhead to approximately its centre of travel, and slide the belt into mesh with the carriage teeth (figure 4.3.1b). No tensioning or setting up is required.

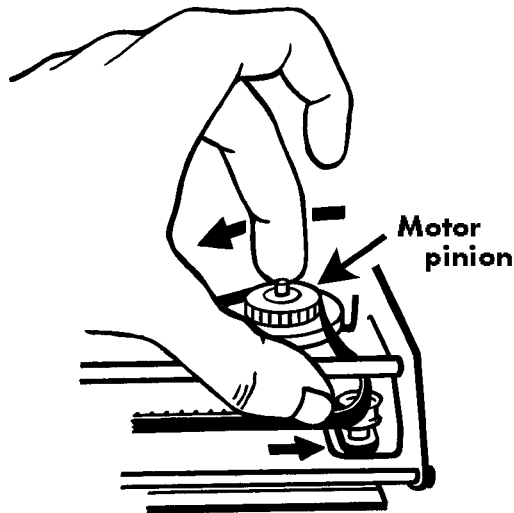


Figure 4.3.1a Fitting a new printhead drive belt

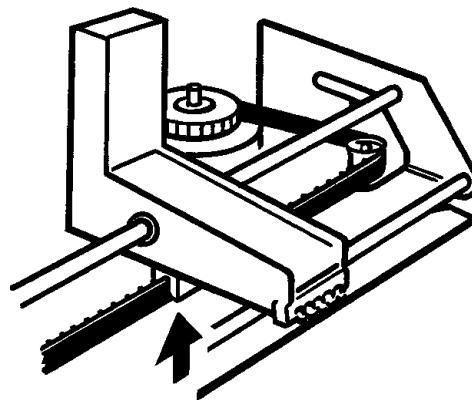


Figure 4.3.1b Meshing the printhead

4.3.2 Removing the pen tray

At the rear of the writing system, release the pen tray connector (A in figure 4.3.2a).

At the front of the writing system, if the printhead cartridge has not already been removed, remove it now (figure 4.3.2c) and store it in a suitable container.

Carefully slide the outer housing of the flexi-cable connector away from the fixed part as far as it will go ('B' in figure 4.3.2b). Pull the flexi cable ('C' in figure 4.3.2b) free.

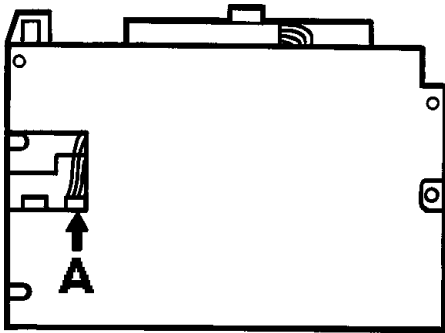


Figure 4.3.2a
Printhead drive motor connector

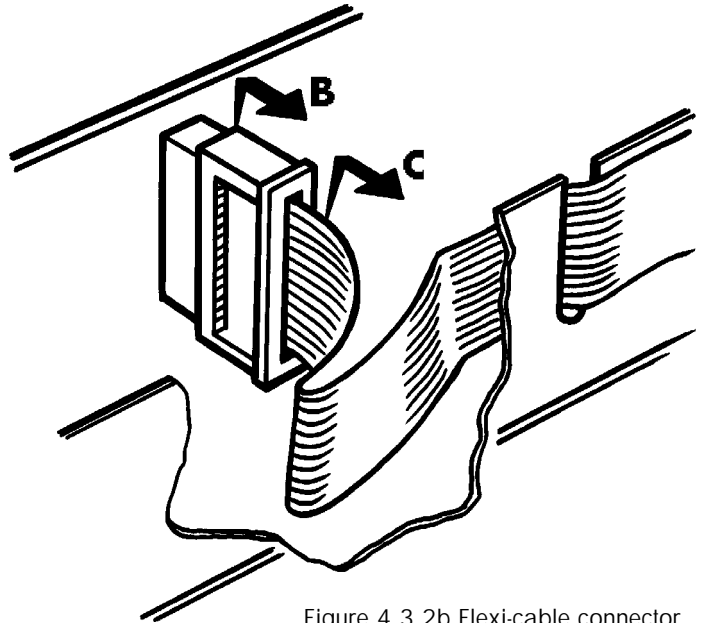


Figure 4.3.2b Flexi-cable connector

If the pen tray is to be completely removed, use a suitable (M3) spanner (wrench) to remove the securing nut for the safety earth stud located towards the left end of the pen tray

Use a suitable screwdriver (e.g. 1/4" Stubby) to undo the captive screw which secures the pen tray to the chassis (figure 4.3.2c).

The pen tray can now be tilted sufficiently to allow access to the printhead drive motor, or if the earth link has been removed, the pen tray can be removed from the chassis and placed in a suitable static-safe environment.

If the motor assembly is to be removed, this is accomplished by releasing its two securing screws ('D' in figure 4.3.3a below).

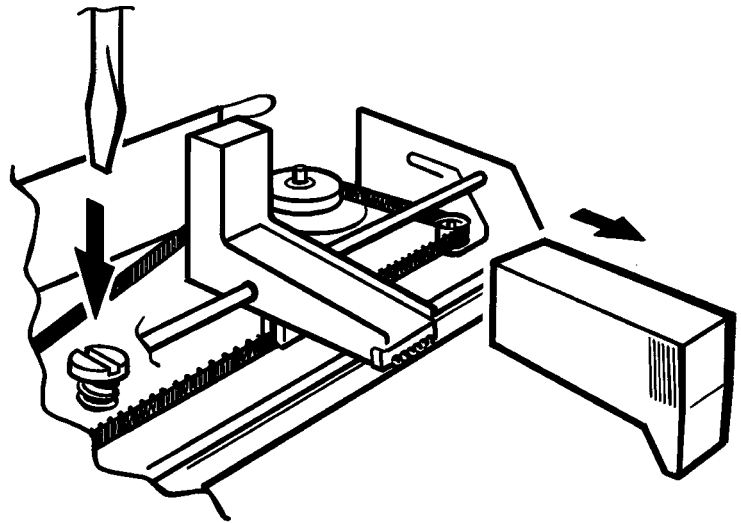


Figure 4.3.2c Pen tray removal

4.3.3 Re-fitting the pen tray

Refitting the pen tray is essentially the reverse of the procedure given above for its removal.

When physically returning the pen tray to the chassis, ensure that it is located correctly on the two vertical locating pins ('E' in figure 4.3.3a), and that the earthing link is re-connected securely.

When re-fitting the flexi-cable, ensure that it is fully inserted (the thicker (wider) part of the track only just protruding from the connector when the housing is pushed home), and that it is not tilted in the vertical plane as it emerges from the connector.

CAUTION

Failure to ensure correct fitting of the flexi-cable into the connector can result in damage being caused to the recorder electronics.

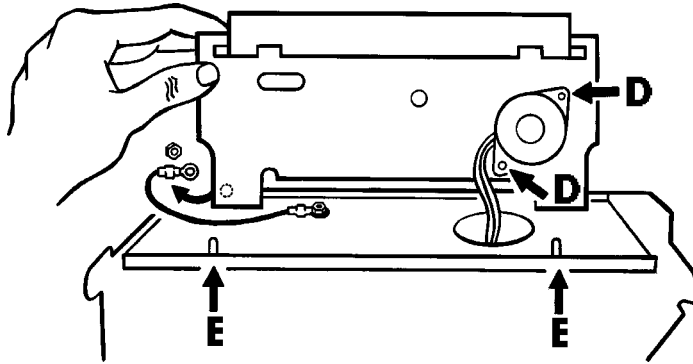


Figure 4.3.3a Printhead drive motor and pen tray alignment spigots

Once physically in place, remake the pen tray connection with the control board, located as shown in figure 4.3.2a above

4.4 PAPER TRANSPORT SYSTEM SERVICING

4.4.1 Drive belt replacement

Remove the writing system from the recorder as described in Section 4.2 above.

Remove the damaged belt by sliding it off the sprocket drive pinion (A in figure 4.4.1). Remove any trapped paper dust or other foreign matter using a brush and compressed air (if available).

Fit the new belt round the motor pinion (B), then slide it over the sprocket pinion. There are no tensioning or setting-up procedures to be followed.

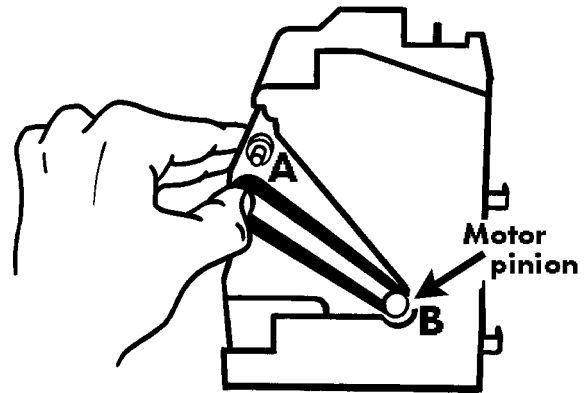


Figure 4.4.1 Chart drive belt replacement

4.4.2 Cassette removal

Remove the printhead ribbon cartridge and the chart.

At the rear of the writing system, disconnect the chart drive motor connector from the control board (figure 4.4.2a).

Applying gentle leftwards force on the lower paper tray, disengage it from its right-hand locating pin as shown in figure 4.4.2b. The lower paper tray can now be removed.

With the lower tray removed, the cassette can be rotated forwards sufficiently to allow it to be pulled up and out of the chassis (figure 4.4.2c).

