9914V TAPE UNIT

SERVICING MANUAL

Document Ref. 95 125456

Draft Issue D

Stock Number: 95 125456 xx

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The German Post Office has been notified that this equipment has been introduced into the market and is granted the right to type-test the equipment for compliance with the regulations.

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Servicing Manual Amendment Record

Amendment	Details	Date
Draft Issue A	Sections 1 - 6	Dec 1992
Draft Issue B	Section 7 added	May 1993
Draft Issue C	Part of Section 8 added Sections 1 - 6 reviewed	Jun 1993
Draft Issue D	Sections 7 & 8 finalised	Jul 1993

1. 9914V Overview

This 9914V Servicing Manual describes the mechanical layout and provides functional circuit descriptions of the unit. These are accompanied by full diagnostic program descriptions and fault codes, fault-finding guides, and servicing procedures.

A companion 9914V User/Diagnostic Manual contains installation details, operating instructions, routine cleaning schedules, and diagnostic program details for the use by the installer or the operator.

The features and capabilities of the 9914V are set out in a separate 9914V Product Specification.

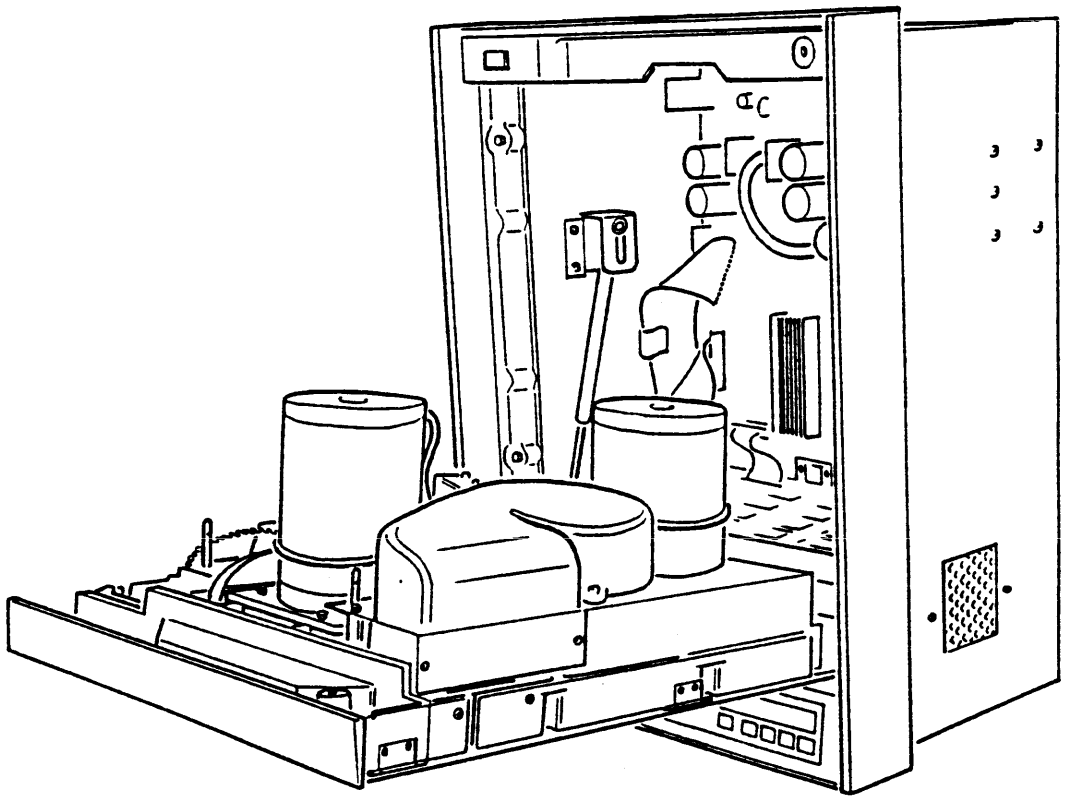

FIGURE 1.1 FRONT VIEW OF THE 9914V

1.1 9914V Background

The 9914V is a rack-mounted, dual-speed, microprocessor-controlled tape unit, using open reels of standard half-inch computer tape on IBM-style hubs. It uses many of the mechanical features of the 9914 tape unit, with virtually identical electronics. The resulting tape unit fits into a shallow 19-inch rack while offering the user a hinged chassis concept (for ease of service access) and quad-density recording (including 6250 bpi GCR).

