4100G

EUROTHERM
CHESSELL

Model 4100G
Video recorder

Technical manual

100mm Graphics Recorder

Technical Manual

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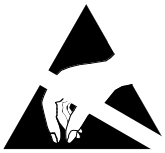
ASSOCIATED DOCUMENTS

HA250209 Installation and Operation Manual
HA249943 Options Manual
HA260334 Portable case Options Manual



STATIC ELECTRICITY

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

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

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

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

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

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

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

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

TERMINOLOGY

Antistatic

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

Static safe

This means that the material in question:

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

Safety Notes

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

WARNING!

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

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

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

Symbols used on the recorder labelling

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

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

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Section 1

Overview

List of contents

SECTION 1: OVERVIEW

1.1 INTRODUCTION

This manual is divided into sections as listed below. For ease of use, certain parts of the Installation and Operation Manual have been repeated here. In case of discrepancy, that manual with the 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 a fault-finding guide, calibration procedures and diagnostics information
Section 3 consists of procedures for the disassembly procedures down to spare part level
Section 4 lists spare parts available for the recorder.

1.2 TECHNICAL SPECIFICATION

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 TECHNICAL SPECIFICATION (Cont.)

1.2.1 Recorder

Board types (I/O)

Universal input board (standard)
3 Change-over relay output board (optional)
4 Normally open relay output board (optional)
4 Normally closed relay output board (optional)
2 channel analogue output (retransmission) board (optional)

Options (See options manual)

Host Communications
Event inputs
Custom Linearisation
Transmitter Power Supply (TRS)
Totalisers/Counters/Timers (TCT)
Maths pack
Additional 'Flash' memory

Environmental Performance

Temperature limits	Operation: 0 to 50˚C (0 to 40˚C if PC Card hard disc fitted). Storage: –20 to + 70˚C
Humidity limits	Operation: 5% to 80% RH (non-condensing). Storage: 5% to 90% RH (non condensing)
Altitude (max.)	<2000 metres
Protection	Door and Bezel: IP54. Sleeve: IP20. Transmitter power supply rear cover: IP10
Shock	BS EN61010
Vibration	10 Hz to 150Hz at 2g peak

Physical

Panel mounting		DIN43700
Bezel size		144 x 144 mm.
Panel cutout dimensions		138 x 138 (both – 0 + 1 mm)
Depth behind bezel rear face		235 mm (No terminal cover); 251 mm (with terminal cover)
Weight		<3.5 kg
Panel mounting	Disc drive installed	Panel must be vertical ± 30˚
	No disc drive	Unrestricted

Electromagnetic compatibility (EMC)

	Emissions	BS EN50081-2
	Immunity	BS EN50082-2
Electrical safety		BS EN61010. Installation category II; Pollution degree 2 (See page 1 - 2 for definitions)

Power requirements

Line voltage	45 to 65 Hz	90 to 264V (standard)
		90 to 132V (Enhanced interrupt protection variant)
	low voltage option	20 to 53V dc or peak ac, (45 to 400Hz)
Power (Max)		100VA
Fuse type		None
Interrupt protection	standard	40 msec. at 75% max. instrument load
	enhanced	120 msec. at 75% max. instrument load

1.2 TECHNICAL SPECIFICATION (Cont.)

1.2.2 Input board

General

Termination	Edge connector / terminal block
Maximum number of inputs	6 (standard); 12 with second input board (option).
Input ranges	- 8 to + 38 mV, - 30 to + 150 mV; - 0.2 to + 1 Volt, - 2 to + 10 Volts (0 to +10 Volts for channel 1)
Input types	DC Volts, dc millivolts, dc milliamps (with external shunt), thermocouple, 2 / 3-wire resistance temperature detector (RTD), Ohms, Contact closure (not channel 1) (Minimum contact closure = 250msec)
Input type mix	Freely configurable
Noise rejection (48 to 62 Hz)	Common mode: >140dB (channel - channel and channel - to - ground). Series mode: >60dB.
Maximum common mode voltage	250 Volts continuous
Maximum series mode voltage	45 mV at lowest range; 12 Volts 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 RMS or dc Channel - to - channel (double isolation), Channel to common electronics (double isolation) and channel - to - ground (basic isolation)
Dielectric strength	Channel - to ground =1350 Vac for 1 minute; Channel - to - channel = 2300 Vac for 1 minute.
Insulation resistance	>10 MΩ at 500 V dc
Input impedance	38mV, 150 mV and 1 V ranges: >10 MΩ; 10 V range: 68.8 kΩ
Overvoltage protection	50 Volts peak (150V with attenuator).
Open circuit detection	± 57 nA max.
Recognition time	500 msec.
Minimum break resistance	10 MΩ

DC Input ranges

Shunt	Externally mounted resistor modules
Additional error due to shunt	0.1% of input
Additional error due to attenuator	0.2% of input

Performance

Low Range	High Range	Resolution	Maximum error (Instrument at 20˚C)	Worst case temperature performance
-8 mV	38mV	1.4µV	0.085% input + 0.06% range	80ppm of input per deg C
-30 mV	150mV	5.5µV	0.084% input + 0.04% range	80ppm of input per deg C
-0.2 Volt	1 Volt	37µV	0.084% input + 0.05% range	80ppm of input per deg C
-2 Volts	10 Volts	370µV	0.275% input + 0.04% range	272ppm of input per deg C

Resistance inputs

Ranges (including lead resistance)	0 to 150 Ω, 0 to 600 Ω, 0 to 6k Ω
Influence of lead resistance	Error = negligible; Mismatch = 1 Ω/Ω
Temperature scale	ITS90

Types and ranges

RTD Type	Overall range (˚C)	Standard	Max linearisation error
Cu10	-20 to + 400	General Electric Co.	0.02 ˚C
JPT100	-220 to + 630	JIS C1604:1989	0.01 ˚C
Ni100	- 60 to + 250	DIN43760:1987	0.01 ˚C
Ni120	-50 to + 170	DIN43760:1987	0.01 ˚C
Pt100	-200 to + 850	IEC 751	0.01 ˚C
Pt100A	-200 to + 600	Eurotherm Recorders SA	0.09 ˚C
Pt1000	-200 to + 850	IEC 751	0.01 ˚C

Accuracy and resolution

Low Range	High Range	Resolution	Maximum error (Instrument at 20˚C)	Worst case temperature performance
0Ω	150Ω	5mΩ	0.045% input + 0.110% range	35ppm of input per deg C
0Ω	600Ω	22mΩ	0.045% input + 0.065% range	35ppm of input per deg C
0Ω	6kΩ	148mΩ	0.049% input + 0.035% range	35ppm of input per deg C

1.2 TECHNICAL SPECIFICATION (Cont.)

1.2.2 Input board (Cont.)

Thermocouple data

Temperature scale	ITS90
Bias current	0.05 nA
Cold junction types	Off, internal, external, remote
CJ error	1˚C max with instrument at 25˚C
CJ rejection ratio	50:1 minimum
Remote CJ	Via any user-defined input channel
Upscale / downscale drive	High, low or none selectable for each thermocouple channel
Types, ranges and accuracy	See table

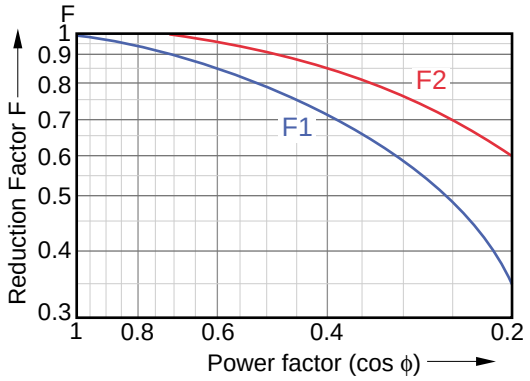
T/C Type	Overall range (degrees C)	Standard	Max linearisation error
B	0 to + 1820	IEC 584.1	0 to 400˚C: 1.7˚C 400 to 1820˚C: 0.03˚C
C	0 to + 2300	Hoskins	0.12˚C
D	0 to + 2495	Hoskins	0.08˚C
E	- 270 to + 1000	IEC 584.1	0.03˚C
G2	0 to + 2315	Hoskins	0.07˚C
J	- 210 to + 1200	IEC 584.1	0.02˚C
K	- 270 to + 1372	IEC 584.1	0.04˚C
L	- 200 to + 900	DIN43700:1985 (To IPTS68)	0.20˚C
N	- 270 to + 1300	IEC 584.1	0.04˚C
R	- 50 to + 1768	IEC 584.1	0.04˚C
S	- 50 to + 1768	IEC 584.1	0.04˚C
T	- 270 to + 400	IEC 584.1	0.02˚C
U	- 200 to + 600	DIN 43710:1985	0.08˚C
Ni/NiMo	0 to + 1406	Ipsen	0.14˚C
Platinel	0 to + 1370	Engelhard	0.02˚C

1.2.3 Relay outputs

The relay specification for resistive loads is given below. Derate with reactive or inductive loads in accordance with the graph, in which:

F1 = Actually measured on representative samples and F2 = Typical values (according to experience), and Contact life = Resistive life x reduction factor.

Number of relays per board	
Change-over board:	Three
Common - Normally Closed board:	Four
Common - Normally Open board:	Four
Estimated life	30,000,000 operations
Maximum contact voltage	250V ac
Maximum contact current	2 Amps
Maximum switching power	500VA or 60W
Isolation (dc to 65Hz; BS EN61010)	Installation category II, Pollution category 2 (See page 1 - 2 for definitions)
Relay-to-relay:	300V RMS or dc (double insulation)
Relay-to-ground:	300V RMS or dc (basic isolation)



1.2 TECHNICAL SPECIFICATION (Cont.)

1.2.4 Analogue outputs

Output ranges (user configurable)

Voltage:	0 to 10 Volts (sources 5 mA)
Current:	0 to 20mA (maximum load (1kΩ)
Update rate	2 Hz
Step response (10% to 90%)	250ms
Linearity	0.024% of hardware range
Performance	See table below
Isolation (dc to 65Hz)(BS EN61010)	Installation category II; Pollution degree 2 (See page 1 - 2 for definitions)
Channel-to-channel:	30V RMS or dc
Channel-to-ground:	30V RMS or dc

Performance in instrument at 20 deg. C		
Range	Accuracy	Temperature drift
0 to 10 V	0.1% of range	0.12mV +0.022% of reading per deg. C
0 to 20mA	0.1% of range	1 µA +0.03% of reading per deg. C

1.2.5 Event inputs

When voltage inputs are used (instead of contact closures), the min/max values are as follows;

Maximum low level voltage	0.8V
Minimum low level voltage	- 30V
Minimum high level voltage	2V
Maximum high level voltage	30V
Maximum input frequency	1Hz
Current sink requirements (Volt inputs)	10mA

Isolation (dc to 65 Hz: BS EN61010)	Installation category II; Pollution degree 2 (see page 1-2 for definitions)
Event input to event input:	0V
Event input to ground:	100V RMS or dc (double insulation)
Event input to chart drive input:	100V RMS or dc (double insulation)
Chart drive input to ground:	100V RMS or dc (double insulation)

1.2.6 Serial communications

Isolation (dc to 65 Hz: BS EN61010)	Installation category II; Pollution degree 2 (see page 1 - 2 for definitions)
Terminals to ground:	100V RMS or dc (Basic insulation)

1.2.7 Transmitter Power supply

Nº of outputs per unit		Three
Nominal output voltage		25V dc
Max current source per output		25mA
Fuse type	110/120V Supply:	100mA anti-surge
	220/240V Supply:	63mA anti-surge
Isolation (dc to 65 Hz: BS EN61010)		Installation category II; Pollution degree 2 (see page 1 - 2 for definitions)
Channel-to-channel:		100V RMS or dc (double isolation)
Channel-to-ground:		100V RMS or dc (basic isolation)

1.3 THE RECORDER

The 100mm graphics recorder is a powerful self-contained data acquisition and paper-less recording instrument, capable of acquiring data from up to 12 analogue or digital inputs. The recorder is fitted with a touch sensitive display screen which allows data to be displayed in trend, bargraph or numeric-value mode. It also allows the operator and configuration menus to be displayed, along with qwerty or numeric keyboards when required.

The instrument can perform the following functions on data received:

1. Scan the inputs for alarm conditions, annunciate them and , if required, initiate complex actions.
2. Process input data to derive other parameters (maths pack-optional extra).
3. Display input and/or derived values on the display screen in one of six display modes.
4. Archive Traces and/or logs to an integral mass storage medium.
5. Store data in an internal memory for subsequent history review and analysis
6. Allow access to results to a host computer using either the communications or the modem option

1.3.1 General description

ENCLOSURE

The recorder is housed in a compact case which fits a panel cutout, 138 mm ($^{+1}/_{-0}$) square cutout. The inside of the recorder is accessed (if necessary) by lifting the handle from the bottom, and pulling the chassis forwards (until it is stopped by the retaining system), pushing the sprung latch in, and disconnecting the 'flexi' cable. This is fully illustrated in section 3.

DISPLAY

The 'door' is replaced by a full colour display in front of which is a transparent touch-sensitive film, The display allows input and derived channels (if fitted) to be traced on a simulated chart background, this being achieved by configuring 'display' groups (six available) to contain up to six required channels etc. (known collectively as 'points'). A group is selected for tracing from the Area display, by touching its icon. Similarly two groups can be configured for logging to the mass storage medium (called the 'disk' from now on, for brevity), if the archiving option is fitted. See the installation and operation manual and the options manual for full details.

KEYBOARD FUNCTIONS

In order to enter text strings or numeric values, qwerty and numeric keyboards can be displayed, and the relevant string or value entered by touching the relevant letter or number. As detailed in the Installation and Operation manual, there are six alpha keyboard sets (three upper case and three lower case) accessible to the operator, thus making the entry of special (e.g. mathematical) characters a simple matter.

INPUTS

Measurements are carried out by one or two high-performance 6-channel input boards. These boards are easily configurable to accept voltage, current, resistance (including RTDs), and contact closure (digital) inputs. For recorders with one input board, up to four option boards can be fitted. For recorders with two input boards, up to two option boards can be fitted.