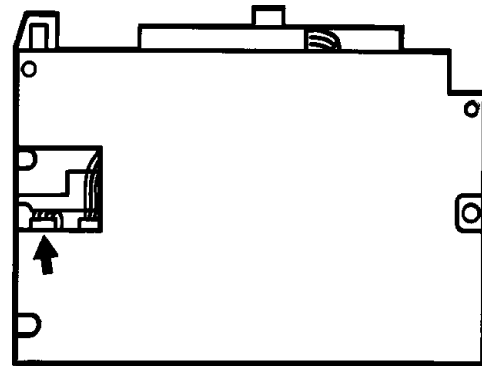


Figure 4.4.2a Chart drive motor connector

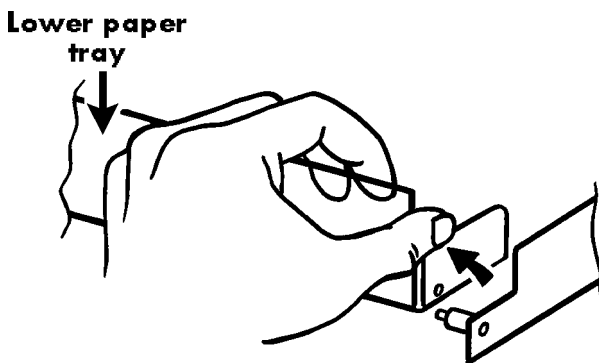


Figure 4.4.2b Lower paper tray removal

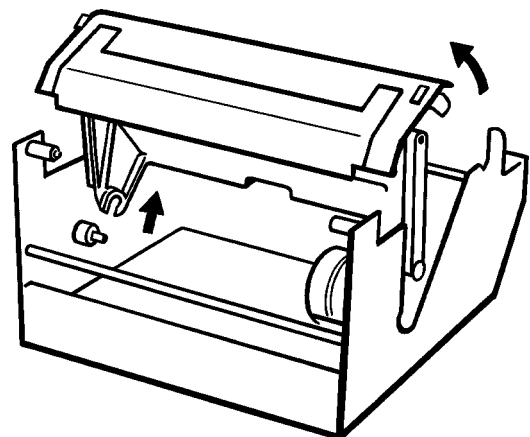


Figure 4.4.2c Cassette removal

4.4.3 Chart drive motor replacement

Access can now be gained to the chart drive motor assembly as shown in figure 4.4.3.

If the motor is to be replaced, remove the drive belt as described above.

When removing the motor note the locations of any washers/spacers etc. so they can be re-fitted correctly at re-assembly.

On re-assembly, tighten the motor screws sufficiently to hold the motor in place. Fit the drive belt, then whilst pushing the motor side-ways to take up any slack in the belt, tighten the motor screws fully.

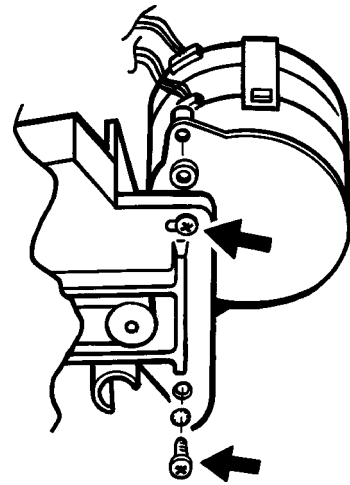


Figure 4.4.3
Chart motor assembly

4.4.4 Replacement of plastic paper guide

The plastic paper guide is removed by pushing upwards as shown in figure 4.4.4.

To replace the paper guide, offer it up to the two location pins, and push the paper guide firmly into position, ensuring that it can be pivoted easily.

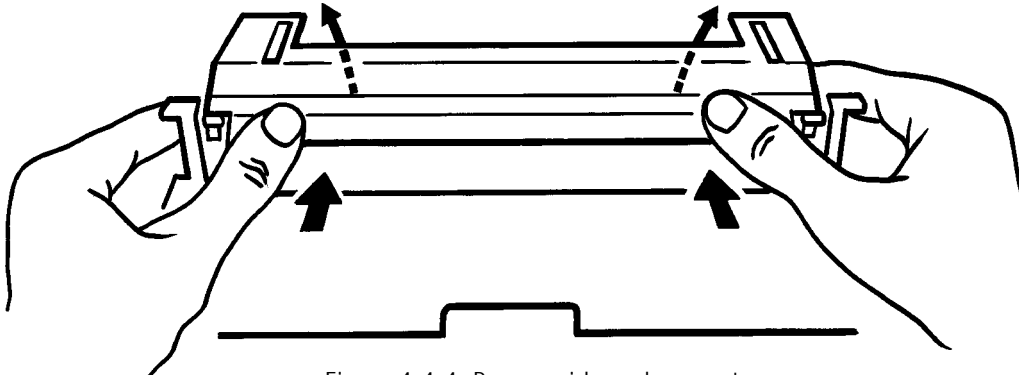


Figure 4.4.4 Paper guide replacement

4.4.5 Re-fitting the cassette

Offer the cassette up to its two pivots, and rotate it if necessary to allow it to slide into position.

Spring the lower paper tray into position.

Re-connect the chart drive motor at the rear of the writing system. Ensure that the harness is kept clear of the metal bulk-heads, as shown in figure 4.4.5.

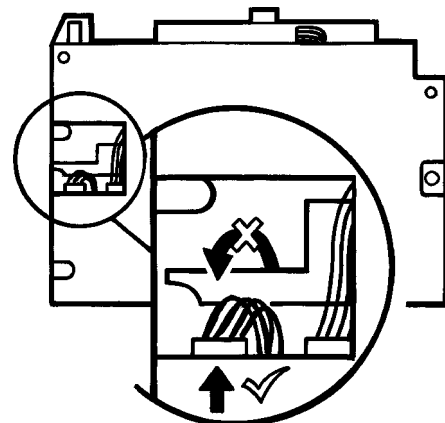


Figure 4.4.5 Chart drive motor connector

4.5 BATTERY PACK REPLACEMENT

In order to maintain the real-time clock, and any counter, timer, totaliser or volatile maths values (e.g. averages) this procedure should be carried out with the recorder powered, and switched on.

At the rear of the recorder, remove the battery pack by undoing its securing screw and disconnecting the connector.

Gently prise the exhausted battery pack from the adhesive pad which holds it to the cover.

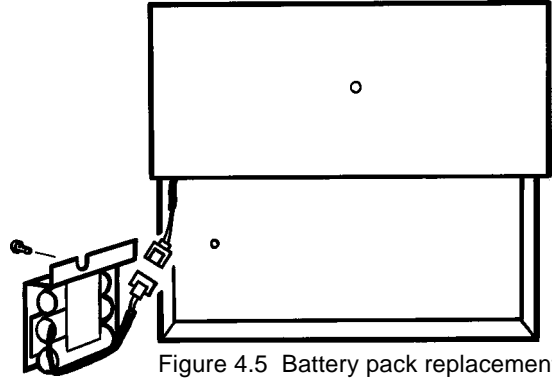


Figure 4.5 Battery pack replacement

Fit the new battery pack to the adhesive pad with the cable form emerging at the left as shown in figure 4.5.

Re-make the connector, and routing the cable as shown, re-fit the cover/battery assembly to the recorder, ensuring that the lugs on the cover are located in the relevant slots in the case. Secure the assembly using the securing screw previously removed.

4.6 DOOR SERVICING (NON-GRAPHICS RECORDERS)

This procedure allows access to all parts of the door assembly. Follow only those parts of the procedure which are relevant to your requirements. See also section 2 for chart illumination retrofit instructions

4.6.1 Chart illumination lamp replacement

WARNING!

The recorder should be isolated from mains (line) power before any attempt is made to replace the fluorescent tube used for chart illumination.

WARNING!

The exhausted tube must be disposed of carefully. Should the tube break, avoid inhalation of the fluorescent, powdery substance on the inside of the tube.

Isolate the recorder from line power. Open the recorder door and remove the plastic cover / reflector which protects the fluorescent tube. Rotate the tube through 90° and pull it 'away' from the door, out of its end connectors (Figure 4.6.1). Dispose of the tube carefully.

Rotate the new tube such that the pins at each end will enter the connectors located at the door. Carefully push the tube home, then rotate it 90°. Spring the plastic cover / reflector into place. Re-apply power to the recorder, switch on and check that the lamp is illuminated.

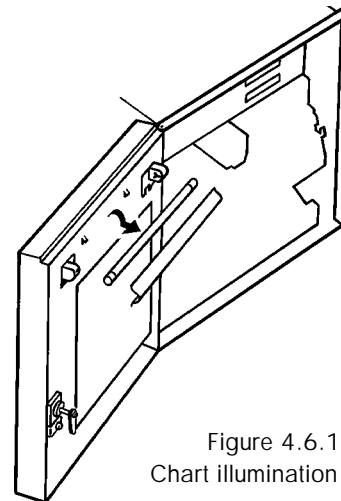


Figure 4.6.1
Chart illumination lamp

* CAUTION

The tube must be rotated 90°, otherwise a heater circuit will not be completed, leading to the early failure of the new tube.

4.6.2 Display board access

WARNING!

The recorder should be isolated from mains (line) power before any attempt is made to carry out the following procedure.

Note: Figure 4.6.2 shows this procedure being carried out with the chart illumination tube fitted. The procedure is similar for recorders without chart illumination.

Release the chart illumination plate by undoing the four securing screws ('A' in figure 4.6.2), carefully retaining the screws and washers for later re-assembly. The plate can now be removed, if required, by removing the earthing link ('B' in the figure) and, if fitted, disconnecting the chart illumination tube connector ('C' in the figure).

Carefully disconnect the ribbon cable and flexi-cable from their connectors on the display board

Remove the hexagonal spacers ('D') using an M2.5 (5 mm across flats) spanner (wrench) or 'nut runner'.