1.1.1 Industry Compatibility

The 9914V user interface is factory-equipped to be

- the industry-compatible unbuffered Pertec, *or*
- the industry-compatible buffered Pertec Cache, *or*
- the ANSI-compatible SCSI, *or*
- the ANSI-compatible Enhanced SCSI.

The 9914V's tape data formats are all IBM-compatible to conform with both ANSI and ECMA specifications for PE, NRZ, and GCR methods of data recording.

The 9914V can be mounted in a standard 19-inch rack.

1.2 Specific 9914V Features

1.2.4 Configuration Options

User options are held in non-volatile ram (NVR) on the Data Control board. This dispenses with the need to remove a board and operate links or slide switches to re-configure the unit, as well as giving increased flexibility. Not only are the firmware-orientated functions such as ' load on door closure ' changed via NVR, but also the hardware-orientated unit address.

The basic 9914V options are described in Section 4. Options which belong to SCSI or the Pertec cache interface are described in the appendices.

1.2.2 Diagnostics

The 9914V contains extensive diagnostic facilities and self-test routines, which provide assurance of machine integrity and aids for fault diagnosis.

When power is switched on, the self-check diagnostics verify basic requirements such as the presence of power supplies, presence of the ADP and DDP boards, and compatibility of the board builds.

A wide range of diagnostic routines may be selected from a comprehensive program suite, by the operator or the host. The SCSI (or PCI) board buffer is used to enable full data I/O checks, which can be selected from programs with or without tape motion. Diagnostic programs can be run individually, grouped together, or (in either case) may be continuously repeated.

The diagnostic programs are described in Section 5. Fault-finding flowcharts and tables are set out in Section 3.

The status bytes (some of which are updated by diagnostic programs) are listed in Section 6. Special Access Status byte commands are provided to transfer these bytes over either Pertec interface, while the Receive Diagnostic Results command is provided to transfer them over the SCSI interface. Status bytes can be fetched to the operator's display by using diagnostic program 68.

1.2.3 Access, Modularity, and Tools

The deck chassis hinges downwards to gain access to all the electronic and mechanical assemblies. The Power Supply board and the Servo Control board - where the tape motion control functions of the 9914V originate - are located at the back of the mounting tray. The data boards are fitted in a hinged card rack, and any SCSI or PCI interface board is fitted to the mounting tray.

Access the tape path itself is gained by opening the tape loading door, hinging the chassis is not necessary.

Parameters such as read gains are determined by diagnostic programs, eliminating the need for numerous readings and calculation. Servo parameters are determined by a power-on routine, eliminating the need for special test cables and dc current meters. Special tools are available to speed up the process of setting the hub heights.

1.2.4 Tape Path and Tape Threading

Clamping and Releasing the Tape Reel

Any size of tape reel is positively and accurately located on the supply hub by merely pushing the reel onto the supply hub. This is achieved by a unique hub design; releasing the reel is achieved by pushing on the centre boss of the hub and lifting the reel clear.

Threading the Tape

Having located the tape reel, the user merely has to close the tape loading door to initiate the auto-threading sequence. This threads the tape along past the head, and drives the take-up hub to accept the free end and pull until tape tension is established. Any malfunction is detected and notified to the operator by means of a message on the 9914V display.

The operator does not have to touch the tape at any stage, unthreading the tape is also under firmware control - the sequence ends with the tape fully rewound onto the supply reel.

Write Protect

A Write Enable protection facility is designed in, to prevent the accidental erasing/ overwriting of data, the user is informed when writing is enabled by means of the illuminated WT EN legend in the display panel.

Tape Path Access

The tape loading door is designed to prevent operator contact with the tape while it is in motion, the door can be opened for routine inspection or cleaning of the tape path. A transparent window in the tape loading door enables the presence of a tape reel to be safely observed without withdrawing opening the door.