1.3.1 GENERAL DESCRIPTION (Cont.)

OPTIONS

For full details of these and other 'software' options, refer to the options manual.

ANALOGUE OUTPUT

Scaled and linearised versions of one or two input signals can be output using an analogue output (retransmission) option board. The user can configure the required output type (Volts or mA) and ranging.

RELAY OUTPUT

This board is available in three versions: Three Change-over relays; Four normally open relays or Four normally closed relays. The purpose of the option is to provide contact closure outputs for alarms, events etc.

Notes:

1. These relays are normally energised (i.e. they are de-energised under alarm conditions). This provides a fail-safe system in case of relay failure, or of loss of power to the recorder.
2. When energised, user terminal 'C' is shorted to user terminal 'NO'; when de-energised (alarm state) the 'C' terminal is shorted to 'NC' terminal.

EVENT INPUTS

This option offers six isolated event input circuits which can be used either as six discrete inputs, or inputs one to four can be used as a binary coded 4-bit word, the inputs being read (strobed) on closure (negative edge) of the fifth input. (When used in this way, input six is still available as a single discrete input.)

COMMS/MODEM

These options use a 1/2-width board in slot 2 or 4 to provide a link with a host computer, either directly, or via a telephone (MODEM) link. Either RS232 or RS485 can be used as the transmission standard.

PROFIBUS COMMS

Available as an alternative to the standard communications option board, this 1/2 width option board allows the recorder to be used as a PROFIBUS slave device

TRANSMITTER POWER SUPPLY

This option, which is fitted in the rear terminal cover, supplies one or two sets of three isolated 25 Volt (nom.) outputs. Each output is intended to supply power to a remote transmitter in order to power a 0 to 20 mA or a 4 to 20 mA loop.

1.3.2 Recorder functions

MEASUREMENT OF PROCESS VARIABLES

Up to 12 input channels are supported, each of which can be thermocouple, mA, Volts, Ohms (including RTDs) or contact closure. The Maths pack options both provide 24 derived channels. The TCT option supplies 6 each of Totalisers, Counters and Timers.

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

1.3.2 RECORDER FUNCTIONS (Cont.)

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

JOBS

Each alarm can have two jobs assigned to it, selected from the list in table 1.3.2 below. Jobs cause the operation of the recorder to change as the result of an initiating trigger which can be an alarm going active, an event input, a totaliser reaching a pre-defined value and so on. For details of maths pack, totaliser, counter and timer jobs, refer to the options manual.

No action	
Chart Span B Ch N	While Active, While Inactive, While UnAck'd
Chart Span B for all	While Active, While Inactive, While UnAck'd
Sound Buzzer	While Active, While Inactive, While UnAck'd
Disable all alarms	While Active, While Inactive, While UnAck'd
Ack All Alarms	On Going Active, On Going Inactive, On Acknowledge
Log 1 to archive 1	On Going Active, On Going Inactive, On Acknowledge
Log 2 to archive 2	On Going Active, On Going Inactive, On Acknowledge
Archive interval B	While Active, While Inactive, While UnAck'd
Print Message N	On Going Active, On Going Inactive, On Acknowledge
Display Message N	On Going Active, On Going Inactive, On Acknowledge
Message N to archive 1	On Going Active, On Going Inactive, On Acknowledge
Message N to archive 2	On Going Active, On Going Inactive, On Acknowledge
Reset DV N	On Going Active, On Going Inactive, On Acknowledge
Reset all DVs	On Going Active, On Going Inactive, On Acknowledge
Switch to B DV N	While Active, While Inactive, While UnAck'd
Disable DV N	While Active, While Inactive, While UnAck'd
Disable all DVs	While Active, While Inactive, While UnAck'd
Trigger DV N	On Going Active, On Going Inactive, On Acknowledge
Start Timer N	On Going Active, On Going Inactive, On Acknowledge
Reset Timer N	On Going Active, On Going Inactive, On Acknowledge
Increment Counter N	On Going Active, On Going Inactive, On Acknowledge
Decrement Counter N	On Going Active, On Going Inactive, On Acknowledge
Preset Counter N	On Going Active, On Going Inactive, On Acknowledge
Preset All Counters	On Going Active, On Going Inactive, On Acknowledge
Disable all Counters	While Active, While Inactive, While UnAck'd
Preset Tot	On Going Active, On Going Inactive, On Acknowledge
Preset All Tots	On Going Active, On Going Inactive, On Acknowledge
Disable All Tots	While Active, While Inactive, While UnAck'd
Add 1 hour	On Going Active, On Going Inactive, On Acknowledge
Subtract 1 hour	On Going Active, On Going Inactive, On Acknowledge

Table 1.3.2 Job triggers and actions

1.3.2 RECORDER FUNCTIONS (Cont.)

MESSAGE TYPES

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

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

Cyclic messages. Time and date are printed cyclically at a rate sufficient to ensure that at least one such message is always visible to the operator.

Demand messages. Alarm, event and change messages are generated asynchronously. 20 configurable messages can also be printed as a result of Job action. Configuration of these messages (Instrument MSG'S) can be simplified by embedding times, dates and process variable values as described in the 'MESSAGE CONFIGURATION' section of the installation and operation manual.

LOGS

Logs are alpha-numeric reports showing the current values of a specified group of variables as set up as a part of Group Configuration to be directed to a memory card, either as a result of operator action, as an alarm job, or for log 2, automatically at a configurable time period. Log 1 is saved to a file defined in 'ARCHIVE 1' configuration, and log 2 is saved to a file as defined in 'ARCHIVE 2' configuration.

ARCHIVE INTERVAL

If memory card archiving software is fitted, two archive intervals (A and B) can be entered, as a part of 'ARCHIVE 2' configuration. The contents of log 2 group are subsequently saved to the filename defined in ARCHIVE 2 at interval A, unless interval B has been selected by Job action. The intervals are in hours, minutes and seconds; and entry of 00:00:00 disabling automatic printing. As supplied by the factory, both archive intervals are set to 00:00:00 (off).

ALARMS

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

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

Each of the above alarm types can be defined to be:

1. Off
2. Trigger (initiates jobs but is not otherwise annunciated in any way)
3. Latching: Initiates jobs until the alarm source is no longer active. Alarm indication remains active until the alarm is acknowledged.
4. Non-latching: Initiates jobs until the alarm source is no longer active. Alarm indication remains active until acknowledged OR until the source is no longer active.

Jobs may be initiated on alarm going active, going inactive or on acknowledgement.

Alarm indication consists of a 'warning symbol at the top of the display page, and in the point's icon in the area display page. These indicators flash until the relevant condition in items 3 or 4 above is met.

1.3.2 RECORDER FUNCTIONS (Cont.)

ALARMS (Cont.)

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

INTERNAL EVENTS

Internal events fulfil two functions:

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

MATHS PACK

The maths pack option provides 24 'derived' channels (DV1 to DV24), in addition to the measuring channels. The option is available in two levels: level 1 which provides basic arithmetic functions, and level 2 which provides advanced functions such as averaging, Relative Humidity calculations, mass flow etc. Level 2 also introduces a further group, called the DV group, which is used to assemble channels for use in group averaging, max/min functions etc.

FUNCTIONS

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

Constant	Multiply
Copy	Divide
Add	Modulus
Subtract	Off

The level two functions are as follows:

Square root	Relative humidity
Channel / Group / Rolling averages	F value
e^x	Mass flow (linear) and square root)
$\log_e x$	Mass flow (square root)
10^x	Zirconia probe
$\log_{10} x$	Switch inputs
Rate of change	High/Low select
Sample and hold	Stopwatch
Channel min/max	Time stamp
DV Group Latching min/max	O_2 correction
DV Group Continuous min/max	Percentile
Polynomial	

1.3.2 RECORDER FUNCTIONS (Cont.)

TOTALISERS/COUNTERS/TIMERS (TCT) OPTION

This option supplies six each of totalisers, counters and timers.

TOTALISERS

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

If the 'Event input' option is also fitted, each totaliser can count pulses (max 6 Hz) which it does by counting edges and dividing by two.

COUNTERS

Each counter can be incremented or decremented as a result of job action. Provided access is permitted, the operator may preset the value of each counter. A threshold can be set up to initiate jobs in the same way as for channel alarms.

TIMERS

Each timer can be configured to start at a specific time and date relative to the real-time clock in the recorder. Once initiated, the timer will run for a configurable time period (duration) and repeat at a configurable rate. Once initiated, the timer will restart every repeat period until it is disabled. Each timer can have up to two jobs assigned to it, and these jobs remain active for the timer Duration Period.

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, as described in the Installation and Operation Manual.

Alarm setpoint adjustment
Operator message edit/print
Log initiation
Memory card status / directory display
Save / Restore configuration to/from memory card
Archive interval selection
Memory card on-off-line selection
Derived channel control
Counter pre-setting; edit preset
Timer control
Totaliser presetting; edit preset

Modem operations are protected under a second password as described in the options manual.

Section 2

Fault finding

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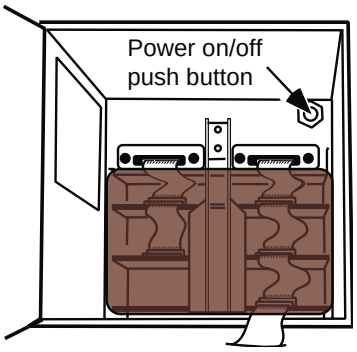
SECTION 2: FAULT FINDING

2.1 FAULT FINDING GUIDE

This section attempts to give some indication of possible faults and some causes and cures. Because of the complexity of the electronic systems involved it is not possible in a document such as this to fault-find to a level deeper than module (e.g. power supply unit, circuit board etc.) replacement.

2.1.1 Recorder completely inoperative



1 Check that the recorder is powered up
2 Check the supply voltage wiring to the rear of the recorder.
3 Check that the supply voltage is present at the recorder supply
4 Withdraw the recorder from the case and check that the flexi cable is fully inserted into the SBC connector, and that the flexi emerges perpendicular to the face of the connector. Leaving the flexi-cable connection intact, carefully remove the recorder from the case sufficiently to be able to operate the power on-off switch by hand.

Operate the on-off switch and check the status of the LEDs on the SBC and Video board (figure 2.1.1)

4a If both are on steadily.
Release the power button, and then, whilst watching the display screen, operate the power on/off switch again, and see if there is a brief 'flash' at switch on. If so, the backlight is working - replace the interconnect board. If this fails to cure the problem, replace the display unit.

4b If the SBC led is flashing or OFF. See section 2.1.2 (2).

4c If both LEDs are off, the 5V supply is not reaching the SBC through the flexi cable. Check the integrity of the flexi cable route between the SBC and the power supply unit, ensuring that all connections are correctly made. If correct, replace the power supply unit.

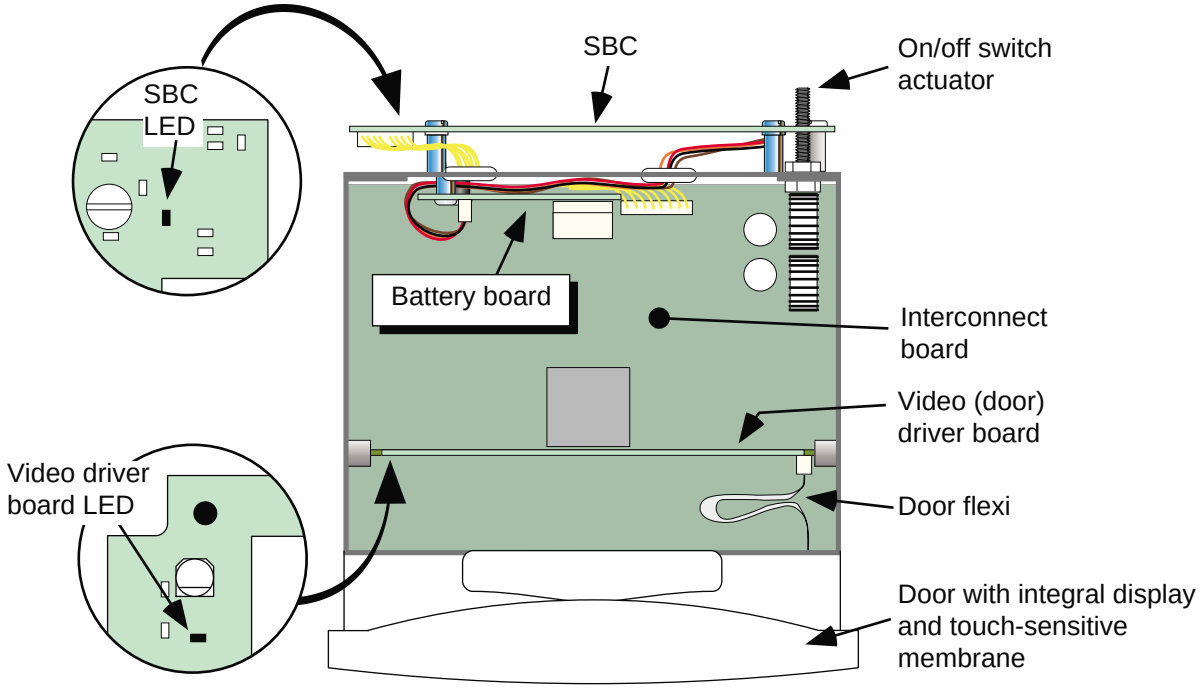


Figure 2.1.1 Component locations

2.1.2 Door resets continuously

1 If a disk is inserted, switch the recorder's power off, eject the disk and re-apply power. If the recorder now initialises correctly, replace the disc drive
2. If no disk or memory card is inserted, withdraw the recorder from its case, and check the status of the SBC LED (fig 2.1.1 shows location). If this LED is flashing, replace the SBC. If it is on continuously, replace the interconnect card.

2.1.3 Touch screen 'offset'

In this case, the displayed response to touching the screen appears in a different place from that expected. For example, touching one of the menu items highlights the item below it or above it. (It is not likely that the 'offset' would be as extreme as this, it may just be a millimetre or less out, but enough to make the recorder unfriendly to use.) To correct this offset, follow the screen recalibration procedure at the end of the display/ backlight replacement instructions (section 3.3.7).