The display board can now be removed by undoing the two screws ('E')

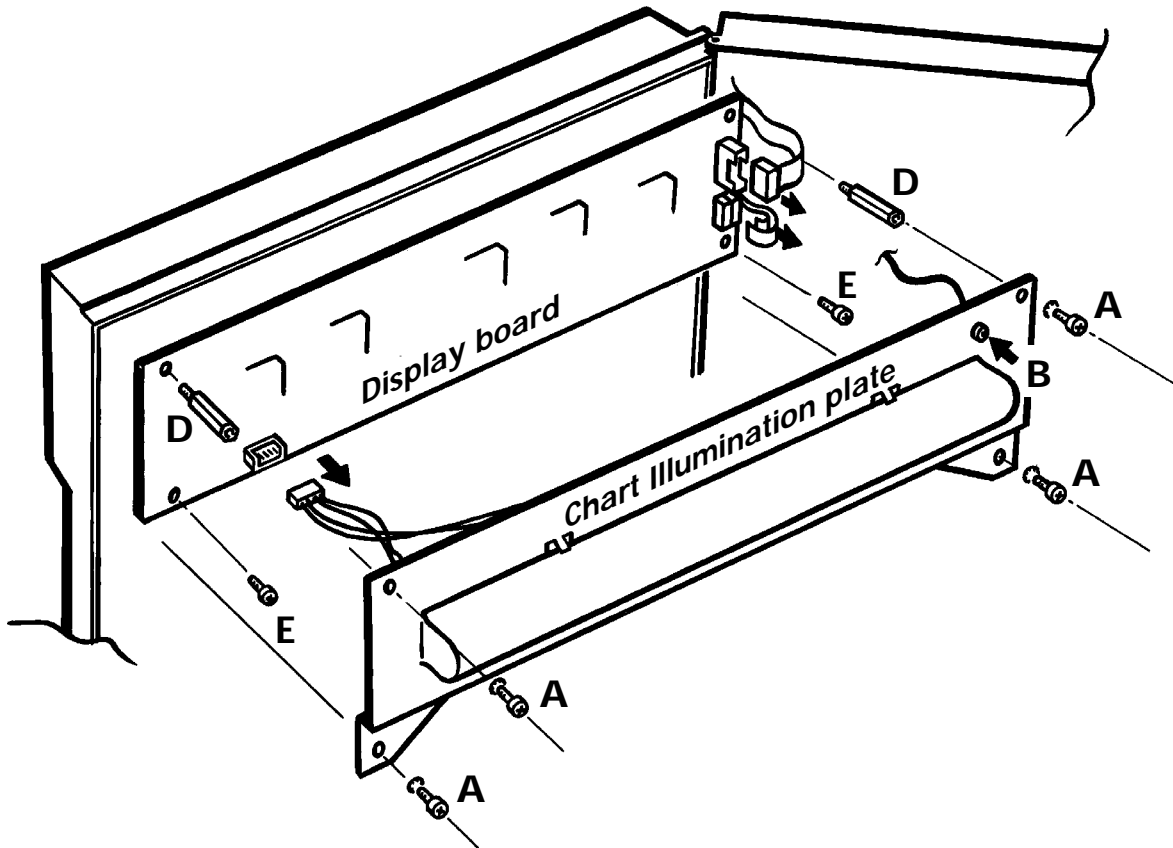


Figure 4.6.2 Door component access.

4.6.3 Keyboard replacement

With the display board removed, the self-adhesive membrane keyboard can, with care, be peeled away from the front of the door.

Remove the backing paper from the replacement keyboard, and carefully apply the keyboard to the door, ensuring that it is positioned correctly, and that it is the right way up.

Firm the keypad into place using light pressure, then peel-off the translucent protective sheet.

Whilst carefully routing the keyboard flexi-cable such that it emerges from the right of the display board as shown in the figure, re-fit the display board using the screws ('E') and hexagonal spacers ('D') previously removed.

With care (and patience), fit the end of the flexi-cable into its connector.

Re-make the ribbon cable connector.

Re-connect the chart illumination lamp ('C') if fitted.

Re-make the earth connection ('B')

Re-fit the chart illumination plate (screws 'A' and shake-proof washers)

4.6.4 Door removal

Warning!

The sprung pin discussed below can be ejected with some force. It is recommended that eye protection be used whilst removing the door.

Note: Figure 4.6.2 above shows the first stages of this procedure being carried out with the chart illumination tube fitted. The procedure is similar for recorders without chart illumination.

Release the chart illumination plate by undoing the four securing screws ('A' in figure 4.6.2 above), carefully retaining the screws and washers for later re-assembly. Remove the chart illumination assembly by disconnecting the earthing link ('B' in the figure) and, if fitted, the chart illumination tube connector ('C' in the figure).

Carefully disconnect the ribbon cable from its connector on the display board.

Using a small screwdriver or similar, press down on the sprung pin at the top of the door as shown in figure 4.6.4, and carefully remove the door, ensuring that the spring pin at the top does not 'escape'.

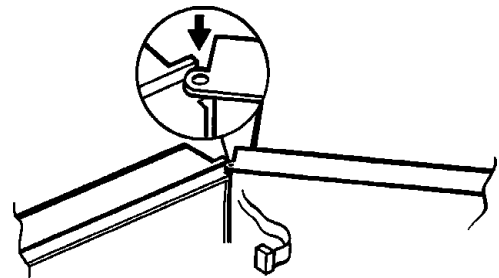


Figure 4.6.4 Door hinge-pin location

To re-fit or replace the door, the procedure is the reverse of the above.

4.7 MEMORY CARD RETROFIT KIT

4.7.1 Introduction

These instructions are intended to assist those who are required to fit a memory card driver module to a non-graphics recorder.

4.7.2 Kit contents

1. Memory card driver module
2. Cable clip (2 off)
3. Instructions (HA248386)

4.7.3 Installation procedure

CAUTION

This upgrade 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 section entitled 'Static Electricity' in section i of this manual

1. Isolate the recorder from all high voltage sources (both supply and signal).
2. Remove the writing system from the case, as described in section 4.2 above.
3. Remove the I/O board retainer (figure 4.7.3a).
4. Release the ribbon cable connectors from the I/O boards (figure 4.7.3b). Make a note of the I/O board addresses (relative to their physical locations) before removing the I/O boards, and placing them in a suitable static-safe environment.
5. Referring to figure 4.7.3c, remove the Safety earth link at the top left of the case and release the ribbon cable clamp to leave the earth lead and ribbon cable free.

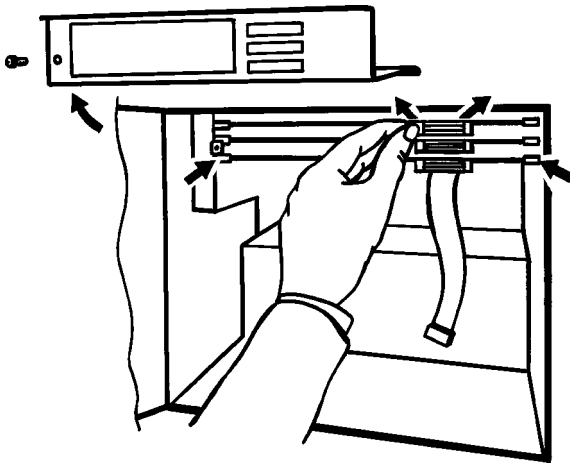


Figure 4.7.3a I/O board removal

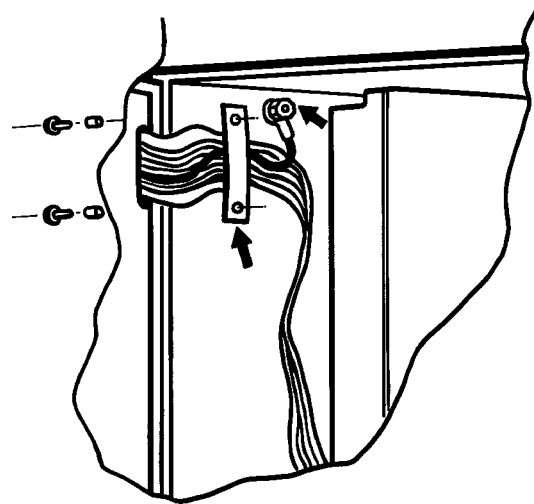


Figure 4.7.3b
Earth link and cable clamp removal

4.7.3 MEMORY CARD OPTION INSTALLATION (CONT.)

6. Remove the strengthening member from the Memory card slot by undoing the securing screws ('A' in figure 4.7.3c).
7. As indicated in figure 4.7.3d, insert the memory card driver module (first inserting the cable harness into the slot and down across the top of the PSU).
8. Secure the memory card driver using the two screws previously removed ('A' in figure 4.7.3d).
9. Clip the memory card harness to the top of the power supply unit as shown in figure 4.7.3d.

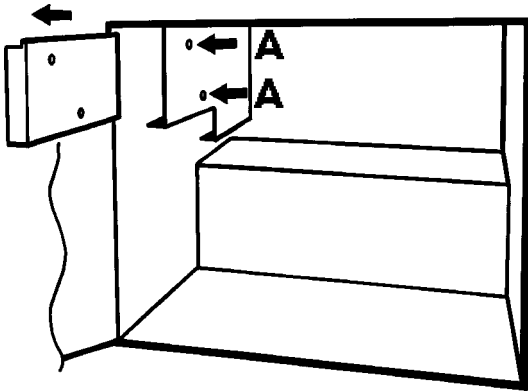


Figure 4.7.3c Strengthening member removal

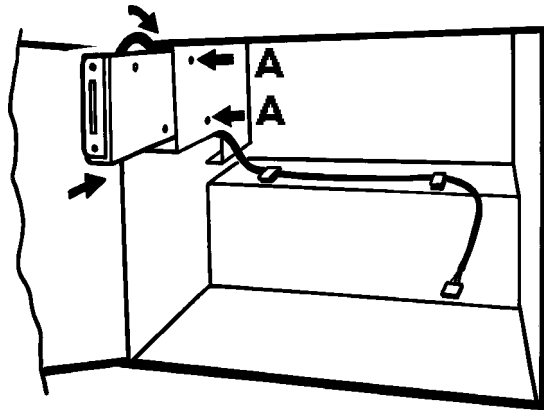


Figure 4.7.3d Memory card driver fitting

10. Re-fit the earthing link and the ribbon cable retainer (figure 4.7.3b).
11. Carefully re-fit the I/O boards, ensuring that they are in their correct positions. Re-make the ribbon cable connections to the I/O boards.
12. Re-fit the circuit board retainer (figure 4.7.3a).
13. At the writing system, if either of the archiving options has been purchased, then the associated option key should be fitted now (figure 4.7.3e). (Release only as many connectors as are necessary to allow access to the option key locations)
14. At the writing system, disconnect the existing 9-way connector loom from the control board, then remove the 9-way D-type connector itself and discard.
15. Fit the replacement 9-way D-type connector, passing the control board connector under the motor pinion bracket as shown in figure 4.7.3e. Connect the harness from the D-type to the control board.
16. Return the writing system to the case, ensuring that all previous connections are re-made, and that the new connection is made between the memory card driver and the supplementary harness to the D-type plug, as in figure 4.7.3f.
17. With the writing system returned to the case, and power applied to the recorder, initiate an Autoconfigure. Reset the system time and date.