The Door Interlock circuit stops tape motion and places the 9914V off-line if the tape loading door is opened at the wrong time.

Reel Recovery after Power Failure

If power is removed from the 9914V when the tape is tensioned, the tape can be recovered without restoration of power. First the operator has to set the power switch to ' off '. Next rewind the tape manually onto the supply reel, then press the centre boss of the supply hub to release the tape reel. The operator can then lift off the reel.

1.2.5 Circuit Boards

A block diagram of the 9914V is shown in Figure 1.2.5.

The **Servo Control** board includes a microprocessor and its EPROM memory to supervise tape motion and interface with the Data Control board and operator control panel.

The **Data Control** board includes a microprocessor and its memory (non-volatile RAM and EPROM) to supervise all of the data encoding/decoding procedures, the data diagnostic programs, and the Pertec interface (which forms part of the 9914V's internal bus).

The **DDP board** makes extensive use of Very Large Scale Integration (VLSI) circuits to encode and decode data for any of the four possible densities (800 bpi NRZ, 1600 bpi PE, 3200 bpi PE, or 6250 bpi GCR); this level of complexity is achieved on a single board by the use of surface-mount components and a multi-layer artwork.

The **ADP board** handles the data from the DDP board by converting it into analogue form for presentation to the write channels, at the correct write current. Conversely it takes read data from the pre-amplifier and converts it to digital form before passing it to the DDP board for decoding according to the currently selected density. Use is made of surface-mount components and a multi-layer artwork.

A **pre-amplifier** is placed near the head assembly to boost the head read signals, prior to being processed by the ADP board.

The **SCSI** board's microprocessor and buffers interface between the SCSI bus and the 9914V's internal bus, converting the SCSI protocol into 9914V internal bus format

The **PCI** board's microprocessor and buffer is able to stack up commands and data between the Pertec bus and the 9914V's internal bus.

A **Power Supply** board takes ac voltages from the secondary side of the mains transformer and converts them to the required internal dc voltages.

Various small pcbs (such as the tension arm sensor circuits) form an integral part of other assemblies.

1.2.6 Data Paths

The 9914V data paths are shown in Figure 1.2.6.

The data paths consist of three pcbs housed in the card cage. The pcbs are interconnected via a motherboard at the bottom of the cage and connected to the head and pre-amplifier by cables from the top of the ADP board.

The nucleus is the Data Control board's microprocessor, which handles the Pertec interface signals and controls the parameters and actions of the DDP and ADP boards. The DDP board houses the entire quad density encoding and decoding logic while the ADP contains all the analogue functions such as main amplification and signal conditioning.

Therefore ADP and DDP are effectively peripherals to the intelligent Data Control board, which co-ordinates tape motion and data channel activity during data transfer operations.

The optional fourth board is an intelligent buffered interface pcb. A secondary function of these pcbs is to generate the diagnostic program data patterns, therefore a buffered interface is required to run data-dependent diagnostic programs.