2.1.4 Screen saver not working

The screen saver feature introduced in 1998, required a change to the hardware on the video board. It is thus possible, that if the software has been upgraded 'in the field', the menu will appear in the 'instrument' section of configuration, but the screen brightness settings will be ignored. To correct this, contact the local service representative for an upgrade board.

2.1.5 Measurements outside specified tolerance

Input open circuit	Check sensor leads and termination
Configuration problem	Check that the input ranges, scales, are as required. For thermocouples, check the cold junction type and settings.
Unsuitable environment	Check that the ambient temperature and humidity are within specification limits
Faulty input board	May affect more than one channel; replace board.
Inputs adjusted	Check input adjust (section 2.2) and restore factory configuration if necessary.

2.1.6 Battery low / battery flat message

If either of these message appears during normal operation, replace the battery board. If the messages appear after the recorder has been powered down for a protracted period (several months), allow the recorder to operate continuously for 48 hrs. or so, then power off and on again. If the message recurs, replace the battery board - otherwise continue normal operations

2.1.7 Disk problems

DISK LIFE ESTIMATES

Manufacturers of high quality diskettes quote lifetimes of between 10 and 20 million revolutions per track. To estimate a conservative disk life, we have taken a value of 2.5 million revolutions and assumed that half the spinning time is spent on one track, thus giving a life of 5 million diskette revolutions. The disk spins five times per second, giving a life of 1 million seconds or approximately 11.5 days of continuous use.

Thus, if your diskette is spinning say 15 seconds every minute (on/off ratio = 1/4), the expected life is 11.5 x 4 = 46 days. Clearly this is a conservative estimate, and diskettes do vary in quality.

2.1.7 DISK PROBLEMS (Cont.)

ENVIRONMENT

Disks are susceptible to damage from dust and dirt in the environment. If this is a problem in the recorder area, then adequate air filtering should be installed.

SYSTEM ERROR: DISK OVERDRIVE

This means that the internal archiving buffer has overflowed, and data has been lost. This can be caused by the following:

1. The product has been left archiving whilst in the off-line menu.
2. The product has ben left archiving without a mass storage medium (disk) fitted.
3. The product logging rate/number of points is too great for the recorder
4. The product has encountered a disk error and subsequently recovered. This will usually result in multiple files being created.

If the problem is only 'disk overdrive' check your archiving configuration.

MULTIPLE FILES

This fault results in files with extensions such as *.AS1, .AS2*, etc. being stored on the disk, because the required file name (with *.ASC* extension) already existed. This might have been caused by the following:

1. The off-line menu has been entered. This causes all files to be closed. When the off-line menu is quit, new files will be opened. Providing Disk Overdrive has not occurred, no data will have been lost.
2. The storage medium has been removed and then replaced. Providing Disk Overdrive has not occurred, no data will have been lost.
3. The product has reset. Some loss of data may have occurred.
4. Error writing to disk, caused by a faulty disk, dirt in the drive or a faulty drive. For recorders with status levels Q27 or later, one or more error messages (Disk worn or Disk corrupt) will have been generated.

NO DISK ICON

The disk icon at the top of the screen appears only when a formatted disk has been accessed since being inserted. If the disk is properly formatted, and attempts to access the disk are made (e.g. Directory, status, archive) and the icon does not appear within 30 seconds, it is likely that the disk or disk drive is faulty.

1. Try a new high-quality disk.
2. Try using a disk drive cleaner.
3. For recorders with software revision levels prior to 2.29 (SBC) and 1.13 (Door), upgrade to the latest software.
4. If the problem remains, replace the disk drive unit.

VISIBLE DAMAGE TO THE DISK SURFACE

1. Use a disk-drive cleaner to clean the drive unit.
2. Try a new, high-quality disk.
3. For recorders with software revision levels prior to 2.29 (SBC) and 1.13 (Door), upgrade to the latest software.
4. If problems remain, replace the disk drive unit.

DOS-TYPE MESSAGES AT DISPLAY AND PRODUCT RESETS

This can be caused by the unit having difficulty writing to the disk.

1. Use a disk-drive cleaner to clean the drive unit.
2. Try a new, high-quality disk.
3. If problems remain, replace the disk drive unit.

2.2 INPUT ADJUST

2.2.1 Adjustment procedure

This feature allows input channels to be adjusted to make allowance for non-standard inputs. The technique used is to apply a known input at the low end of the input range for each channel in question. Once the reading displayed by the recorder has stabilised, the 'correct' value is entered. The process is repeated for a value near the high end of the input range.

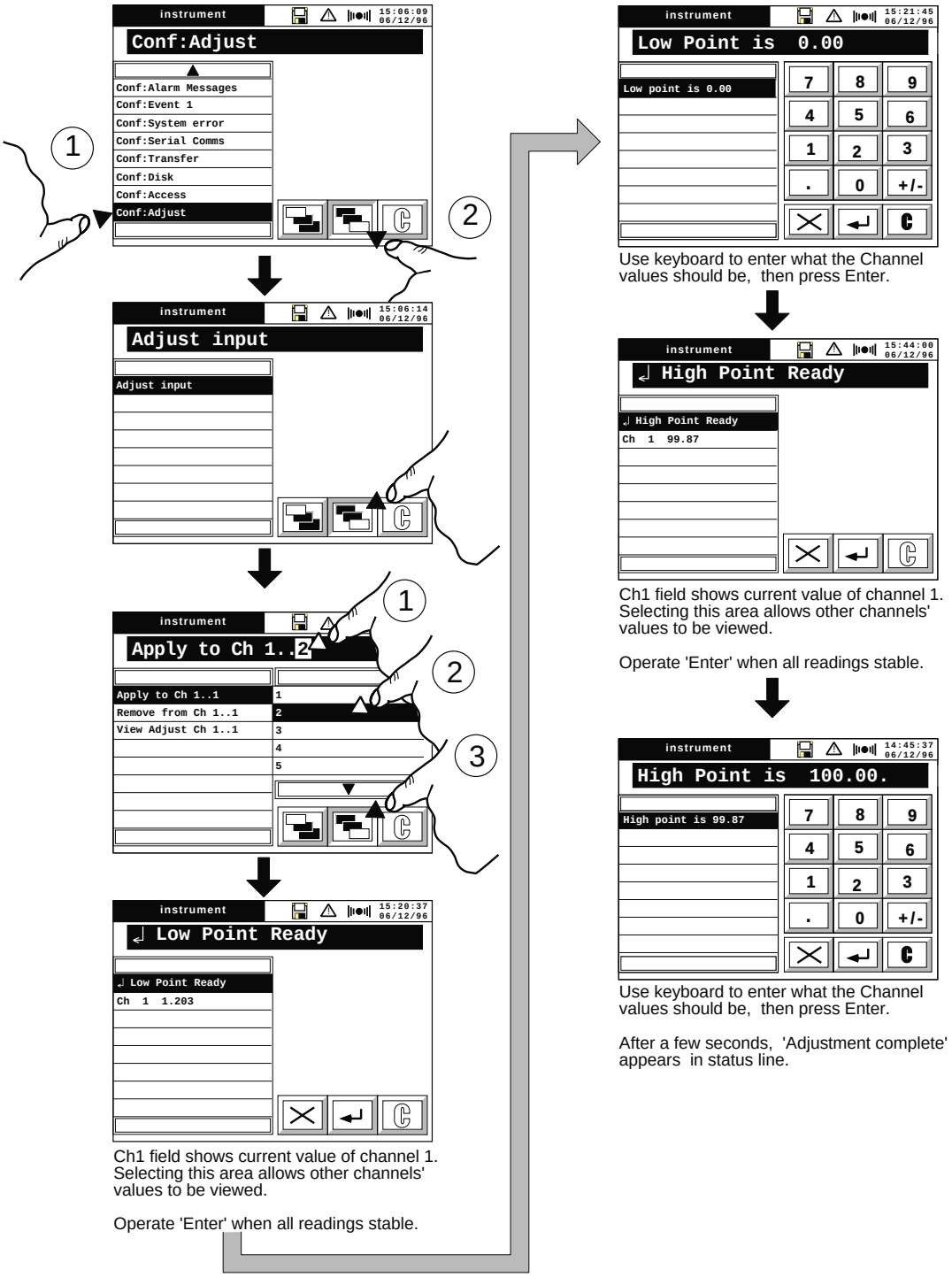


Figure 2.2.1a Input adjust configuration pages

2.2.1 INPUT ADJUST (Cont.)

Adjustments can be removed, and channels can be checked to see if they are 'adjusted' as shown in figures 2.2.1b and 2.2.1c respectively.

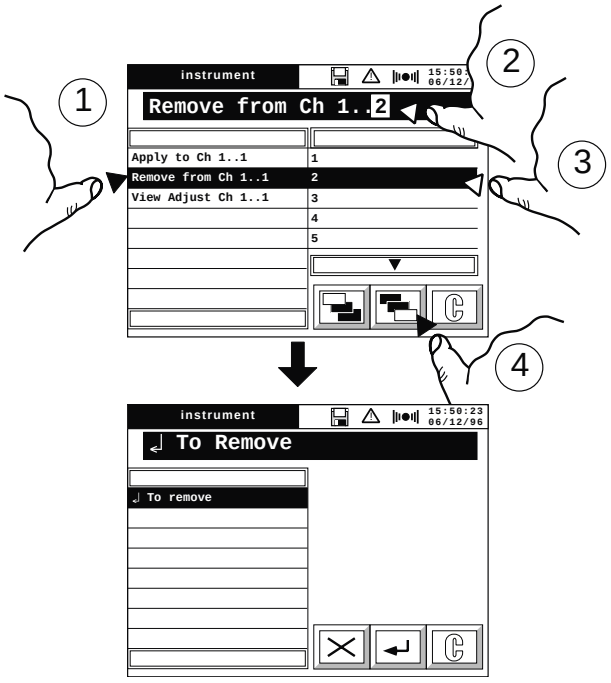


Figure 2.2.1b Adjustment removal

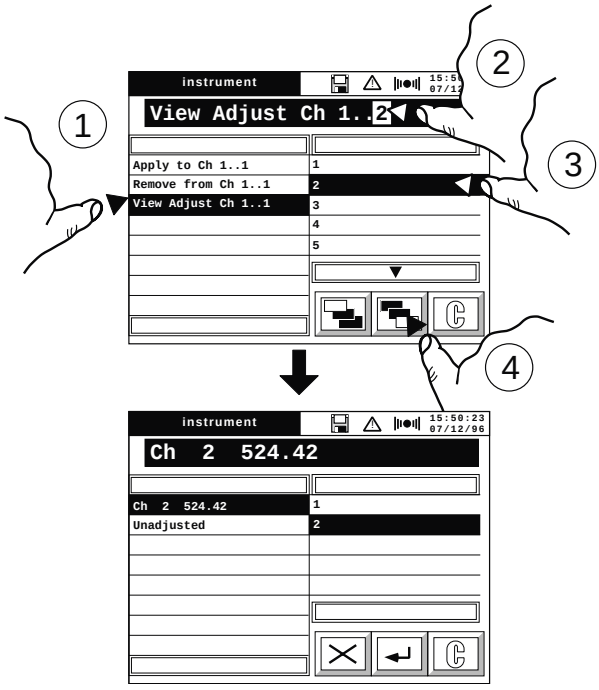


Figure 2.2.1c Adjustment view

2.2.2 Default configuration

This feature returns the recorder's configuration to its default state. All user-entered adjustments are lost, and if required must be re-entered after the default configuration has been returned to.

Operating the Enter key from the '↵ to default config' page, causes a '↵ sure?' confirmation request to appear.

If you wish to proceed with restoring the configuration, operate the Enter key from the confirmation page. If not, use the 'Go back to previous display' key (bottom left below the screen) or the navigation keyboard to quit the page.

If you do go ahead, by operating the Enter key, a 'Please wait' message appears for about 1 minute, after which a display language has to be selected. Once this has been done, the recorder re-initialises itself.

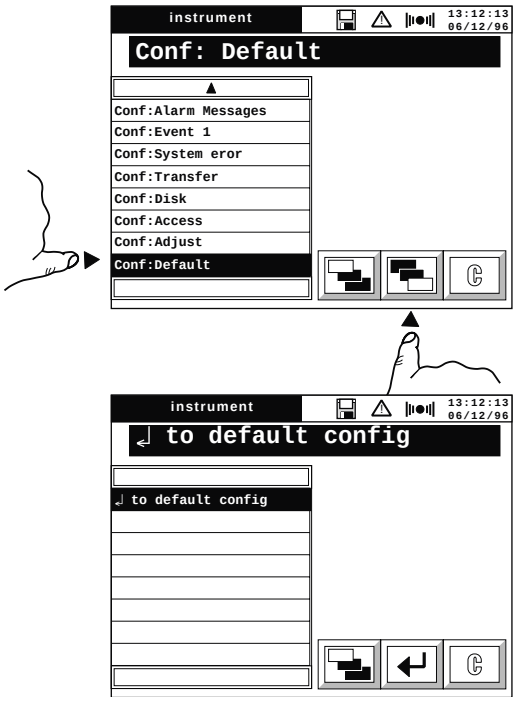


Figure 2.2.2 Restore factory configuration

2.3 CALIBRATION

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

Note: Calibration checks 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

2.3.1 DC Inputs

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.

EQUIPMENT REQUIRED

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

CALIBRATION CHECK

1. Connect all the channels to be checked to the voltage reference as indicated in figure 2.3.1. Ensure that the recorder rear terminal cover is in place after wiring.
2. Configure a group to contain all the relevant channels.
3. For each 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 2.3.1 below.
4. Set the output of the voltage reference to the first checkpoint value in table 2.3.1. Check that each channel’s value 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 each channel to be checked, set scale and range to the next hardware range in table 2.3.1.
7. Repeat steps 4, 5 and 6, until all the hardware ranges have been checked.
8. Restore original input wiring and configuration if necessary.