When re-fitting the flexi connector, ensure that it is fully inserted. I.E. The thicker (wider) part of the tracks only just protrude from the connector housing when the housing is fully pushed home. It is also essential that the flexi is not tilted in the vertical plane as it emerges from the connector – see section 4.3.2.

CAUTION

Failure to ensure the correct fitting of the flexi-cable into the connector can result in damage being caused to the recorder electronics.

4.7.3 MEMORY CARD OPTION INSTALLATION (CONT.)

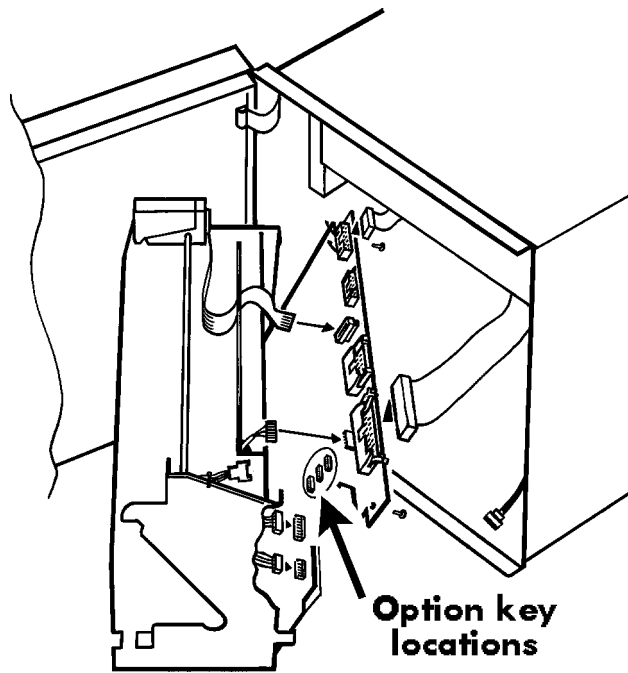


Figure 4.7.3e Option key locations

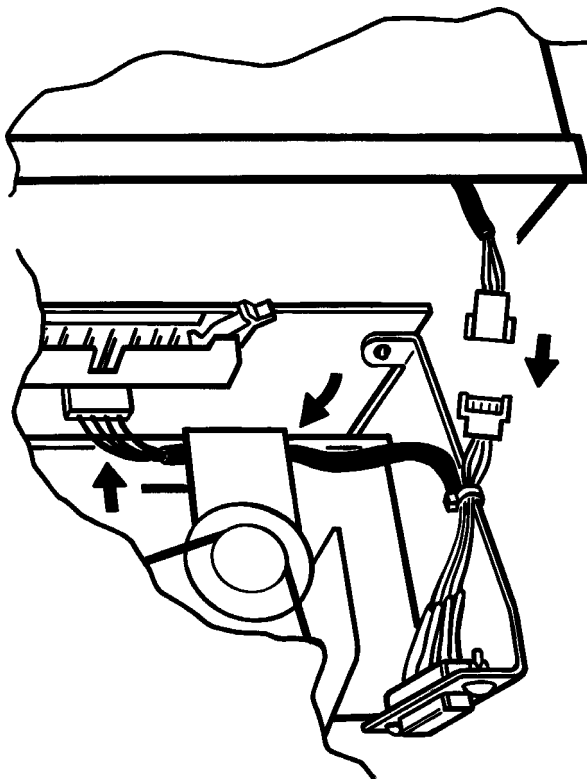


Figure 4.7.3f D-type harness routing

4.8 COMMUNICATIONS RETROFIT KIT

These instructions are intended to assist those who are required to fit a Serial Communications Module to a 180 mm non-graphics recorder. It should be noted that volatile data such as maths channel averages and totaliser values will be lost, as will the system time and date.

4.8.1 Kit contents

1. Communications module (LA248398)
2. Cable clip (FE244811)
3. Instructions (HA248398)

4.8.2 Installation procedure

CAUTION

This upgrade involves the handling of components which are sensitive to static electrical discharge. All relevant personnel must be aware of correct static handling procedures. If in doubt reference should be made to the section entitled 'Static Electricity' in section i of this manual

1. Remove the writing system from the case, as described in section 4.2 above.
2. Release the Power supply unit from the front, using screws 'A' in figure 4.8.2a, then from the back, by removing the safety earth (nut 'B' in figure 4.8.2b) and securing screw 'C'.

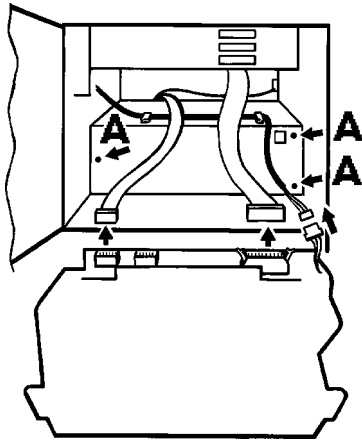


Figure 4.8.2a PSU securing screw locations

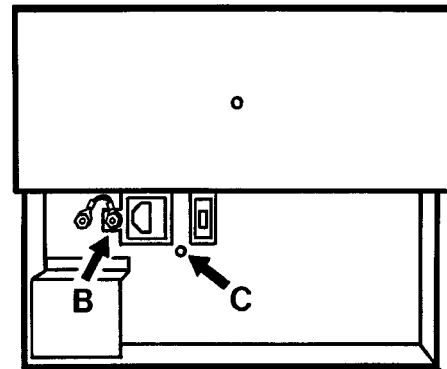


Figure 4.8.2b PSU release (rear view)

3. Disconnect the battery pack as shown in figure 4.8.2c
4. Rotate and lift out the power supply as shown in figure 4.8.2d, carefully avoiding damage to the battery pack connector. Fit the plastic cable clip as shown in figure 4.8.2e.
5. At the rear of the recorder, remove the blanking plate, and fit the communications module (figure 4.8.2g).
6. Feed the communications module ribbon cable across the inside back of the recorder, secure it with the clip, then fold the cable back on itself and make a right angle turn upwards (figure 4.8.2f).
7. Re-fit the power supply unit, and ensuring that the battery pack connector is passed through its aperture, secure it at the front and at the back, using the four screws **AND SAFETY EARTH NUT** previously removed.
8. Return the writing system to the case, ensuring all the connectors are re-made.
9. Set the three switches between the 9-way connectors all up for RS232 or all down for RS422/485
10. Apply power to the recorder and initiate an Autoconfigure as described in section 4.12 of the installation and operation manual.