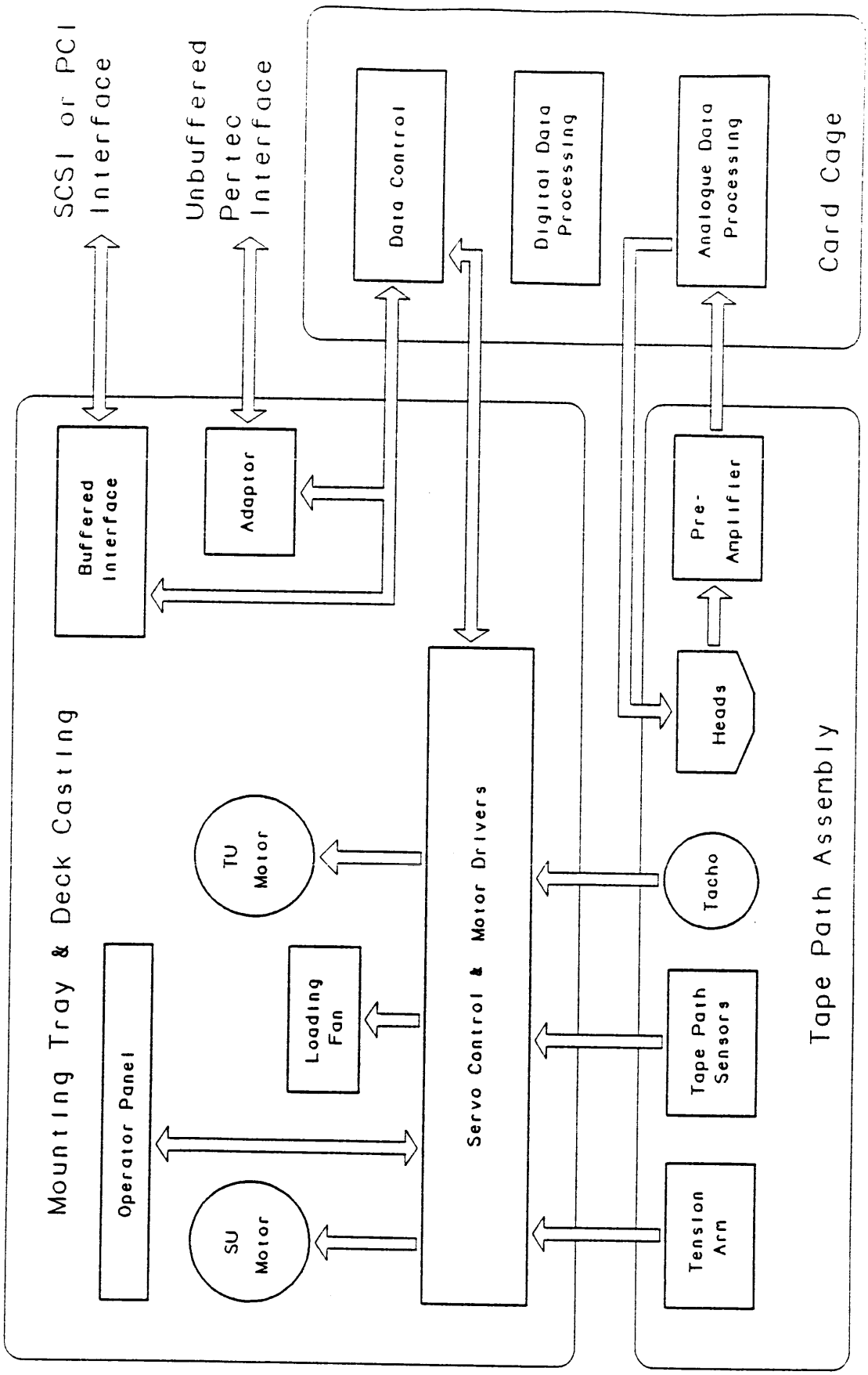

FIGURE 1.2.5 9914V BLOCK DIAGRAM

1.3 Short-Form Specification

Tape Type	Standard half-inch computer tape on 10.5 in, 8.5 in, 7 in, or 6 in, (267 mm, 216 mm, 178 mm, or 152 mm) standard IBM hub
Tape Tension	285 gm (10 oz) nominal
Formats	6250 bpi GCR, 3200 bpi PE, 1600 bpi PE, 800 bpi NRZ
Tape Speeds	Vary with the recording density:

	Low Speed	*High Speed*
800 bpi NRZ	42 ips	125 ips
1600 bpi PE	42 ips	125 ips
3200 bpi PE	62 ips	62 ips
6250 bpi GCR	42 ips	125 ips

Speed Variations	±2% long term ±4% short term
Power Requirements	200 VA working < 35 A inrush current
Mains Voltage Tolerance	+10% -15% of nominal input setting
Mains Frequency	48 to 62 Hz
Weight	36 kg rack-mount, unpacked 39 kg desk-top, unpacked
Dimensions:	
behind Rack face	(23.2 in x 16.7 in x 9.7 in) 590 mm H x 425 mm W x 245 mm D
overall	(24.0 in x 18.9 in x 13.1 in) 610 mm H x 482 mm W x 330 mm D
Environmental	See the 9914V Product Specification