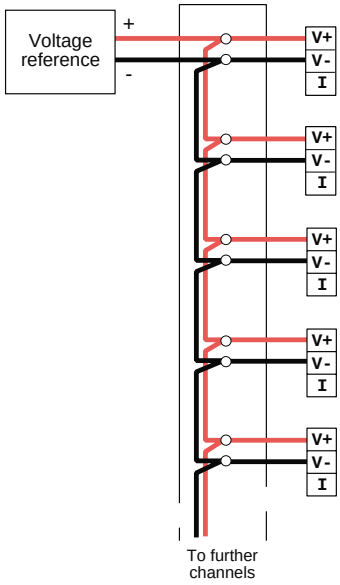


Figure 2.3.1
Calibration check wiring: voltage inputs

* 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.

Input range (mv)	Check points (mv)										Max. Tol (mv)
	1	2	3	4	5	6	7	8	9	10	
-8 to + 38 mV	-8.0	-2.9	2.2	7.3	12.4	17.6	22.7	27.8	32.9	38	0.063
-30 to + 150 mV	-30	-10	10	30	50	70	90	110	130	150	0.201
-200 to +1000 mV	-200	-66.7	66.7	200	333	467	600	733	867	1000	1.443
-2000 to +10000 mV	-2000	-6667	6667	2000	3333	4667	6000	7333	8667	10000	32.303

Table 2.3.1 calibration checkpoints: voltage inputs

2.3.2 Internal cold junction compensation (CJC) checking

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

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

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

2.3.3 Resistance inputs

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

EQUIPMENT REQUIRED

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

Notes:
1. 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.
2. Ensure that all leads to the resistance box are of the same length, gauge and material.

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 2.3.3. 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 2.3.3 below. Repeat this configuration with 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 2.3.4, and after a suitable time period (see note above), check that the channel’s value is equal to the applied resistance within the specified tolerance.
5. Set the resistance box to each of the remaining checkpoints in turn * and check that the channel 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.

* 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.

2.3.3 RESISTANCE INPUTS (Cont.)

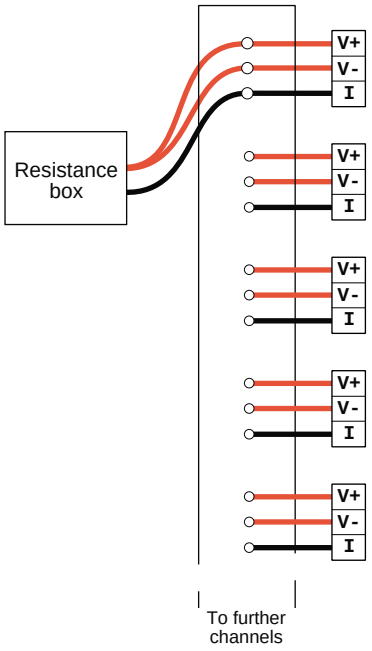


Figure 2.3.3 Calibration check wiring: resistance inputs

Input range (Ω)	Check points (Ω)										Max tol. (± Ω)
	1	2	3	4	5	6	7	8	9	10	
0 to 150 Ω	0	17	33	50	67	84	100	117	133	150	0.1145
0 to 600Ω	0	67	133	200	267	333	400	467	533	600	0.437
0 to 6kΩ	0	667	1333	2000	2667	3333	4000	4667	5333	6000	4.145

Table 2.3.3 Resistance input calibration checkpoints.

2.4 RECORDER MESSAGES

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

BAD REMOTE CJ TEMP

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

BAT BACK RAM CLEARED

This appears if the back-up battery has failed AND the unit has been switched off for more than 48 hours (typical) without a replacement being fitted. The battery maintains the real-time clock and supports the RAM which holds totaliser and counter values (if the Totaliser/Counter/Timer option is fitted).

BATTERY FAILURE

This message appears when the RAM support battery is no longer holding its charge and should be replaced.

CLOCK FAILURE

This message appears at power-up if
a. the clock has lost date or time (or the clock has never been set), or
b. if the battery is exhausted (see 'Bat Backed RAM Cleared' above) or
c. there is a hardware fault in the clock circuit.

The error is cleared by setting time and date.

CLR DISK OVERDRIVE

Occurs when the internal archiving buffer is full. Cleared by use of the enter (↵) key See section 2.1.7 for causes.

DISK CORRUPT - PLEASE REPLACE

This message appears when the disk is damaged to the extent that a write cannot be performed properly. In such a case, it is possible that some data has been lost. Should the damaged area be in the system area of the disk, it might appear to the recorder to be unformatted, and the disk icon at the top of the display area will disappear. The disk should be replaced immediately

DISK WORN - PLEASE REPLACE

This message appears when a number of attempts have been made before a write-to-disk was successful. No data is lost, but it is recommended that the disk be replaced as soon as it is practicable to do so.

DV 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.

2.4 RECORDER MESSAGES (Cont.)

EEPROM DB DEFAULTED

This message appears at power up if any part of the database is found to be corrupt at power-up, and the database has been defaulted.

INPUT CHAN FAILURE

Input channel hardware fault, or if configured to use a remote CJ, the remote CJ is disabled or is not providing a suitable signal.

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 CONFIG

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

MODEM FAILURE

Occurs if:

a. Modem not fitted/powered-on
b. Wiring to Modem incorrect
c. Incompatible type of Modem in use
d. User-entered initialisation string not recognised.

OUTPUT CH FAILURE

Output channel hardware fault

> RANGE

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

< RANGE

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

Section 3

Recorder disassembly

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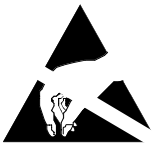
SECTION 3: RECORDER DISASSEMBLY

3.1 INTRODUCTION

This section shows how to take a recorder apart, to the level of sub-assemblies (i.e. as far as those items which can be purchased as spare parts). The instructions are in two main sections - the recorder, including the main processing and memory circuits as well as the display, and the case (sometimes called 'the sleeve)' which includes the power supply unit and I/O and option boards, as well as the mechanical connectors etc. accessible from the rear of the case when the red/orange terminal cover is removed.

Caution



To all intents and purposes, all the circuit boards associated with this recorder contain circuits which are susceptible to damage by static electrical discharge of voltages as low as 60V. It is therefore essential that all relevant personnel are aware of correct static handling procedures, and that a proper, static-safe work area is available, fitted with conductive mats, wrist/ankle strap facilities, and if possible an ion shower.

Caution

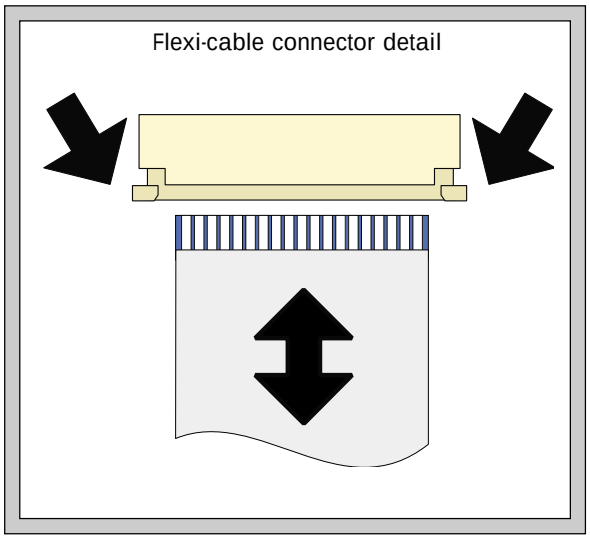
Although this manual describes how to change the display backlight unit, the procedure is not recommended either by the display manufacturer or by the recorder manufacturer. Any repair to the recorder, which becomes necessary as a result of an unsuccessful attempt to replace the backlight unit, will be charged for by the manufacturer. I.E. the backlight replacement kit is not warranted.

If an attempt is made to replace the backlight unit, the display manufacturer recommends that a clean area to class c be available, fitted with static safe equipment as described immediately above.

WARNING!

The recorder must be isolated from all sources of hazardous voltages (i.e. both supply and signal) before this procedure is started. Hazardous voltages are defined as those greater than 30V RMS or 60V dc.

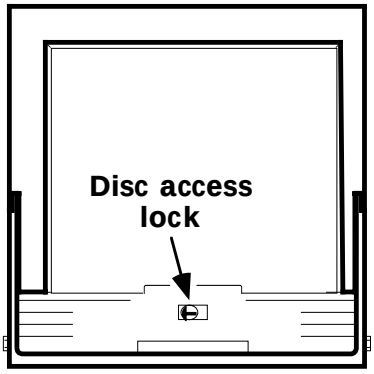
Note: Flexi-cable connectors consist of two parts, the housing (which is fixed to the circuit board), and the clamp which can be slid in and out of the housing approximately 1mm. To remove the flexi, the clamp must be released by pulling on the two lugs (arrowed in the drawing). Once the clamp has been pulled out (as shown) the ribbon cable can be gently removed. To re-insert the flexi, the clamp must again be pulled out, the flexi inserted into the fixed part of the connector, and the clamp pushed into its locked position. When correctly inserted the flexi cable emerges perpendicular to the clamp face, with the 'silver' part of the cable almost completely contained within the connector housing

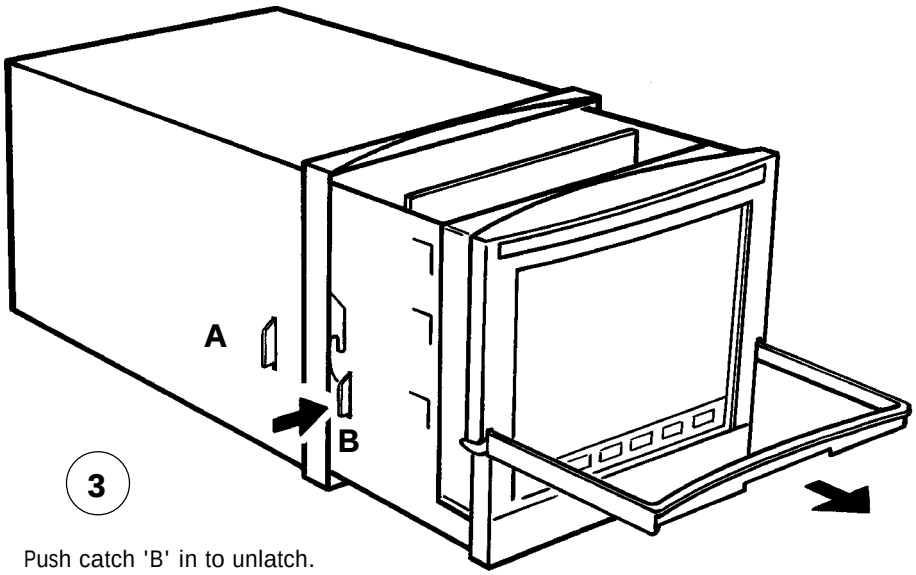


3.2 REMOVAL OF THE RECORDER FROM THE CASE

1

Remove M3.5 securing screws if fitted
(6mm AF spanner (wrench) required)
(Seismic option only)



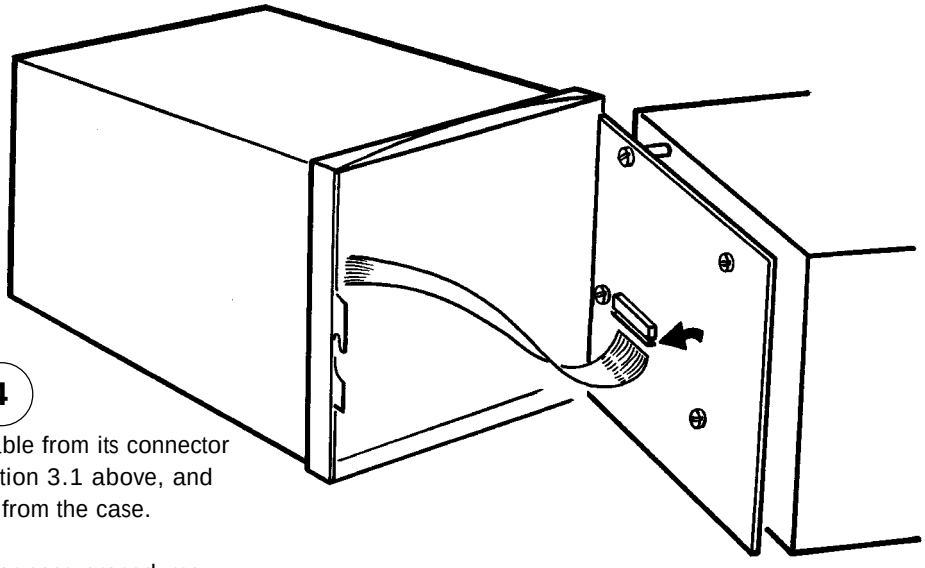


2

Lift the handle, and pull the recorder out until catch 'A' engages

3

Push catch 'B' in to unlatch.
Slide the recorder gently forwards until the flexi cable connector becomes accessible



4

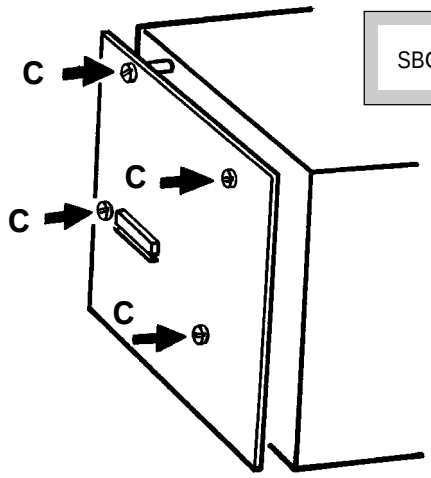
Remove the flexi cable from its connector as described in section 3.1 above, and remove the chassis from the case.