4.8.2 COMMUNICATIONS MODULE INSTALLATION PROCEDURE (CONT.)

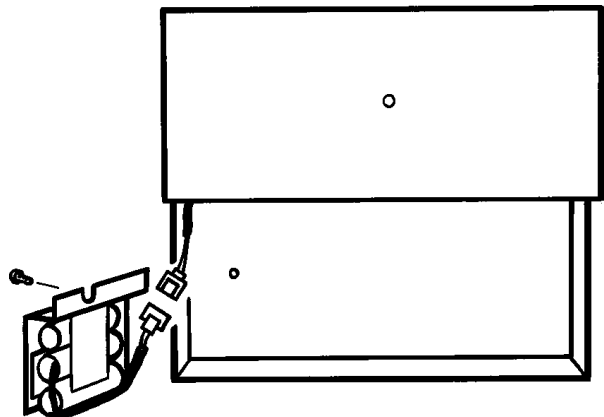


Figure 4.8.2c Battery pack disconnection

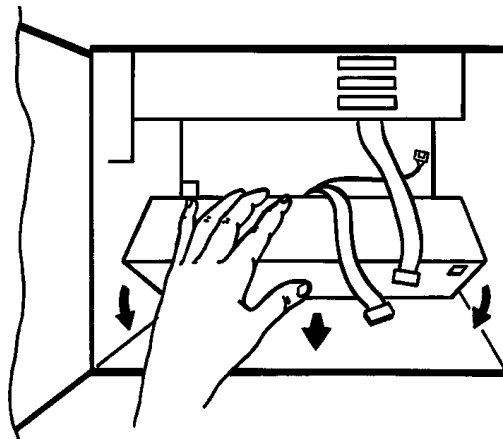


Figure 4.8.2d PSU removal

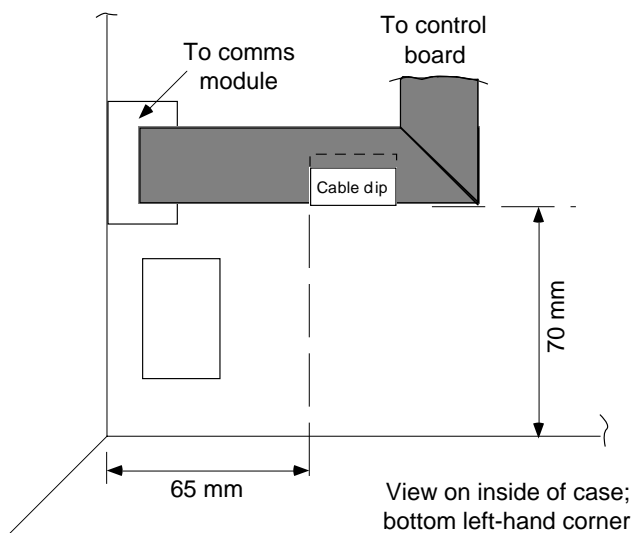


Figure 4.8.2e Cable clip location

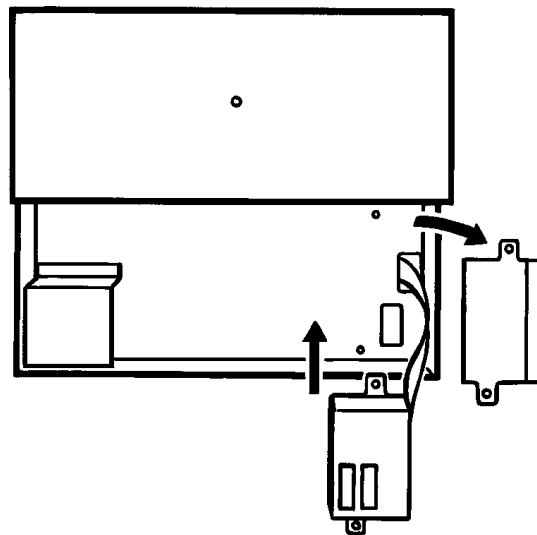


Figure 4.8.2f Fitting communications module

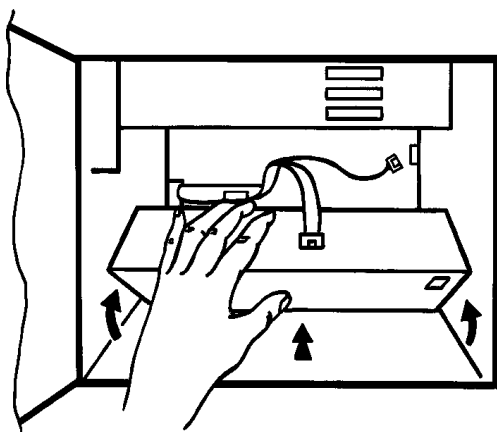


Figure 4.8.2g
Routing cable and returning PSU

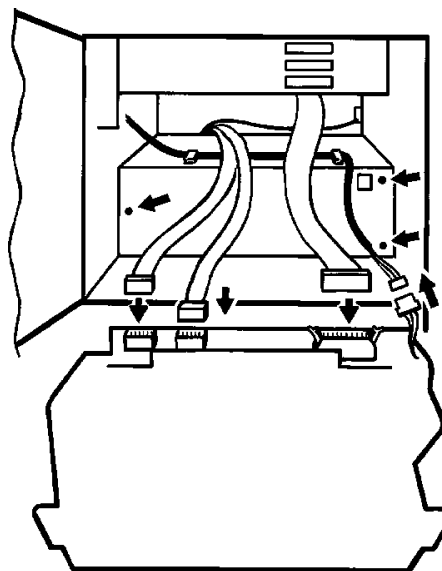


Figure 4.8.2h
Communications connector location

4.9 CHART ILLUMINATION RETROFIT KIT

These instructions are intended as an aid to those required to retro-fit chart illumination to a non-graphics recorders

4.9.1 Kit contents

The retrofit kit (LA248378) contains the following items:

1. Cover plate (BA248055)
2. Lamp cover (BT248066)
3. Lamp loom including connectors
4. Fluorescent tube (CJ248065)
5. 'High Voltage' warning label
6. Instructions (HA248378)

4.9.2 Procedure

WARNING !

Isolate the recorder from line power before carrying out this procedure.

1. Open the recorder door by lifting the latch and turning it anticlockwise.
2. Referring to figure 4.9.2a, release the existing cover plate by undoing the four securing screws. Retain the fixings for use in later re-assembly.
3. Referring to figure 4.9.2b, disconnect the earthing loom (harness) by removing the securing nut and associated washer. Retain the fixings for use in later re-assembly.
4. Remove the rubber insulator from the edge of the cover plate. Discard the cover plate.

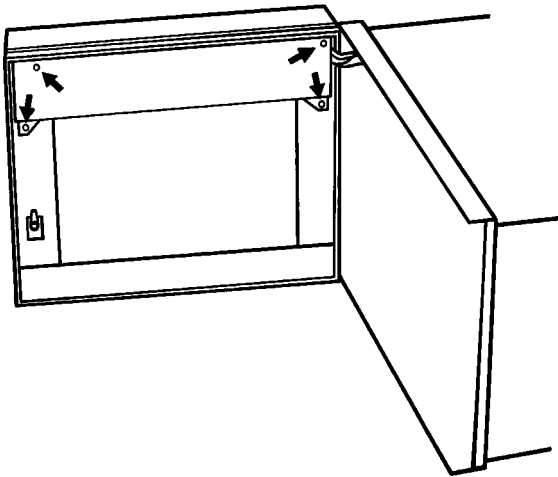


Figure 4.9.2a Cover fixing locations

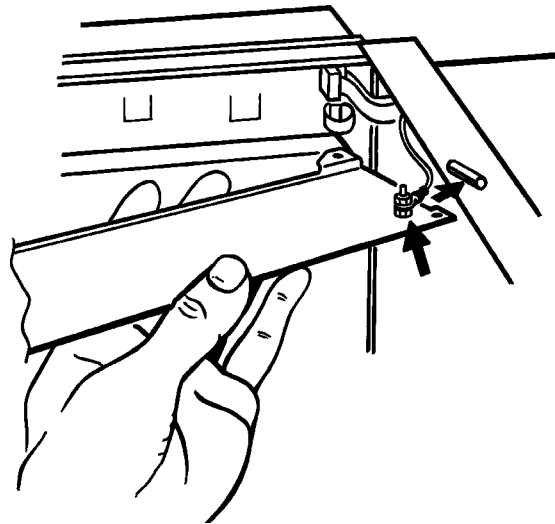


Figure 4.9.2b
Earth loom and rubber insulator

4.9.2 CHART ILLUMINATION RETROFIT PROCEDURE (CONT.)

5. Referring to figure 4.9.2c, fit the rubber insulator to the edge of the new cover plate supplied with the kit.
6. Ensuring correct orientation*, clip the lamp connectors into the apertures in the cover plate.

* The 4-way connector must be towards the left-hand end of the plate (i.e. the end furthest from the earth loom connection) as indicated in figure 4..8.3c.

7. Referring to figure 4.9.2d, use the nut and washer, previously removed, to secure the earth loom to the new cover plate. Plug the 4-way connector onto its mating half on the display board.
8. Use the four screws, previously removed, to secure the new cover plate to the recorder door.

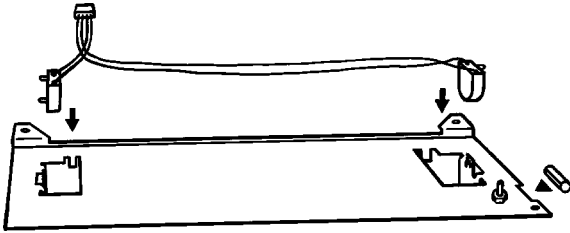


Figure 4.9.2c Fit insulator and lighting loom

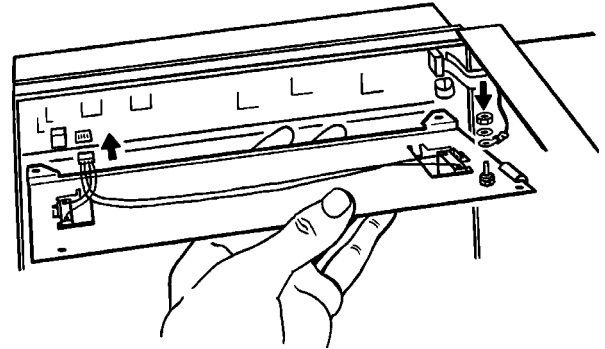


Figure 4.9.2d Connect earth and lamp loom

9. Referring to figure 4.9.2e, take the fluorescent tube and carefully insert it into the connectors. Rotate the tube through 90°. **THIS ROTATION IS ESSENTIAL FOR MAXIMUM LAMP LIFE.**
10. Clip the cover over the lamp. Fit the warning label in a prominent position on the new cover plate.
11. Apply power to the recorder and check that the fluorescent tube operates correctly.

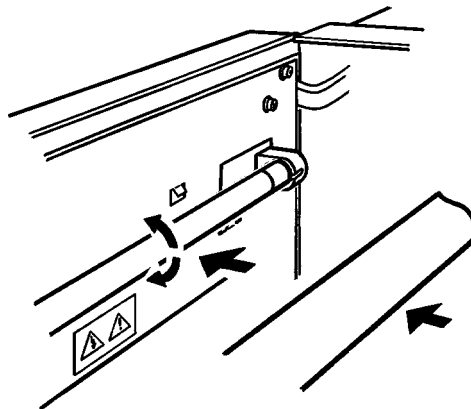


Figure 4.9.2e Fit lamp, lamp cover and warning label

4.10 BACKLIGHT REPLACEMENT PROCEDURE

For recorders with status levels P10 onwards, please follow the instructions below. For units with status level prior to P10, refer to Annex A of this manual for replacement instructions.

The status level forms the last section of the recorder's serial number, and consists of a letter (e.g. P) to denote software status followed by one or more numeric characters (e.g. 10) to denote hardware status.

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.

4.10.1 Door removal

- a. Open the recorder door
- b. Remove the earth lead and the cover (if fitted) (figure 4.10.1a), 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 4.10.1b.
- 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.

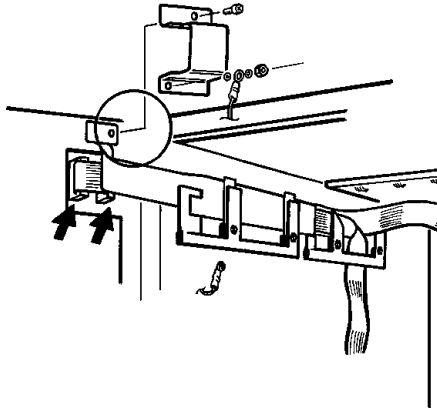


Figure 4.10.1a Earth lead and ribbon cable connectors

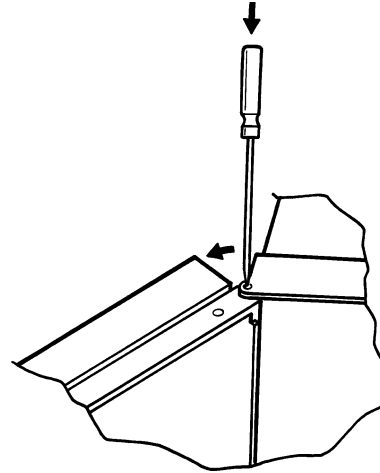


Figure 4.10.1b Door hinge location

(Continued)

4.10.2 Removal of the display unit assembly

- a. Release the door inner cover by undoing and removing the fixing screws ('A' in figure 4.10.2a). Remove the plastic door guide if fitted ('B' in figure 4.10.2a) and keep safely for later re-assembly. Remove the door latches ('C' in figure 4.10.2b) if fitted (depends on model).