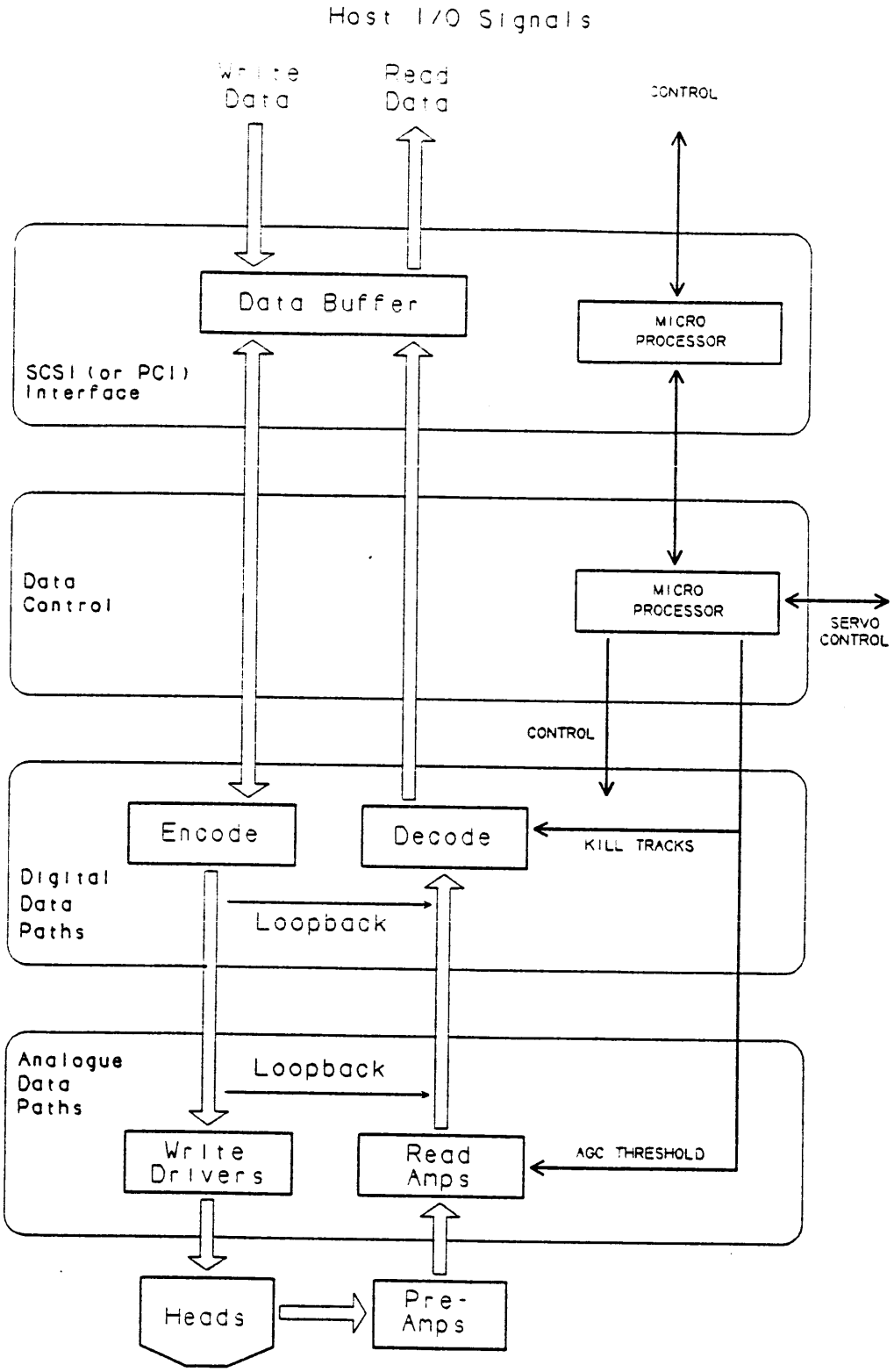

FIGURE 1.2.6 9914V DATA PATHS

1.4 Streaming

To maintain streaming, the next data block must be ready for synchronous transfer before the expiry of the Command Reinstruct Time (CRT) at the end of the current block.