Go to section 3.4 for case procedures

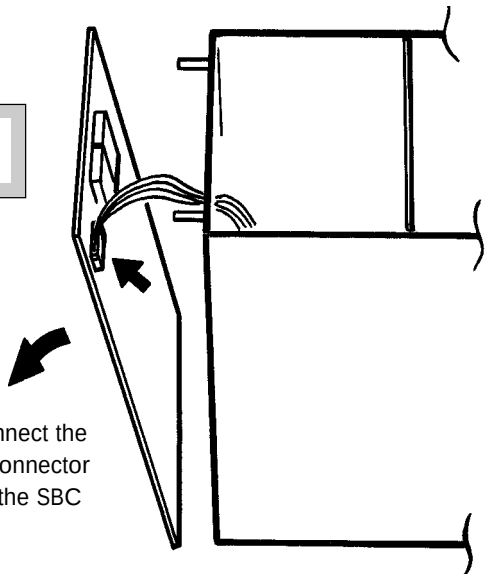
3.3 RECORDER DISASSEMBLY

3.3.1 SBC Removal and software upgrade

(To replace the video board, go to section 3.3.3)



SBC Part Nº AH249611U300

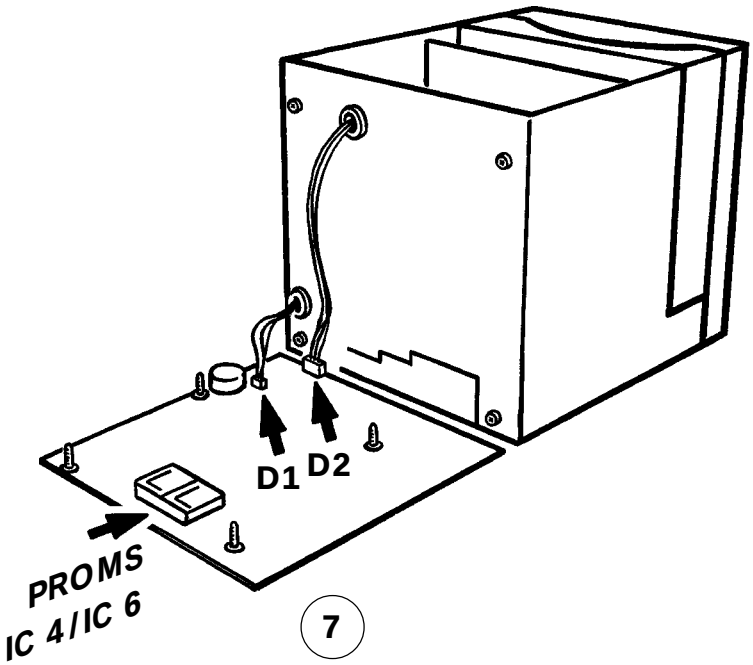


6

Carefully disconnect the loom from the connector near the top of the SBC

5

Release the SBC by undoing screws C. Take care not to damage the 'Option key' - a small circuit board perpendicular to the SBC.

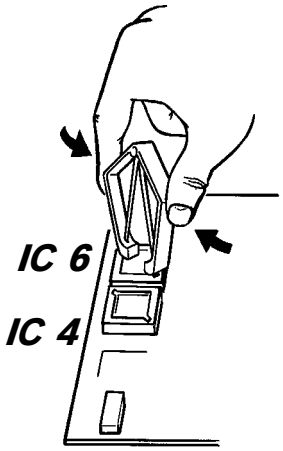


7

If you are replacing the SBC, disconnect the two connectors D1 (configuration port) and D2 (battery back-up). Fit the new board and re-assemble the recorder.

Note: Disconnecting D2 causes the real-time clock and any totaliser and counter values to be lost. If you are **NOT** replacing the SBC, continue at '8' overleaf.

Software upgrade



The SBC software is held on two PROMS, IC4 and IC6. The two PROMS are identified by part numbers on their labels. The one labelled IC4 should be fitted in IC4 location, and the one labelled IC6 in IC6 location.

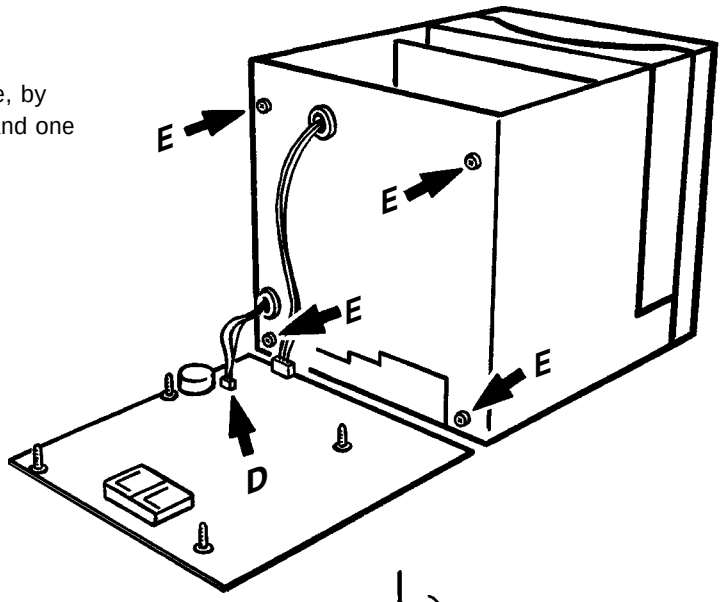
Note the orientation of the PROMS before extracting them with a PLCC extractor tool as shown. Fit the new PROMS ensuring correct orientation.

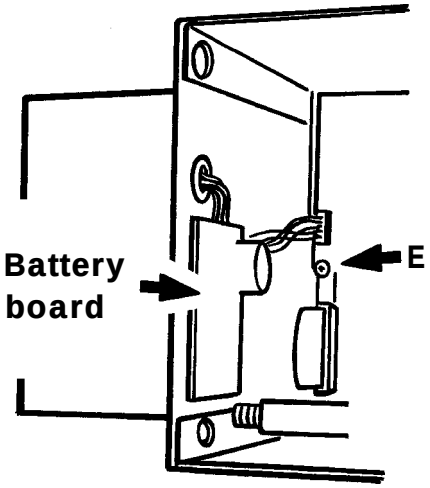
Note that the extraction process requires considerably more force than implied in the above sketch which is drawn for maximum clarity.

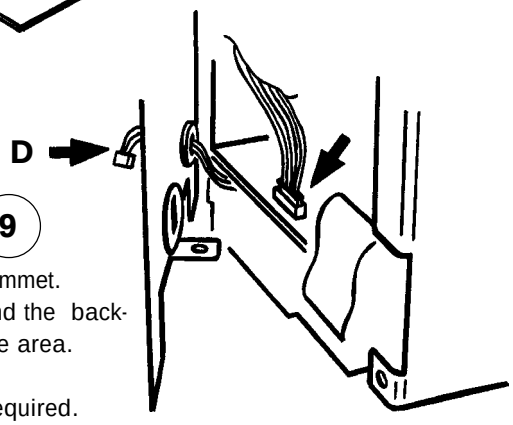
3.3.2 Battery board replacement

8

Disconnect connector D, then remove the back-plate, by undoing screws E (four at the rear of the recorder and one inside the recorder).







9

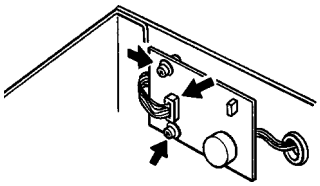
Pass connector D through the back-plate grommet. Disconnect connector F. Remove the SBC and the back-plate together and place them in a static safe area.

The battery board can now be replaced if required.

Battery board (AH249860) replacement

If required, the battery board can now be replaced as follows:

a. Disconnect the battery connector from the battery board.
b. Remove the battery board by undoing its two securing screws.
c. Fit the new board using the two screws previously removed, ensuring that the harness is retained between the board and the back plate.



Notes:

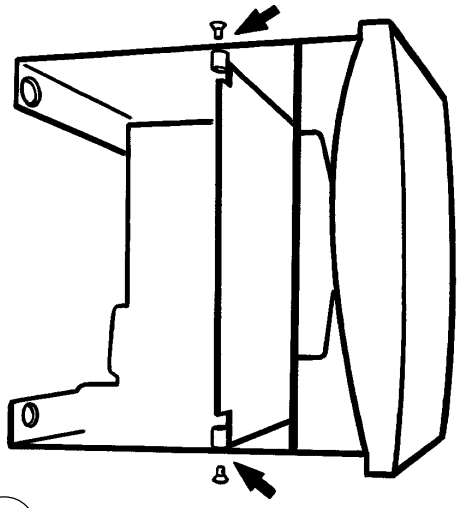
1. The battery is a NiCad type and should be disposed of according to local regulatory requirements
2. Do not allow either the old or the new board to come into contact with the metal back-plate or other metal surface.
3. Configuration, trace history etc. are retained in Flash memory during this process. Time/date and accumulated values of totalisers, counters and other maths functions (if fitted) are not retained.

3.3.3 Video board removal

The video board will be removed either as a part of the recorder disassembly procedure, continued from section 3.3.2, or because it is to be replaced. In the latter case, only section 3.2.1 needs to be carried out prior to video board removal, and sections 3.3.1 and 3.3.2 can be ignored.

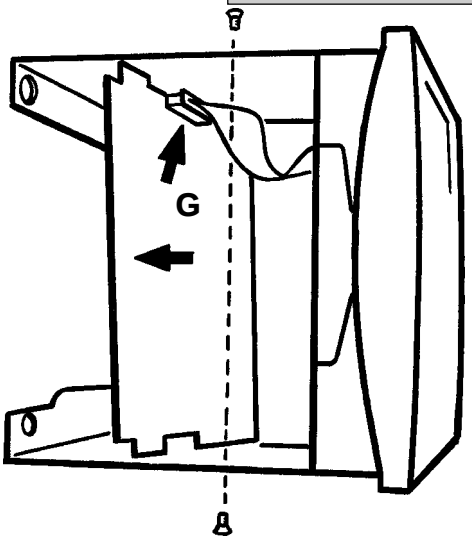
The following instructions continue the general disassembly procedure.

Video Board Part Nº	
800kB	AH248670
2MB	AH248670U100



10

Remove the circuit board retainers.

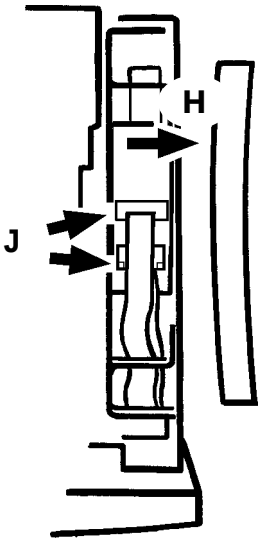


11

Lift the video board out of its guides, and move it towards the rear of the recorder, until the connector (G) can be accessed, and its associated flexi-cable disconnected. Remove the video board and store it in a static safe area (unless it is to be replaced, in which case it can be discarded).

3.3.4 Final disassembly

This section shows how to remove the disk drive, the interconnect board, the display unit and the door. Use only those sections which are relevant to your needs.



12

To remove the display unit, go to instruction 15. Otherwise, with the recorder upside down, locate the curved insulating strip (H), and remove it.

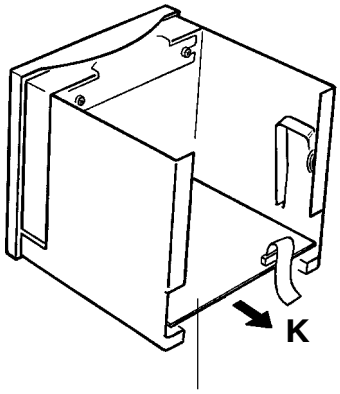
Disconnect the flexies from their connectors (J), either on the small circuit board - if fitted- or from the interconnect board. If the board is fitted, disconnect the remaining connector and remove the board and store it in a safe place for later re-assembly.

To remove the interconnect board go to instruction 13.
To remove the disk drive unit go to instruction 14.
To remove the door, go to instruction 15.

3.3.4 FINAL DISASSEMBLY (cont.)

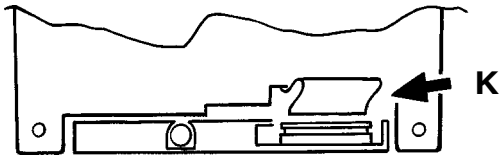
INTERCONNECT BOARD REMOVAL

Interconnect board Part Nº AH248671



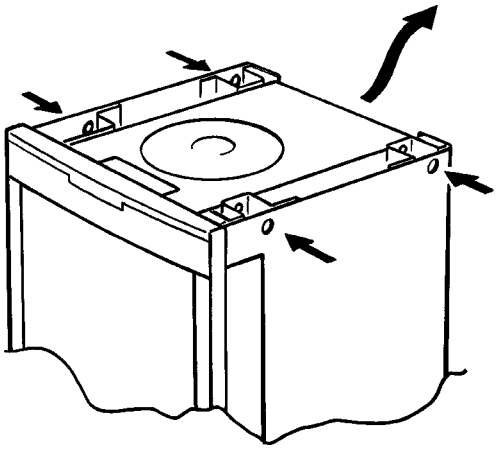
Interconnect board

13 Disconnect the flexi-cable (K) from the disk drive unit. The interconnect board can now be removed by pulling it gently out of the back of the recorder.



DISK DRIVE UNIT REMOVAL

The description of this procedure is complicated slightly by the fact that a number of different drive units have been fitted, each of which has had a slightly different method of mechanical fixing. The flexi connector can be in one of two orientations, one in which the cable emerges from the back of the drive, the other having the connector in the same place, but rotated 90 °, so that the cable emerges at the top of the unit.



14 If the flexi cable (K) has not yet been disconnected, disconnect it now.

Undo the three or four fixings which secure the drive unit to the chassis. The unit can now be carefully withdrawn from the chassis.

Note: The fixings are one of:
4 off cross-head screws*
3 off cross-head screws
2 off cross-head screws and 2 off socket grub screws

Where socket head grub (set) screws are fitted, a 1.2 mm (0.050") AF Allen key is required.

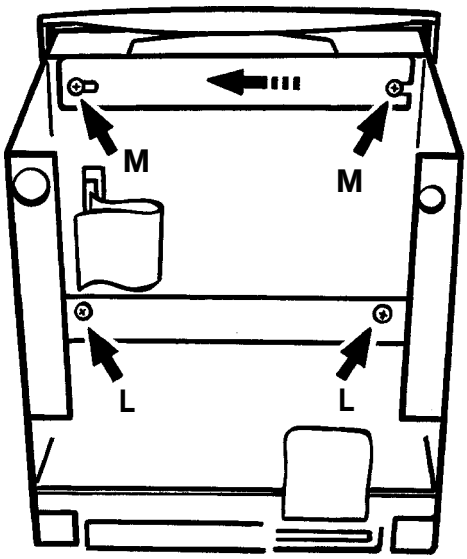
*Note: It is particularly important that with four-screw fixing, that the screws are not over-tightened on re-assembly.