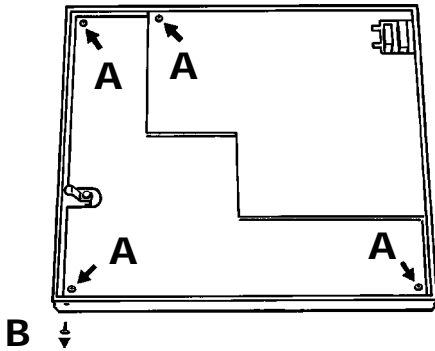


Figure 4.10.2a Inner cover securing screws

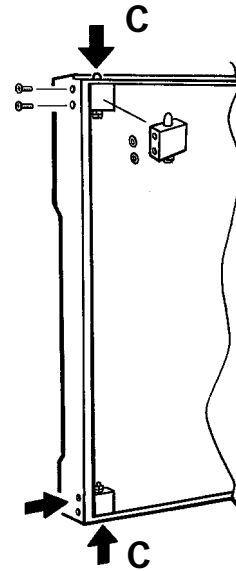


Figure 4.10.2b Door catches (if fitted)

- b. Carefully remove the door inner cover, by lifting the cover and disconnecting the connector as it becomes accessible (figure 4.10.2c). Swing the cover over to reveal the display unit (figure 4.10.2d).
- c. Remove the four display unit securing screws ('D' in figure 4.10.2d) and lift the display unit out and lay it on the inner cover (figure 4.10.2e).

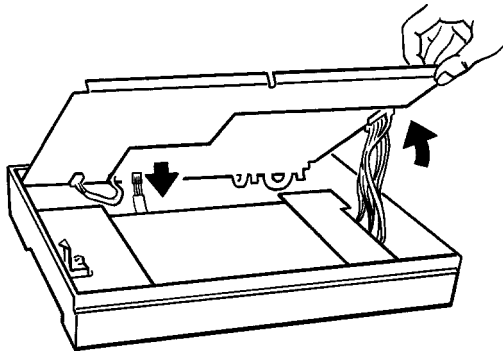


Figure 4.10.2c Lift inner cover and disconnect connector

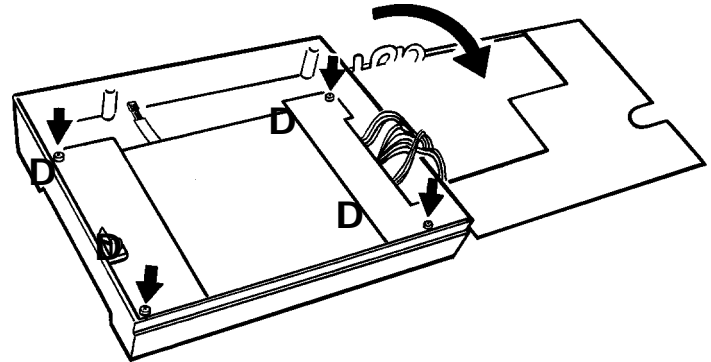


Figure 4.10.2d Cover open

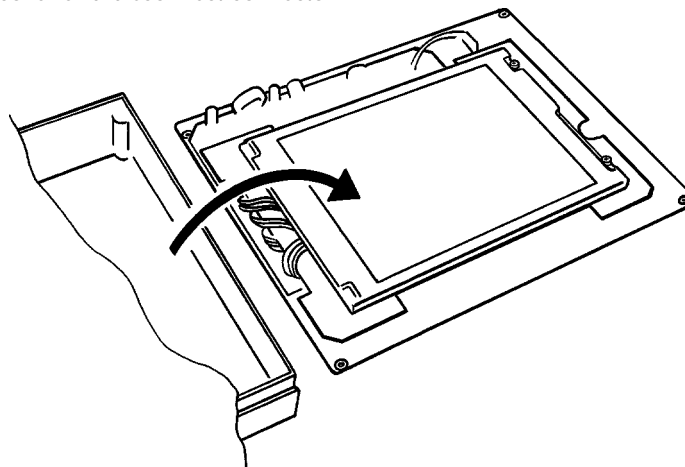


Figure 4.10.2e Display unit removal

4.10.3 Illumination tube replacement

- a. Remove securing screws ('E' in figure 4.10.3a) and turn the display unit over to reveal the circuit board (figure 4.10.3b).
- b. Gently lift the wires out of their channels (F in figure 4.10.3b), remove the flexi-cable ('G') and remove the circuit board retaining screws ('H').

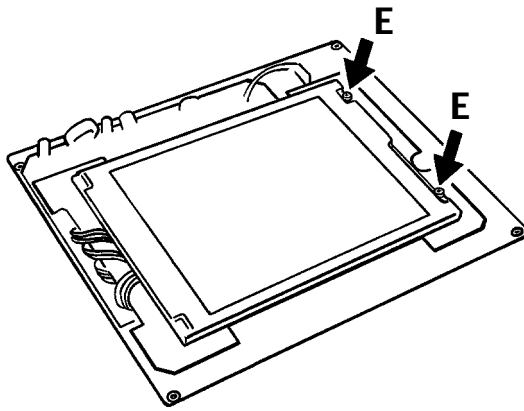


Figure 4.10.3a Removing securing screws

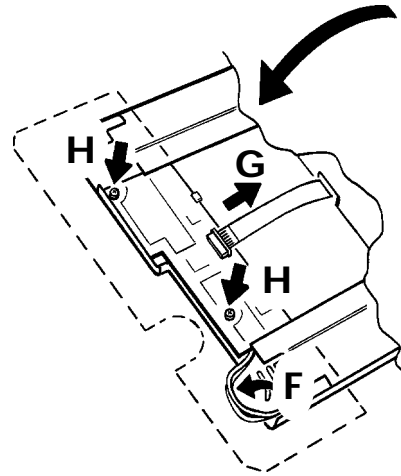


Figure 4.10.3b Circuit board removal (1)

- 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 4.10.3c).
- d. Undo the tube securing screw ('J' in figure 4.10.3d) and carefully extract the lamp.

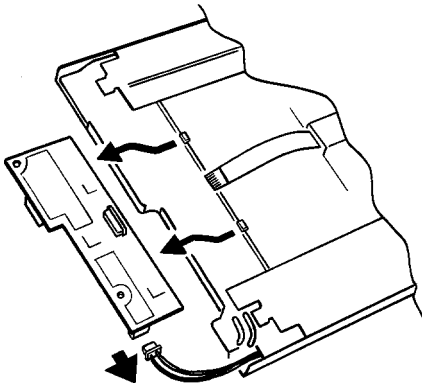


Figure 4.10.3c Circuit board removal (2)

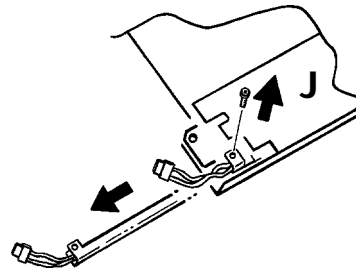


Figure 4.10.3d Tube removal

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

4.10.4 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 ('F' in figure 4.10.3b 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 4.10.4.

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.