If the CRT is exceeded, a time penalty is incurred while a reposition sequence is executed; during this the tape is halted and spaced back sufficiently to allow ramping up to synchronous speed before the next block. Figure 1.4 is a simplified reposition diagram which shows tape motion past the head, if the reinstruct time (at point B) is exceeded, if no new command is received the tape halts at point F, if a new command is received it continues to the next block via point G.

A normal length inter-block gap (IBG) is written, whether streaming or after repositioning, except in special circumstances. In applications where the average host data rate is slightly lower than required by continuous streaming, the user may effectively extend the usual CRT by the 'IBG size' option (configuration byte 12), to allow more time in which to assemble the data. This gives a write time throughput advantage.

Where the average data rate is much lower than required by continuous streaming, the user may be better advised to select the lower tape speed; this may appear to be a retrograde step but calculation will reveal whether low speed with no repositions gives faster throughput than high speed with constant (longer) repositions.

If the 'IBG size' configuration option is used but the extra time allowed between 'end of data' and a new command expires, the tape repositions to point F and awaits the next command.

The above paragraphs are a brief explanation of reposition during forward write conditions. In practice the cycle may be modified on-the-fly; eg if a reverse command is received during the forward stop time, the reposition cycle is modified so that the new command is executed at the correct tape position.

1.4.1 Command Reinstruct Time

The command reinstruct time is defined as the time from 'end of data' to the latest point at which the next command may be accepted without a reposition cycle being executed.

1.4.2 Access Time

Access time is defined as the time taken to accelerate from stopped position to normal speed and be ready to exchange data. The access time is shown in Figure 1.4, and is unaffected by the command reinstruct time.

1.4.3 Positioning Time

The positioning time is defined as the time taken to reach the stopped position (point F) in readiness for the next command, when no new command is received before the end of the command reinstruct time.

1.4.4 Repositioning Time

The repositioning time is defined as the time taken to regain streaming speed (via points B to G); this assumes that a new command is received between points B and F.