Floppy disk drive replacement kit Part Nº LA261045
Flexi-cable (K) Part Nº DN248672U050

3.3.4 FINAL DISASSEMBLY (cont.)

DISPLAY UNIT REMOVAL

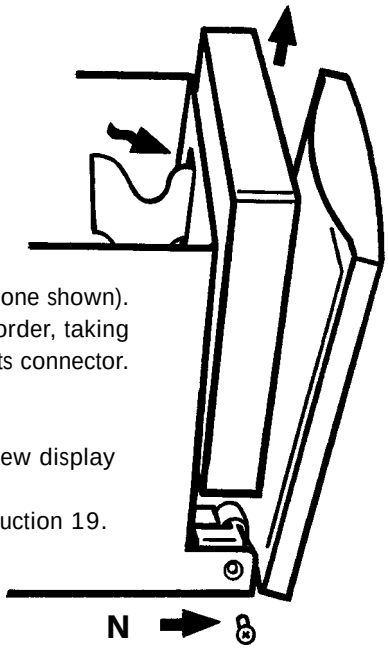
It is recommended that plastic or latex gloves be worn whilst handling the display and door, to avoid fingermark contamination of the display or touch screen on the inside of the door. Such contamination cannot subsequently be removed.



15

With the recorder chassis the right-way up again, remove screws 'L' and release screws 'M'.

Slide the sliding catch to release the top of the door.



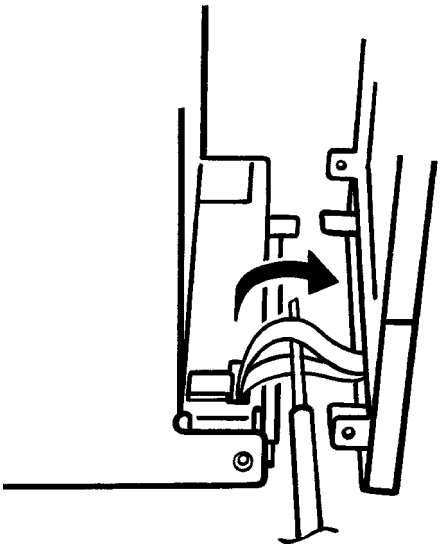
(also on right hand side)

16

Remove the two remaining door retaining screws 'N' (only one shown). Carefully separate the display from the door and lift it out of the recorder, taking care not to damage the ribbon cable (DN248673U080) or its connector.

17 If you are replacing the display, but not the door, fit the new display unit and continue at step 22.
If you are replacing the backlighting unit, continue at instruction 19.
If you are replacing the door, continue at step 18.

DOOR REMOVAL



18

Taking note of how the flexies are routed through the recorder mechanics, and the position of the rubbery cable protector, use a small screwdriver blade, or similar, to prise the two* flexi cable 'tails' out of the recorder.

The door can now be removed and the new one fitted.

* On some recorders only one flexi is fitted

3.3.5 Backlight replacement

Notes:

It is recommended that the display unit be returned to 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 herein 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 electrostatic 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 lighting unit 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 lighting unit is physically damaged, adequate care must be taken to avoid personal injury. It is also likely that pieces of broken glass will not be extricable, resulting in lighting evenness quality problems once the replacement unit is installed.

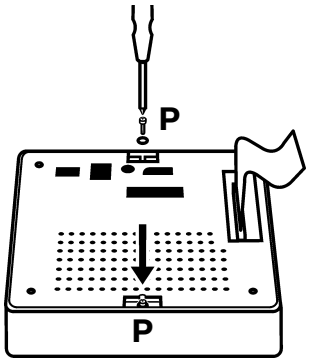
QUALITY CONSIDERATIONS

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

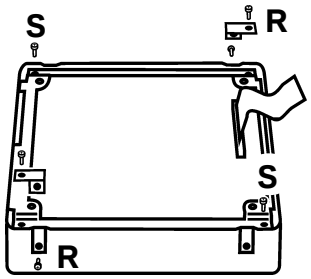
Finger contact with connectors may cause bad electrical contact to develop. It is recommended that finger cots or plastic or latex gloves are used when carrying out this procedure.

Backlight replacement kit Part Nº
LA260283

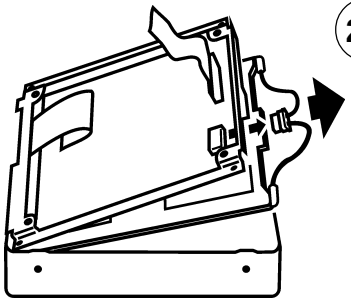
3.3.5 BACKLIGHT REPLACEMENT PROCEDURE (Cont.)



19 In a clean area (to class C), remove the rear cover of the display unit by undoing the two screws P



20 Remove the two securing brackets (R) and remaining securing screws (S).



21 Disconnect the backlight connector and remove the backlight unit.

DO NOT TOUCH THE REAR FACE OF THE LCD SCREEN - it cannot easily be cleaned, as most common solvents (e.g. Iso-propyl alcohol) damage the surface.

Carefully slide the replacement backlighting unit into place, and using a source of clean pressurised air, or similar, ensure that no dust particles are present anywhere between the backlight and the LCD screen.

Reconnect the connector and reassemble the display unit.

3.3.6 Reassembly

The re-assembly of the recorder is the opposite of the disassembly procedure given so far.

Hints:

1. When fitting the door, route the shorter 'flat' flexi through the mechanics first, so that it can act as a guide for the longer, pre-formed flexi.
2. When refitting the back plate, the securing lug at the bottom of the back-plate goes under the main 'interconnect' board.

3.3.7 Offset correction

This ensures that the image is positioned correctly relative to the screen.

At switch-on, continuously hold a finger in contact with the display screen until the 'calibration display' appears (approximately 30 seconds after switch on) as depicted in figure 3.3.7.

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

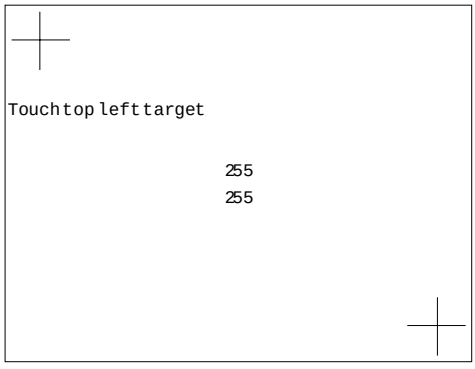


Figure 3.3.7 Calibration screen

Once the top left target has been accepted, continue as requested by the display. Once the targets have been accepted, initialisation continues as normal.

3.4 CASE ITEMS

This section shows how to replace, or retrofit circuit boards, how to fit new connectors and how to remove the power supply for replacement. If necessary, refer to section 3.1 for details of flexi-cable connectors, and section 3.2 for details of how to remove the recorder from the case.

3.4.1 Circuit boards

Figure 3.4.1a shows the inside of the case, with locations for one input board and four option boards.

Notes:
1. Relay output boards and some versions of the event input board need an address to be set using a DIP switch (see tables 3.4.1a and 3.4.1b respectively).
2. Retransmission (analogue output) boards need an address to be set using links (see table 3.4.1c.)
3. Communications boards may be used only in option slot 2 or option slot 4
4. Communications boards have three links which select either RS232 or RS485 as the transmission standard (see figure 3.4.1b).
5. Options board slots three and four can be used for a second six-channel input board, allowing the recorder to be configured as a 12-channel instrument.

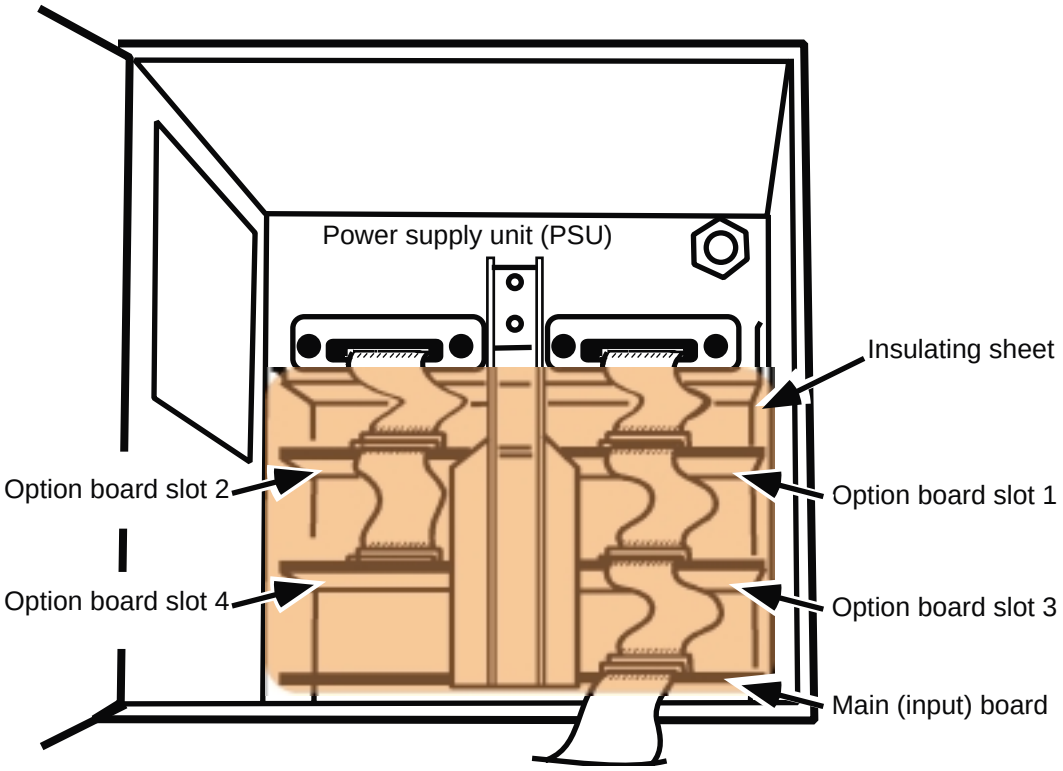


Figure 3.4.1a Circuit board locations (view from front of case)

Circuit board part Nºs:

Input board	AH249777U600
4 n/o relays	AH249712U100
4 n/c relays	AH249712U200
3 c/o relays	AH249712U300
Communications	AH250146U100
Profibus Comms	AH260191U100
Event input	AH250171
Retransmission o/p	AH250184

3.4.1 CIRCUIT BOARDS (Cont.)

Relay board No	Switch element	
	1	2
1	Up	Up
2	Down	Up
3	Up	Down
4	Down	Down

Table 3.4.1a
Relay board address settings

Event i/p board No	Switch element	
	1	2
1	Up	Up
N/A	Down	Up
N/A	Up	Down
N/A	Down	Down

Table 3.4.1b
Event i/p board address settings

Retrans-mission board No	Links fitted	
	1	2
1	No	No
2	Yes	No
N/A	No	Yes
N/A	Yes	Yes

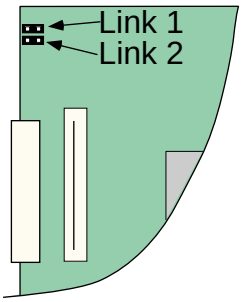


Table 3.4.1c
Retransmission board address link locations

Board type	Insert polarising pin between contacts:			
	Slot 1	Slot 2	Slot 3	Slot 4
Retransmission	48 & 49	61 & 62	26 & 27	39 & 40
Event input	49 & 50	62 & 63	27 & 28	40 & 41
Relay	50 & 51	63 & 64	28 & 29	41 & 42
Serial comms	N/A	64 & 65	N/A	42 & 43
Profibus comms	N/A	64 & 65	N/A	42 & 43