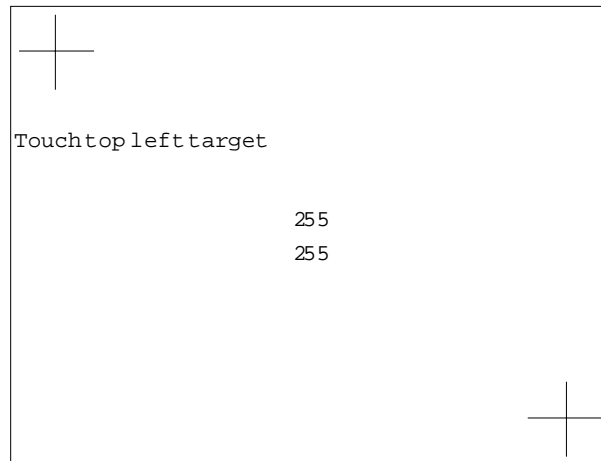


Figure 4.10.4 Calibration display

This page is deliberately left blank

SECTION 5 SPARE PARTS

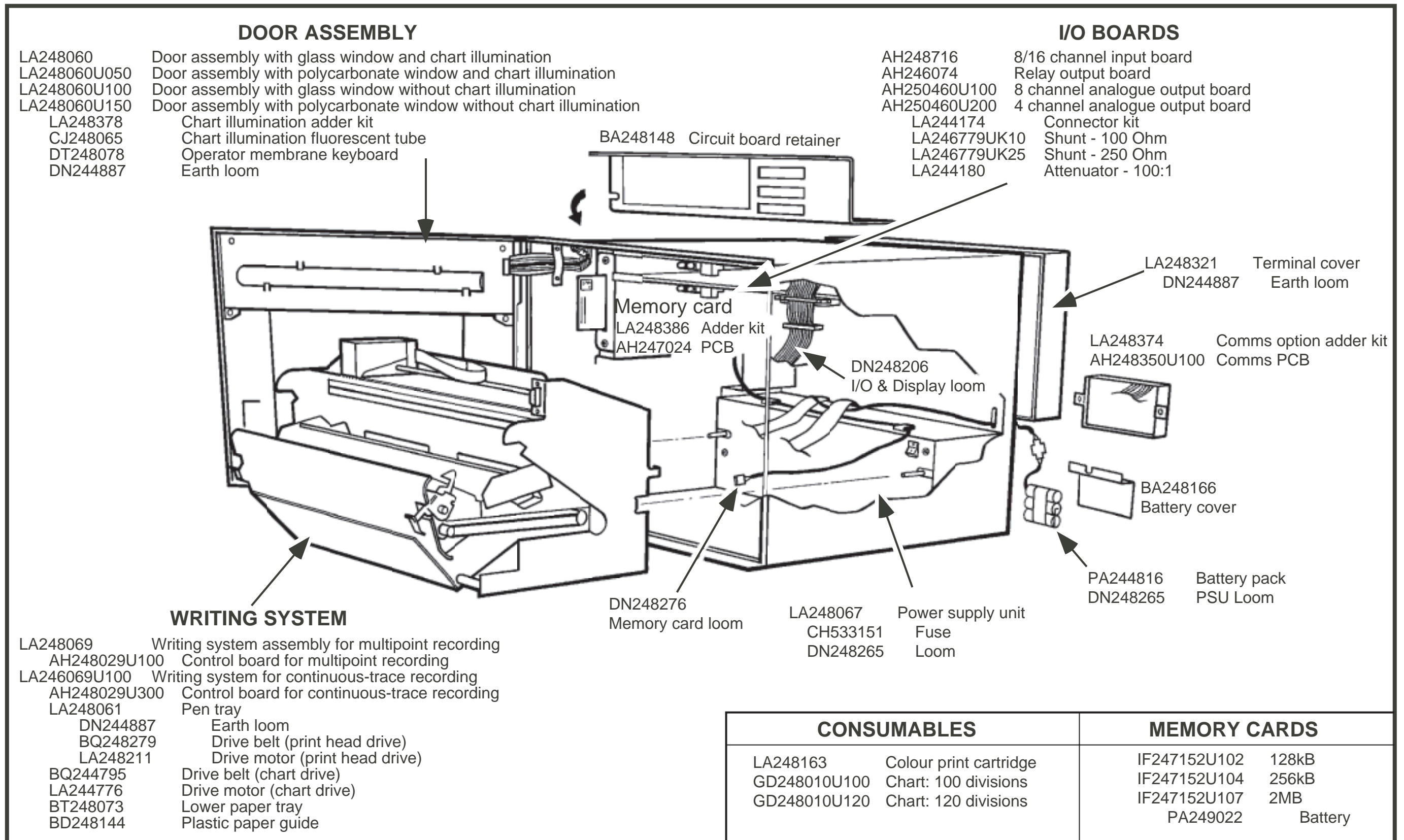


Figure 5.1 Spare parts

This page is deliberately left blank

SECTION 6 CIRCUIT DIAGRAMS

LIST OF CONTENTS

Section	Page
6.1 EIGHT - RELAY OUTPUT BOARD (AH246074)	6 - 3
6.2 EIGHT - CHANNEL UNIVERSAL INPUT BOARD (AH246463) ..	6 - 11
6.3 16-CHANNEL DC INPUT BOARD (AH246865)	6 - 23
6.4 MEMORY CARD PCB (AH247024)	6 - 37
6.5 POWER SUPPLY UNIT PCB (AH248013)	6 - 41
6.6 DISPLAY PCB (AH248023)	6 - 49
6.7 CONTROL BOARD (AH248029)	6 - 59
6.8 COMMUNICATIONS OPTION BOARD (AH248350)	6 - 75
6.9 GRAPHICS CONTROLLER BOARD (AH244469)	6 - 79
6.10 8/16 CHANNEL INPUT BOARD (AH248716)	6 - 99
6.11 ANALOGUE OUTPUT BOARD (AH250460)	6 - 115

Note: This section is not available as a .pdf file. It is available only in printed manuals.

This page is deliberately left blank

ANNEX A :

REPLECEMENT PROCEDURES FOR NON-CURRENT RECORDERS

A1 BACKLIGHT REPLACEMENT INSTRUCTIONS

A1.1 INTRODUCTION

These instructions are intended as an aid to those involved in replacing the backlighting unit of graphics recorders with status levels prior to P10. For recorders with status levels of P10 onwards, see section P10. The status level forms the last section of the recorder's serial number, and consists of a letter (e.g. P) to denote software status, followed by one or two numeric characters (e.g. 10) to denote hardware status.

WARNING!

The process involves prising the existing backlight unit away from the display panel. As both the backlighting 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.

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 section entitled 'Static Electricity' in section i of this manual

Note: Because of the number of different sizes and types of screw fixing involved in this procedure, it is suggested that once an item which is to be removed 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.

A1.2 REPLACEMENT PROCEDURE

A1.2.1 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 (figure A1.2.1a), retaining the fixings for later re-assembly.
- c Remove the two ribbon cable headers (figure A1.2.1a).
- d Using a small screwdriver, or similar, press down on the sprung pin at the top of the door (A in figure A1.2.1b).
- e Carefully, ensuring that the sprung pin is not ejected, ease the top of the door outwards, and away from the case.

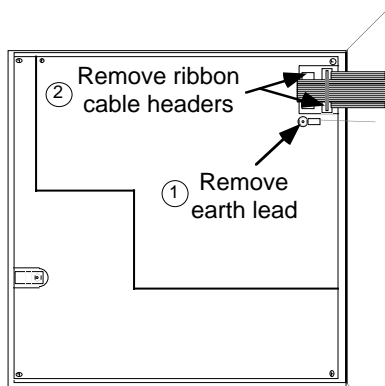


Figure A1.2.1a
Earth lead and ribbon cable connectors

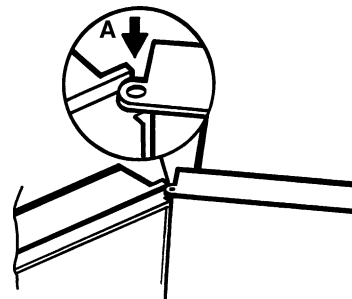


Figure A1.2.1b
Door hinge pin location

A1.2.2 Removal of the display unit assembly

- a Release the door inner cover by undoing and removing the fixing screws as shown in figure A1.2.2a.
- b As shown in figure A1.2.2b, carefully remove the door inner cover, by lifting the cover and disconnecting the various connectors as they become accessible.
- c Mark the flexi-cable connector ('A' in figure A1.2.2c) with correcting fluid or similar so that it is obvious which way to re-connect it. Then, compress the two halves of the latch and separate the two parts of the connector
- d Remove the securing screws (B in figure A1.2.2c)

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

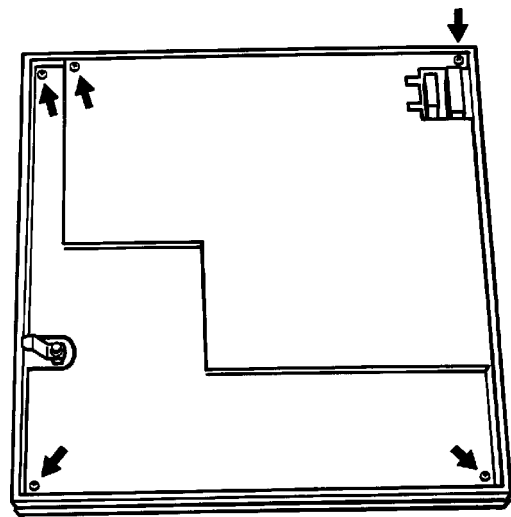


Figure A1.2.2a
Inner cover securing screws

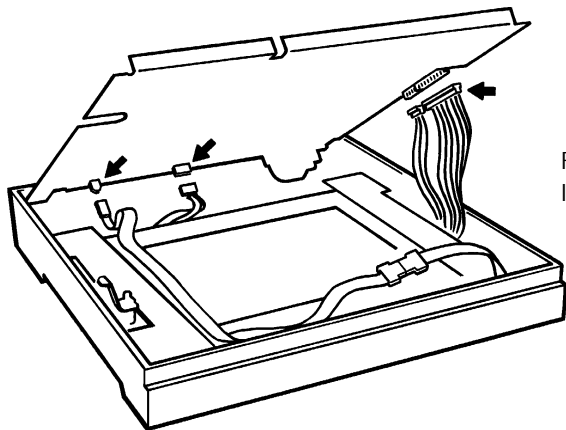
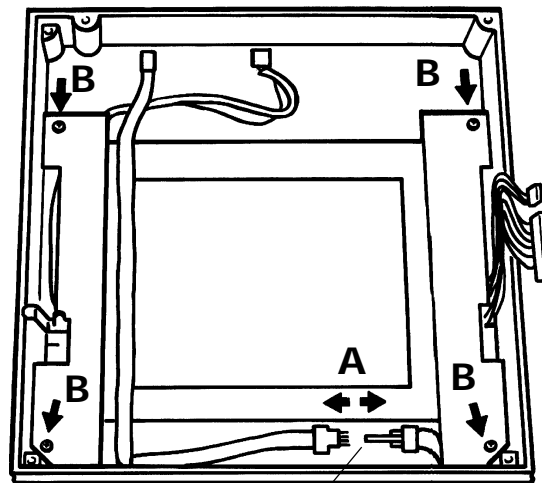


Figure A1.2.2b
Inner cover removal

Figure A1.2.2c
Display unit assembly removal



Mark this connector so you know which way to re-assemble it

A1.2.3 Backlighting unit removal

- a Turn the display unit over and orient it as shown in figure A1.2.3a.
- b Disconnect the four wires ('A' in figure A1.2.3a) to the backlighting unit.
- c Undo the four screws ('B' in figure A1.2.3a)
- d Referring to figure A1.2.3b, turn the unit over, and straighten the five metal lugs. This allows the two parts of the metal frame to be separated.

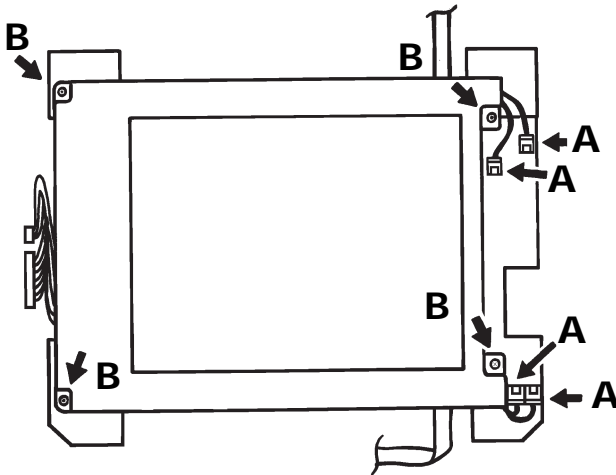


Figure A1.2.3a Display removal (1)

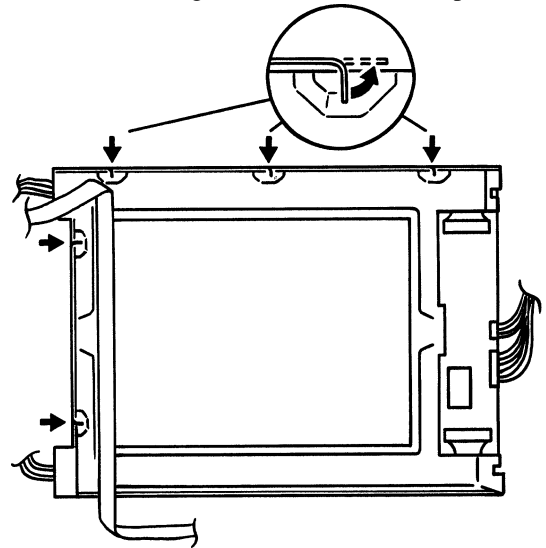


Figure A1.2.3b Display removal (2)

- e Referring to figure A1.2.3c, turn the unit over and remove the securing screws
- f Referring to figure A1.2.3d, turn the unit over, and using a small screwdriver or similar, start gently prising the backlighting unit 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.