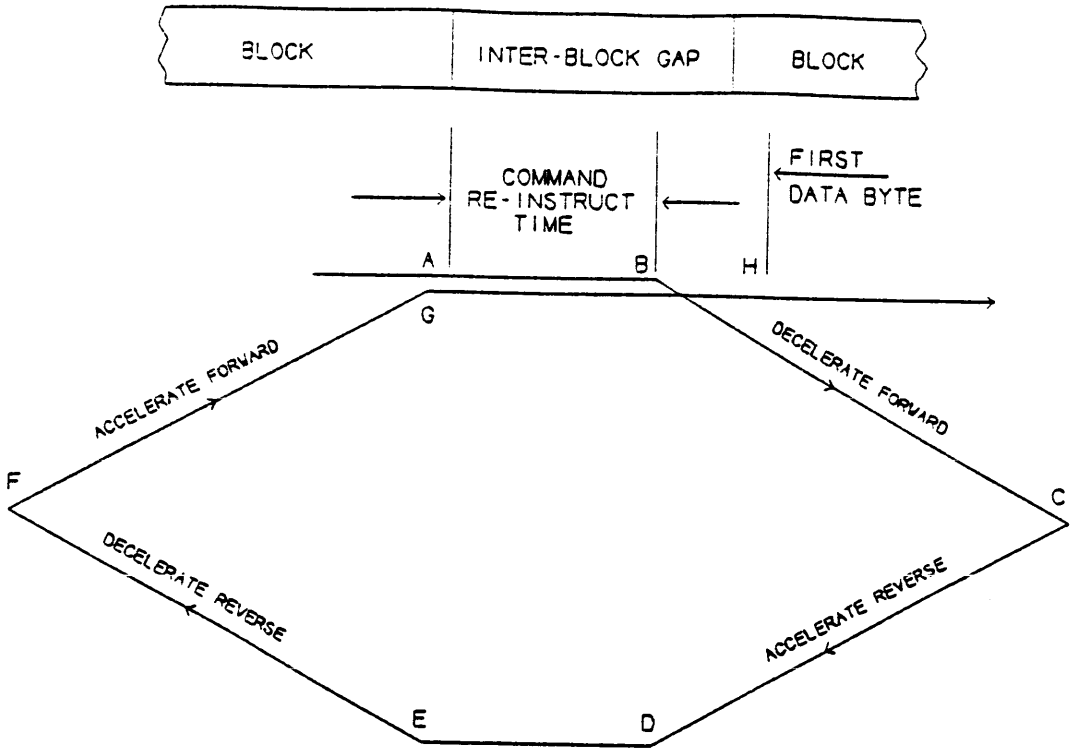

FIGURE 1.4 TYPICAL REPOSITION CYCLE

1.4.5 Data Rates

When a data is being transferred to tape, the data rate is determined by the tape speed and recording density (GCR, PE or NRZ). At 800, 1600, and 6250 bpi, the user may select from two streaming speeds. The inter-relationship of tape speed, average data rate (and data period) for the Pertec interface is detailed in Table 1.4.5. Note that the burst rate will be higher.

Density (bpi)	NRZ 800	PE 1600	DPE 3200	GCR 6250
Speed *(ips)*	41.66 125	41.66 125	62.5 62.5	41.66 125
Data rate *(kbytes/s)*	33.3 100	66.6 200	200 200	260 781
Data period *(us)*	30 10	15 5	5 5	3.84 1.28

TABLE 1.4.5 9914V DATA RATES

Note: the tape speeds normally referred to as '42 ips' and '62 ips' are actually 41.66 ips and 62.5 ips.

1.5 I.T. Mains Systems

Definition: An I.T. mains system is defined as one having the neutral line held at a substantially different voltage to that of the earth line.

Warning: the 9914V must not be connected to an I.T. mains system.

1.6 RFI Compliance

The 9914V is designed to meet certain RFI requirements in *industrial* use. However, if the 9914V is operated in a *residential* environment it has a high potential for causing interference.

Where the 9914V is installed where precautions are not taken to limit radiated emission, screened cables must be used. Suitable connectors such as 3M socket type 2565-2002, or Sun-style (3M type 8350-9005) may be already be fitted to the SCSI models of the 9914V when delivered.

1.7 Interface Cables

Where unscreened Pertec interface cable is acceptable, 3M type 3365 may be a suitable flat ribbon cable with 3M type 3415-0001 connector at the 9914V.

Where a screened cable is required, 3M type 3517 may be suitable where a flat ribbon cable is desired; where a round jacketed ribbon cable is required, 3M type 3659 may be suitable.

A compatible socket connector should be used which mates mechanically (at the rear of the 9914V) with 1.6 mm (0.064") printed edge connections. In screened applications this connector is likely to require a conductive shell.

1.8 ESD Precautions

When some sub-assemblies are removed, it is necessary to disconnect earth bonding straps. These may appear to perform no electrical function, but they must be re-connected in order to maintain good protection against electro-static discharge and to ensure RFI compliance.

Printed circuit boards should be treated in accordance with local ESD regulations, which are outlined in Section 7.

1.9 Associated Documents

The following documents are produced by the Company to give specific product information.

95 125455	9914V Tape Unit User/Diagnostic Manual *(unpublished)*
95 121798	9914 SCSI User Manual
95 121799	Pertec Cache Interface Product Description
95 124768	9914 Enhanced SCSI User Manual
M G8015-A	9914V Tape Unit Product Specification

2. PCB Descriptions

This section contains functional descriptions of the major pcbs. Fault-finding techniques are described in Section 3.

The circuit descriptions are related to signal activity when in operation, and enable fault tracing to the signal source/destination on the board (having first used the diagnostic programs to identify the suspect area). Having established that the board is interfacing correctly, the next stage will normally consist of board substitution. On-site diagnosis down to chip level is not anticipated, partly because extensive use is made of surface-mount components, and partly because down-time is reduced by sub-assembly substitution.

2.1 Care of Printed Circuit Boards

Repair or modification of the surface-mount components should not be attempted without suitable surface-mount rework facilities.

> **Caution**
>
> All the boards described here include CMOS integrated circuits and/or CMOS components, for this reason the usual static precautions should be observed when handling them.