Table 3.4.1d Polarising key positions

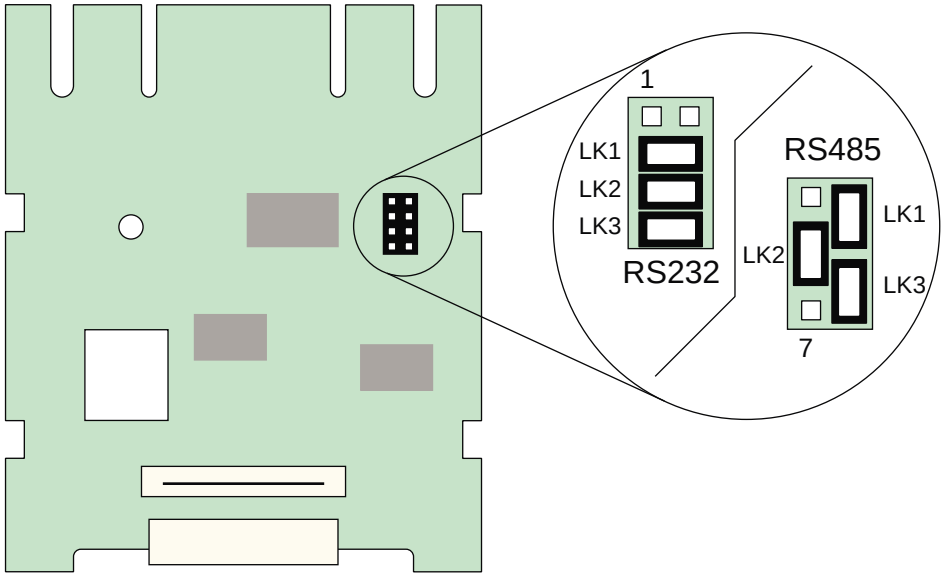


Figure 3.4.1b Serial communications board link settings for RS232 and RS485

3.4.1 CIRCUIT BOARDS (Cont.)

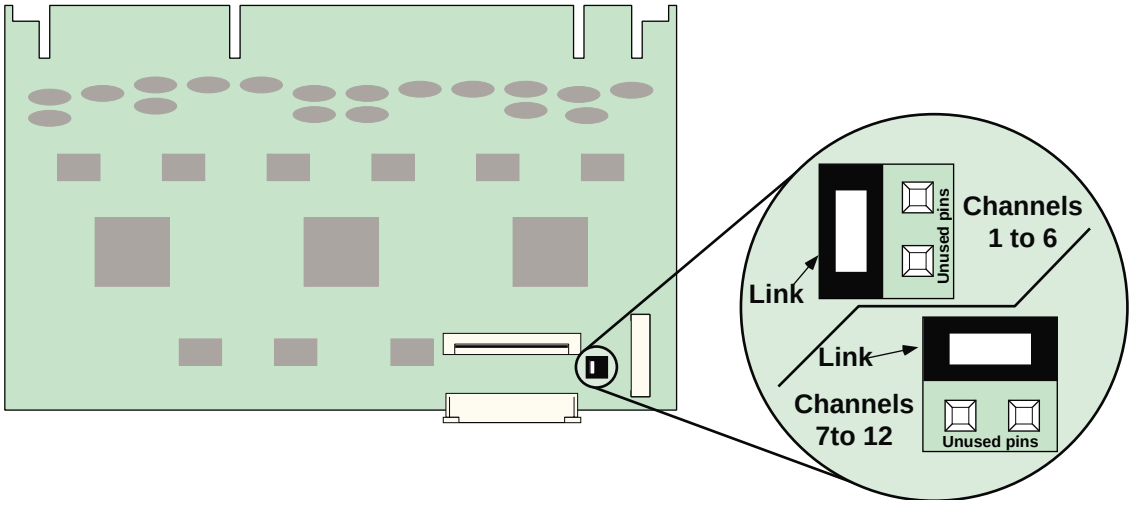
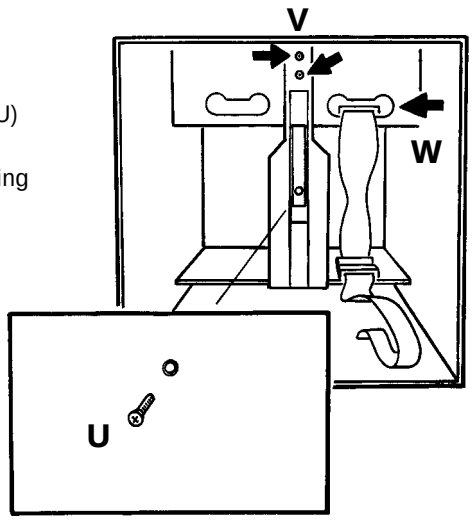


Figure 3.4.1c Input board link setting positions

ACCESS TO CIRCUIT BOARDS

Remove the insulating sheet by undoing its securing screw (U)

Remove the circuit board retainer, by undoing its two retaining screws (V)



ADDING ADDITIONAL BOARDS

1. If you are fitting an additional input board, go to step 13
2. If you are fitting a new option board, and other option boards are already fitted go to step 5 below
3. If no other option boards are fitted, remove the PSU connector cover (W) (if fitted), and remove the flexi cable from both the power supply unit and the input board. Continue at step 8 below
4. If option boards have never previously been fitted in slots 3 or 4, go to step 6, otherwise continue at step 7 below.

5a Option board in slot 1 only - continue at step 8 unless you are going to fit an option board in slot 3, in which case, remove the flexi between the input board and option board 1 before continuing at step 8, below.

5b Option board in slots 1 and 2 - remove the flexi cable between option board 1 and the input board and continue at step 6.

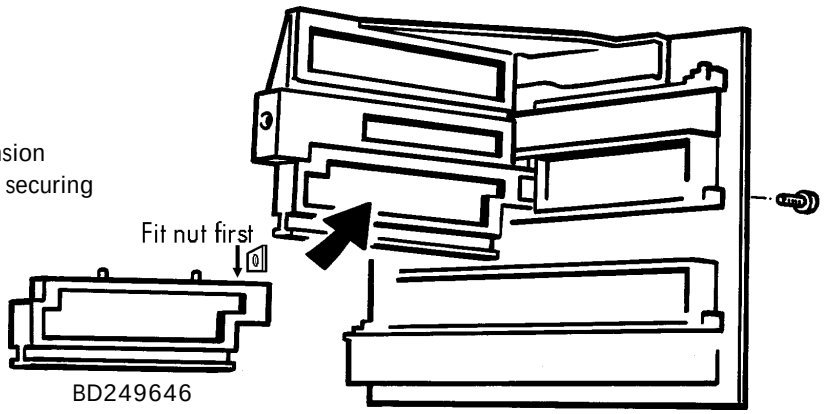
5c Option boards in slots 1, 2 and 3 - continue at step 8

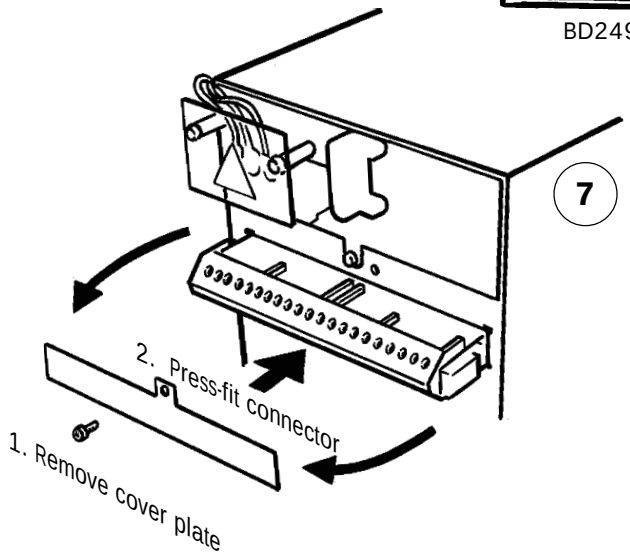
3.4.1 CIRCUIT BOARDS (Cont.)

FITTING THE CIRCUIT BOARD GUIDE EXTENSION (1/2 BOARD SUPPORT BD249646)

6

Slide the square nut into the slot in the extension board guide. Fit the extension board guide, securing it with the M3 x 10mm screw provided .

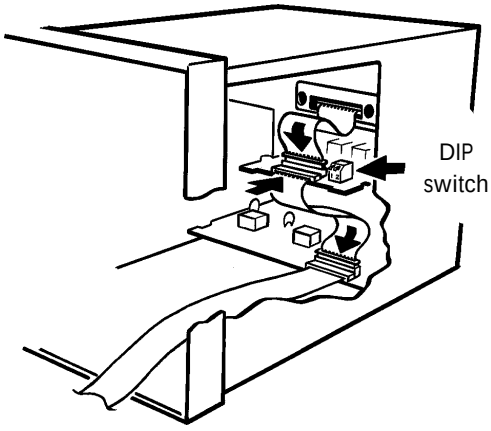




7

At the rear of the recorder, remove the relevant blanking plates (BA249715) and push-fit the connectors (CI249643) until they click into place.
Figure shows process for option boards 1 and 2; the process is similar for option boards 3 and 4.

Clip the screwdriver guide (BD249872) into place and fit the appropriate label to the connector(s) (LA247993 (23 to 44) for the middle connector; LA247994 (45 to 66) for the top connector)



8 Fit polarising keys as shown in table 3.4.1d

9 Set any DIP switches and links as shown on tables 3.4.1a to 3.4.1c.
Fit the option board(s) to the relevant slot(s) and connect the necessary flexi cables (conductive (shiny) surface uppermost) such that:

- 9a Option board 1 is connected to the PSU and either option board 3 (if fitted) or to the input board (as shown).
- 9b Option board 2 (if fitted) is connected to the PSU and to option board 4 (if fitted)
- 9c Option board 3 (if fitted) is connected to option board 1 and to the input board
- 9d Option board 4 (if fitted) is connected to option board 2.

Figure 3.4.1a, above, shows a full set of option boards and their flexi cables for guidance.

10. If previously removed, re-fit the plastic covers over the PSU connector slots, securing them with plastic rivets.
11. Re-fit the board retainer and the insulating sheet
12. Re-fit the recorder to the case.

3.4.1 CIRCUIT BOARDS (Cont.)

FITTING A SECOND INPUT BOARD

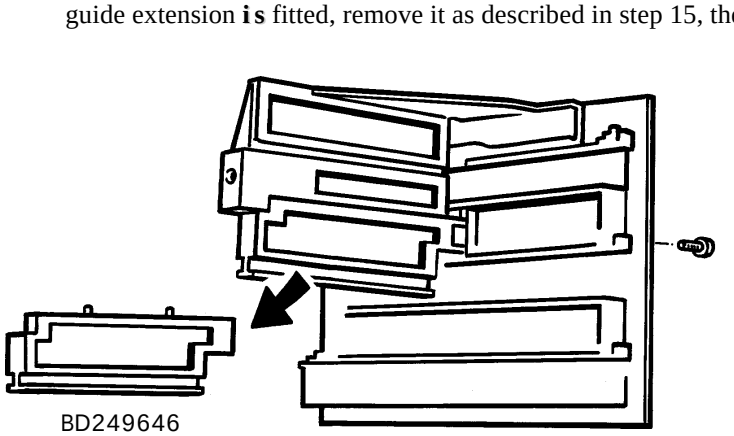
13. If there are option boards fitted in slots three and/or four, continue at step 14. If slots 3 and 4 are empty continue at step 16.

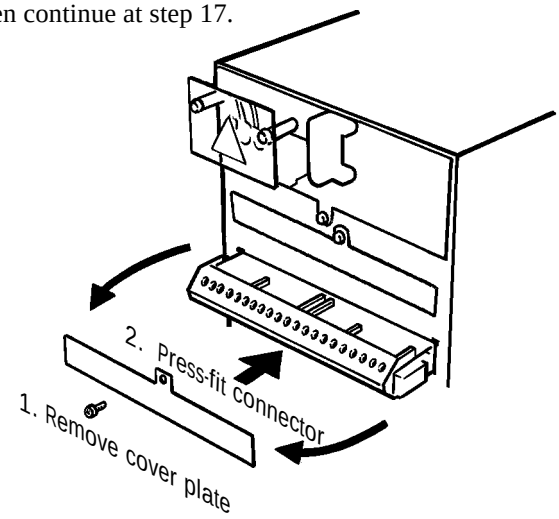
    The new input board occupies option slots three and four, so any option boards located in these slots must be removed as must the circuit board guide extension:

14. Remove all the flexi cables associated with all the option boards and store them in a safe place for use in later re-assembly. Pull any option boards in slots 3 and 4 forwards out of their connector and card guides. Store the cards in a static safe environment until such time as they are needed.

15. Undo the securing screw at the rear of the recorder and remove the circuit board guide extension (1/2 board support - BD249646) as shown in figure 9. Continue at step 18.

16. If slots 3 and 4 are empty, and the circuit board guide extension (BD249646) is **not** fitted, continue at step 18. If the guide extension **is** fitted, remove it as described in step 15, then continue at step 17.

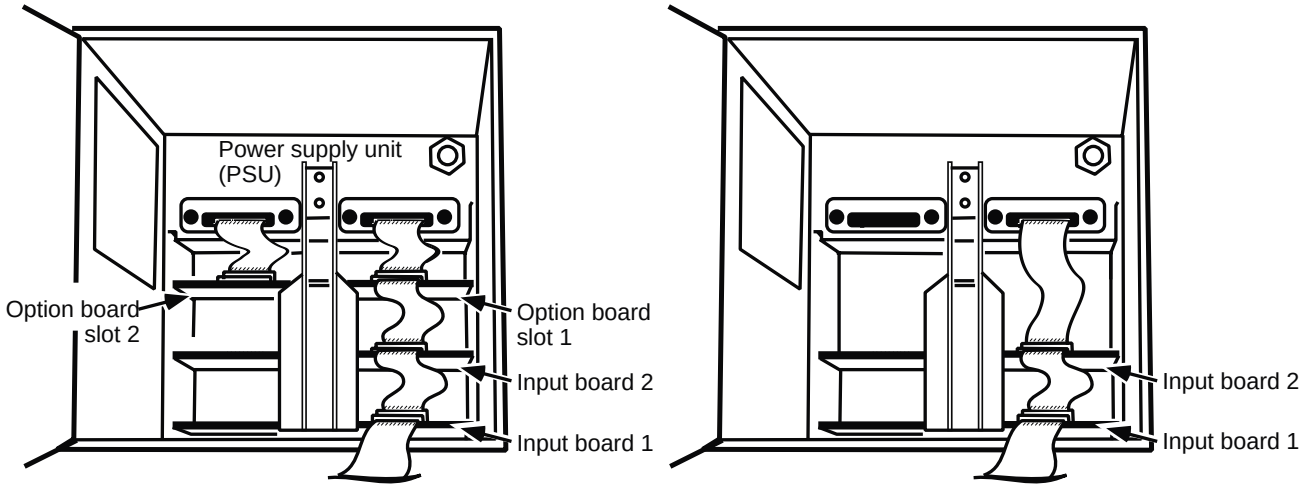




17. If not already fitted, fit the connector (CI249643) by removing the relevant blanking plate (BA249715) and push-fitting the connector until it clicks into place as shown. The connector has orientation lugs to prevent insertion the wrong way up. Clip the screwdriver guide (BD249872) into place, and fit the label (LA247993) to the connector (23 to 44).
18 Set the address link for board 2, as shown, and slide the circuit board into place. Connect the necessary flexi cables (conductive surface (bright-ends) uppermost) as follows.
19.

    If option board 1 IS fitted:
    19a PSU to option board 1 and Option board 1 to Input board 2
    If option board 1 is NOT fitted:
    19b PSU to input board 2
    In either case
    19c PSU to option board 2 (if fitted)
    19d Input board 1 to input board 2.
    19e Input board 1 to writing system
    The figure below shows two possible flexible cable layouts.
20. If previously removed re-fit plastic covers over the PSU connector slots securing them with plastic rivets.
21. Re-fit the board retainer, and the insulating sheet.
22. Re-fit the recorder chassis to the case, ensuring that the flexi cable is properly fitted.

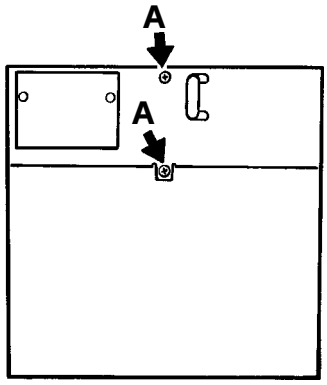
3.4.1 CIRCUIT BOARDS (Cont.)