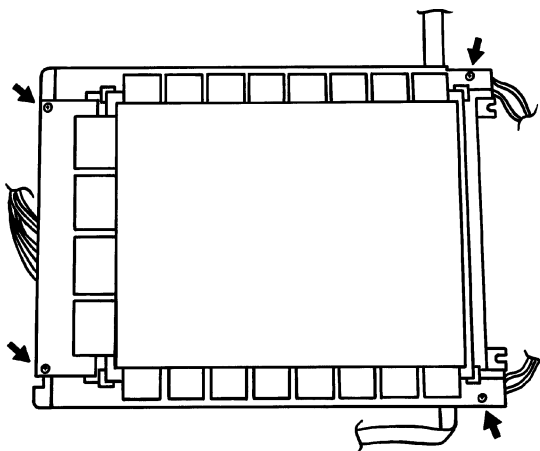
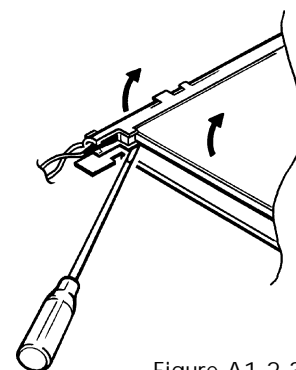
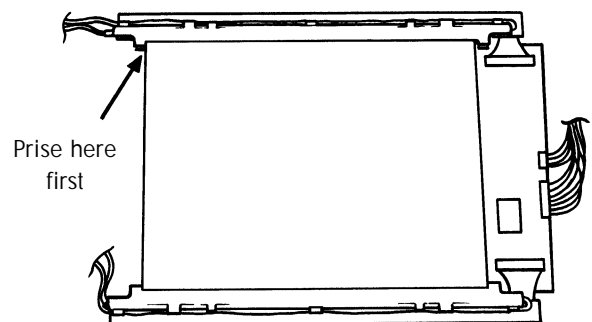


Figure A1.2.3c Display removal (3)

Figure A1.2.3d
Prise display from backlighting unit

A1.2.3 BACKLIGHTING UNIT REMOVAL (Cont.)

- g Referring to figure A1.2.3e, turn the unit over, and using a small screwdriver or similar, release the backlight securing plate clamps. The old backlighting unit can now be discarded.

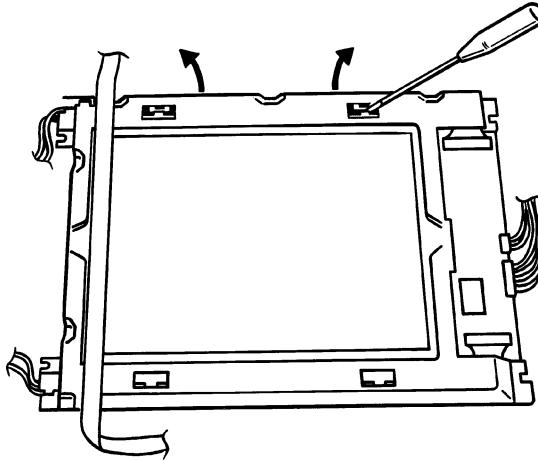


Figure A1.2.3e Backlighting unit removal

A1.2.4 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.

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.

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.

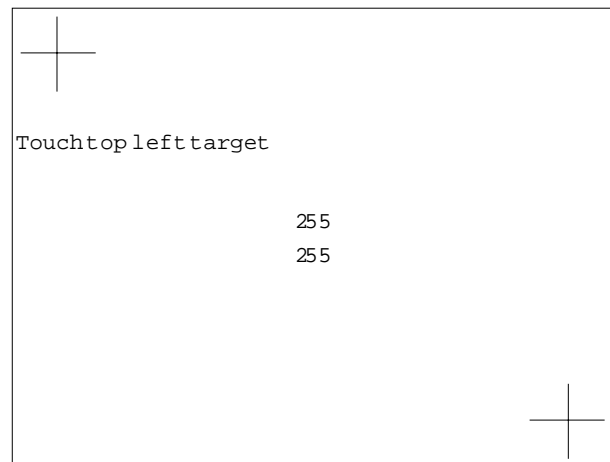


Figure A1.2.4 Calibration display

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
e-mail: eurotherm@eurotherm.com.au
<http://www.eurotherm.com.au>

Austria

Eurotherm GmbH
Geiereckstraße 18/1,
A1110 Wien,

Telephone: 43 1 798 76 01
Fax: 43 1 798 76 05
e-mail: eurotherm@eurotherm.at
<http://www.eurotherm.at>

Belgium and Luxemburg

Eurotherm S.A./N.V.
Rue du Val-Notre-Dame 384,
4520 Moha (Huy)
Belgium

Telephone: 32 (0) 85 274080
Fax: 32 (0) 85 274081
e-mail: sales@eurotherm-belgium.be
<http://www.eurotherm.nl>

Denmark

Eurotherm Danmark A/S
Finsensvej 86,
DK 2000 Fredriksberg,

Telephone: +45 (38) 871622
Fax: +45 (38) 872124
e-mail: salesdk@eurotherm.se

Finland

Eurotherm Finland,
Aurakatu 12A,
FIN-20100 Turku

Telephone: 358 2 25 06 030
Fax: 358 2 25 03 201

France

Eurotherm Automation Division Chessell
Parc d'Affaires,
6, Chemin des Joncs,
BP55

F - 69574 Dardilly, CEDEX
Telephone: 33 0 4 78 66 55 20
Fax: 33 0 4 78 66 55 35
e-mail: chessell@automation.eurotherm.co.uk
<http://www.eurotherm.tm.fr>

Germany

Eurotherm Deutschland GmbH
Ottostraße 1,
65549 Limburg

Tel: +49 (0) 64 31/2 98 - 0
Fax: +49 (0) 64 31/2 98 - 1 19
e-mail: info@regler.eurotherm.co.uk
<http://www.eurotherm-deutschland.de>

Great Britain

Eurotherm Limited,
Faraday Close,
Worthing,
West Sussex BN13 3PL

Telephone: +44 (0)1903 695888
Fax: +44 (0)1903 695666
e-mail: Sales@recorders.eurotherm.co.uk
or: Support@recorders.eurotherm.co.uk
<http://www.eurotherm.co.uk>

Hong Kong

Eurotherm Limited,
Unit D, 18/F Gee Chang Hong Centre,
65, Wong Chuk Hang Road,
Aberdeen.

Telephone: 852 2873 3826
Fax: 852 2870 0148
e-mail: eurotherm@eurotherm.com.hk

India

Eurotherm DEL India Limited,
152, Developed Plots Estate,
Perungudi,
Chennai 600 096,

Telephone: 91 44 4961129
Fax: 91 44 4961831
e-mail: info@eurothermdel.com
<http://www.eurothermdel.com>

Italy

Eurotherm SpA,
Via XXIV Maggio,
I-22070 Guanzate,
Como.

Telephone: 39 031 975111
Fax: 39 031 977512
e-mail: info@eurotherm.it
<http://www.eurotherm.it>

Korea

Eurotherm Korea Limited,
J- Building
402-3
Poongnab-Dong,
Songpa-Ku
Seoul, 138-040

Telephone: 82 2 478 8507
Fax: 82 2 488 8508

Netherlands

Eurotherm BV,
Genielaan 4,
2404CH Alphen aan den Rijn,
The Netherlands

Telephone: 31 172 411 752
Fax: 31 172 417 260
e-mail: Sales@eurotherm.nl
<http://www.eurotherm.nl>

Norway

Eurotherm A/S,
Vollsveien 13D
1366 Lysaker,
Postboks 227
NO-1326 Lysaker
Norway,

Telephone: 47 67 592170
Fax: 47 67 118301
<http://www.eurotherm.no>

Spain

Eurotherm España SA,
Pol. Ind. De Alcobendas,
Calle de la Granja 74,
28108 Alcobendas,
Madrid.

Telephone: 34 91 661 60 01
Fax: 34 91 661 90 93
<http://www.eurotherm.es>

Sweden

Eurotherm AB,
Lundavägen 143,
S-21224 Malmö.

Telephone: 46 40 38 45 00
Fax: 46 40 38 45 45
e-mail: info@eurotherm.se
<http://www.eurotherm.se>

Switzerland

Eurotherm Produkte (Schweiz) AG,
Schwerzistraße, 20,
CH-8807 Freienbach.

Telephone: 41 55 415 44 00
Fax: 41 55 415 44 15
e-mail: epsag@eurotherm.ch
<http://www.eurotherm.ch>

United States of America

Eurotherm Recorders Inc.
741-F Miller Drive
Leesburg
VA 20175-8993

Telephone: 1 703 669 1342
Fax: 1 703 669 1307
e-mail (Sales): sales@chessell.com
e-mail (Technical): support@chessell.com
<http://www.chessell.com>



invensys

EUROTHERM

EUROTHERM LIMITED

Faraday Close, Durrington, Worthing, West Sussex, BN13 3PL
Telephone: 01903 695888 Facsimile: 01903 695666
e-mail: info@eurotherm.co.uk
Website: <http://www.eurotherm.co.uk>