Typical flexi-cable routing

3.4.2 Power supply unit (PSU) replacement

1, Remove the recorder from the case, as described in section 3.2.
2. Remove the flex-cables at option board 2 (if fitted) and either option board 1 (if fitted), or the input board.
3. Make absolutely sure that the supply voltage power cord is isolated from the mains, and after removing the safety cover and cable clamp, unwire the PSU input terminals.
4. Undo the securing screws ('A' in the figure) and gently work the PSU out of the case, ensuring that the flexi cables are free to be extracted with it.
5. Remove the plastic PSU connector covers (if fitted) and remove the flexi-cable(s) and fit them to the replacement unit. Fit the covers if appropriate.
6. Carefully insert the new unit into the case, ensuring that the flexi cables are not trapped, twisted or damaged in any other way.
7. Secure the PSU to the case using the securing screws previously removed.
8. Re-connect the free ends of the flexi cable.
9. Rewire the supply voltage cable and re-fit the safety cover



Power supply securing screws

PSU Part Nºs:	
90 to 264Vac	LA249573U500
24 to 48Vac/dc	LA249573U600

Section 4: Spare parts and exploded diagrams

List of contents

4.1 RECORDER PARTS

Figure 4.1 shows an exploded drawing of the recorder chassis.

4.1.1 Upgrade kits and accessories not shown

LA250993	Review software
LA246843	Configuration editor
DN247979	Configuration cable
LA250907	Communications adder kit
LA250908U100	Relay adder kit (4 normally closed)
LA250908U200	Relay adder kit (4 normally open)
LA250908U300	Relay adder kit (3 change-over)
LA250908U500	Retransmission adder kit
LA250908U700	Event input adder kit
LA261169U300	Input channel adder kit (three channels)
LA261169U600	Input channel adder kit (six channels)

BD249646	1/2 board support (circuit board guide extension)

Software (instrument and door) on floppy disk.
Software (door only) on floppy disk.
Software (instrument only) on floppy disc
Software (instrument and door) on PC card
Software (door only) on PC card
Software (instrument only) on PC Card

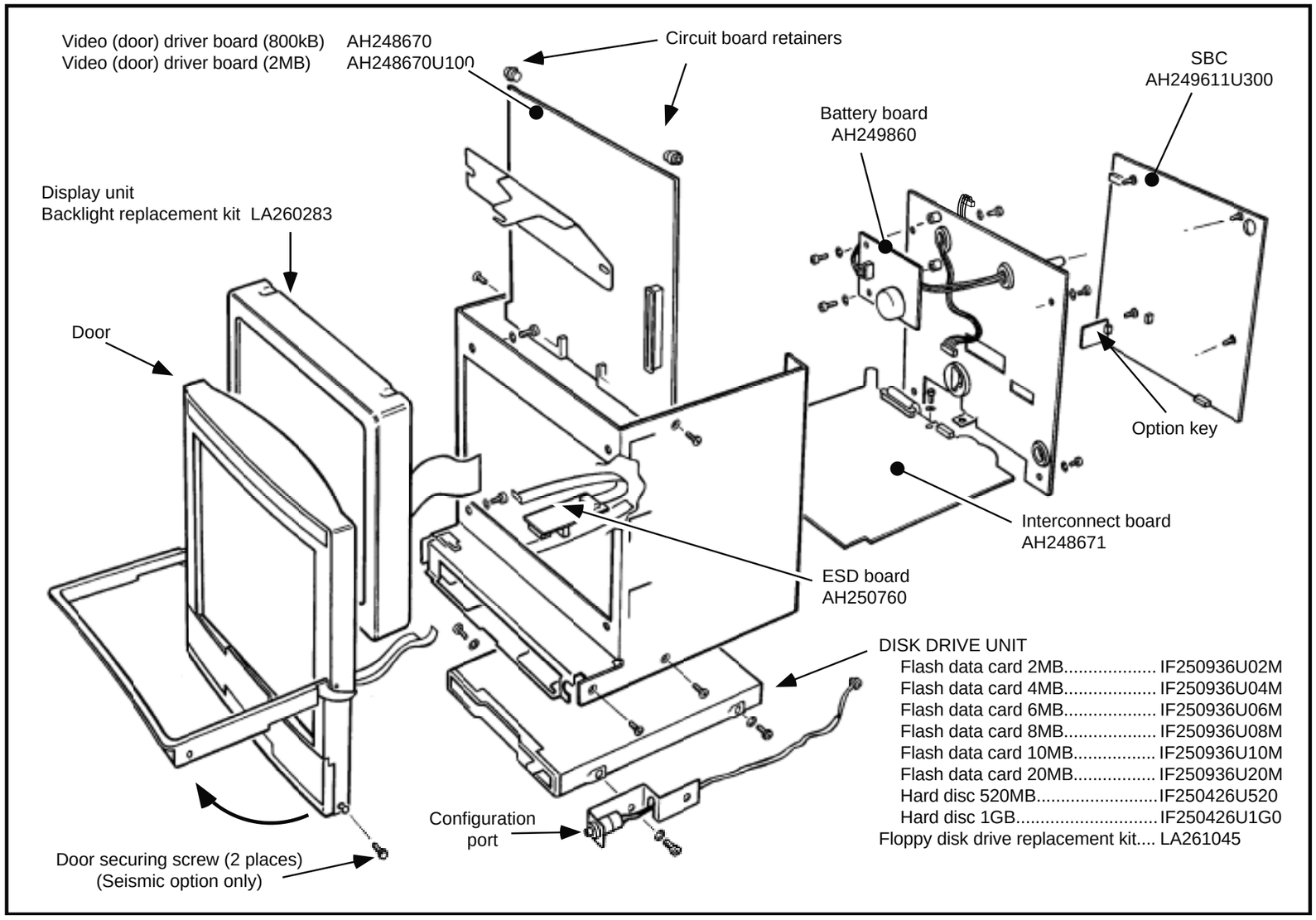


Figure 4.1 Recorder exploded diagram

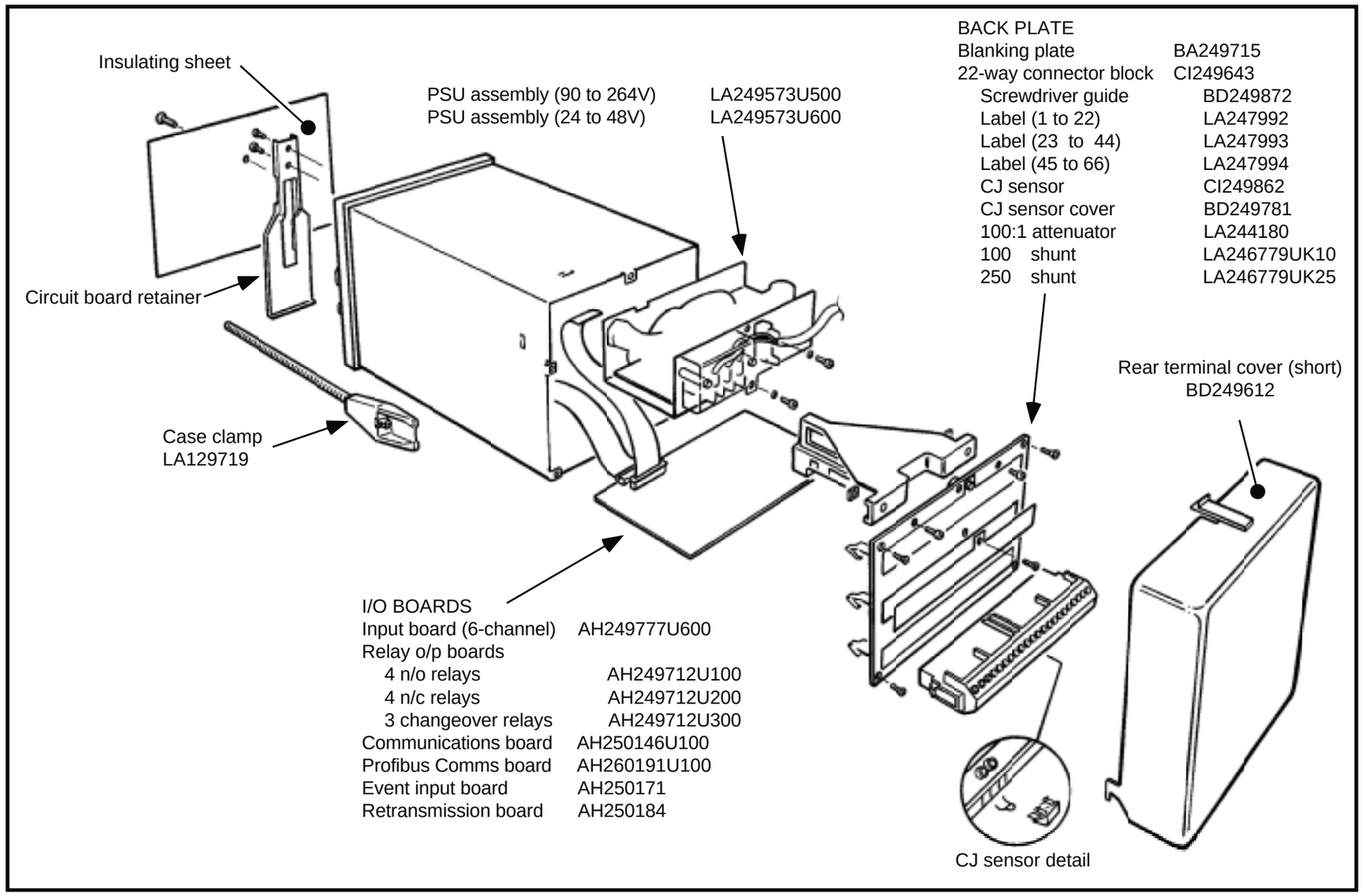
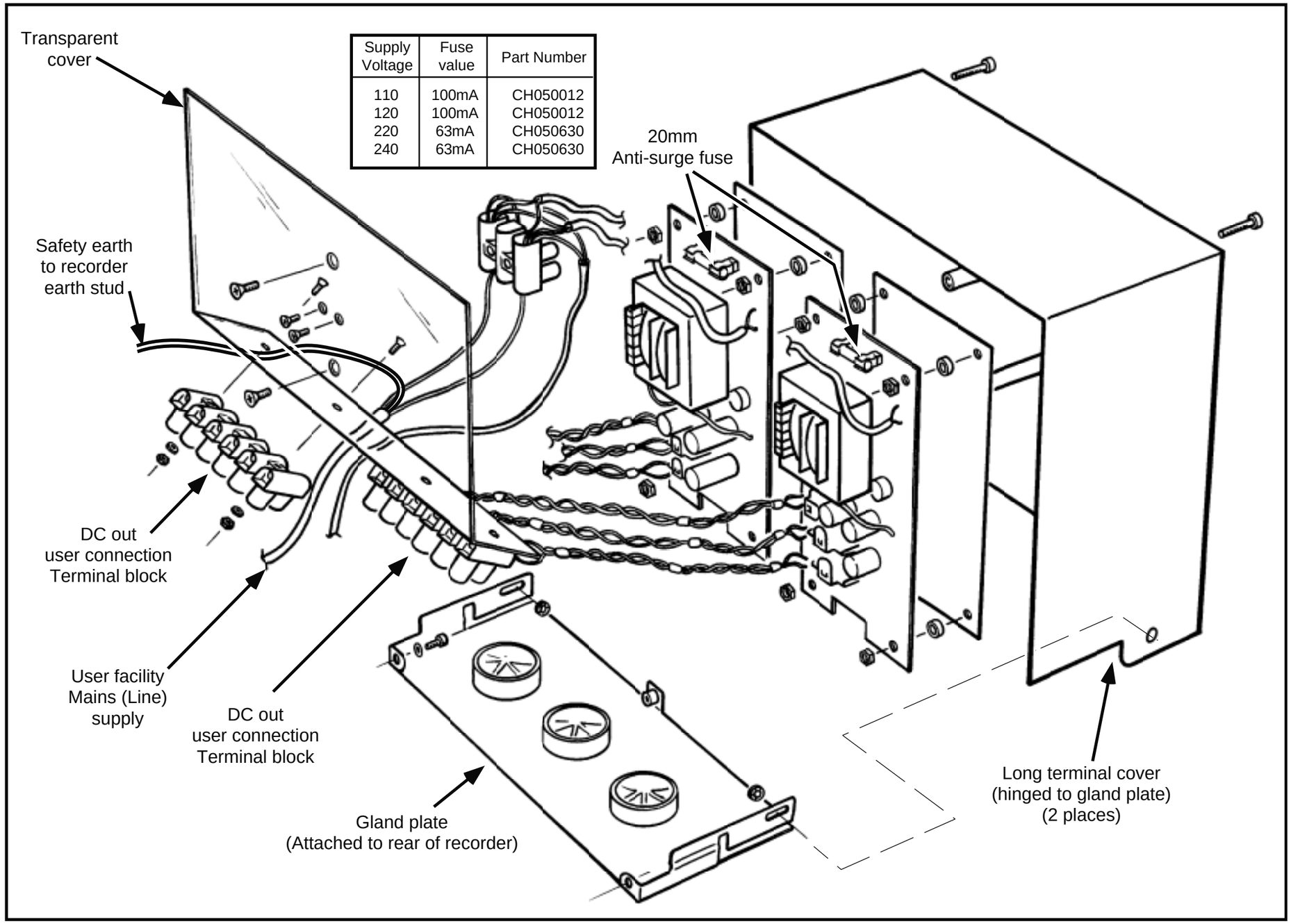


Figure 4.2 Case (sleeve) exploded diagram



Supply Voltage	Fuse value	Part Number
110	100mA	CH050012
120	100mA	CH050012
220	63mA	CH050630
240	63mA	CH050630

Figure 4.3 Transmitter power supply exploded diagram

LIST OF EFFECTIVE PAGES

This (issue 1) manual consists of the following pages at their stated issue number.

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