2.2 Servo Control Board Description

2.2.1 Overview

The Servo Control board, part number 125370, contains the following functions:

a) Interface circuits:

i) to register signals from the operator panel, for interpretation by the microprocessor;

ii) to transfer indications to the operator's 8-character alpha-numeric front panel display;

iii) to communicate with the Data Control board, controlling tape motion which corresponds to the last accepted command (from the host or operator);

iv) to drive the hub lock mechanism;

v) to drive the loading fan.

b) Analogue circuits:

i) to process the tape speed data (ie the processed tacho output pulses) and complete the control loop by deriving the take-up motor drive current;

ii) to process the tape position data and derive the offset value which is applied to the supply motor current, thereby compensating for the varying radius of the tape stack.

c) **Miscellaneous circuits:**

i) to accept the tape path sensor receiver signals;

ii) to drive the tape path LED sensor transmitters;

iii) to perform A/D conversion on some supply rails;

iv) to process the tacho phases, giving speed and direction;

v) to access the operational and diagnostic firmware in PROM.

2.2.2 Control Method

2.2.2.1 Introduction

Control of the 9914V servo circuits is effected by an 8-bit microprocessor system. A block diagram showing the location of the Servo Control board within the 9914V is given as Figure 1.2.6, and a block diagram of the microprocessor and control system is given as Figure 2.2.2.

2.2.2.2 Functional Outline

As can be seen from Figure 2.2.2 this board is a key element in the overall control of the machine. It monitors and controls the operator-panel buttons/display, it interprets tape path sensors in relation to handed-on requests from the Data Control board, and it controls the reel motors to provide whatever action is required at any given time.

As the board design is microprocessor based, the real controlling element is the firmware.

The Servo Control board is essential for even a basic check of the 9914V. With a known good Servo Control board and Power Supply, power may be switched on and a tape loaded to BOT, without any boards being present in the card cage.

2.2.3 Hardware Descriptions

For the purpose of this description, the hardware design has been divided into sub-sections, each of which is discussed separately.

2.2.3.1 Microprocessor and Associated Circuits

The microprocessor used is the standard 8051-compatible (with 16-bit address and 8-bit data output); the address bus is latched by IC39, using the ALE output. 256 bytes of RAM reside within the processor.

The processor clock input is derived from the crystal oscillator circuit, and buffered by IC20.10 for use elsewhere on the board.

External PROM (IC23) accepts the 16-bit address directly from the processor and places the memory data on the p0.0 - p0.7 bus inputs, when the PSEN signal is active.

I/O is achieved via 8-bit ports, typically a 74LS541 for inputs and a 74LS273 for outputs; each port is selected by a CS0-7 enabling input, derived from the addresses (A3-A5 & A13-A15) decoded by IC36.

2.2.3.2 Power-on Reset

When power is first applied to the board, input pin 10 to the processor is low because C65 is in a discharged condition. After approximately 50 ms, C65 charges to above the TTL threshold via R140. The processor is then free to execute instructions while C65 charges further to a value near +5 V.

If power fails, C65 discharges very quickly (via D33) into the +5V rail, this mechanism ensures a reset condition even after short power breaks. The data and address lines are tri-state during reset.

2.2.3.3 Processor OK

After power is applied to the board, the processor carries out a self-check routine. When this check is successful, IC27.19 is driven high to illuminate the on-board led, indicating a good condition without reference to the operator panel display. The SPROC_OK signal is used at the Data Control board to allow release of its reset circuit; if the servo processor is not ok, the data processor is not allowed to function.

2.2.3.4 Crystal Oscillator

The processor contains a circuit to maintain oscillation in an external crystal, which is connected to the x1 & x2 pins (20 & 21). A 10.0 MHz crystal is used, with capacitors C58 & C59 to trim the frequency.

2.2.3.5 Power Failure

The +24V and +12V rails are monitored directly at the ADC chip IC11, with the +5V, -5V, and -12V rails monitored at IC11 via resistor networks. Levels outside 10% in the +12V rail are detected by the processor, the other rails may vary by the same or greater amounts (depending on the ADC input circuit) before a failure condition is logged and the POWER message placed on the operator panel display.

The +5V rail is not specifically monitored, since this supplies the power to the processor, which is effectively the power fail detector.

If the servo supply (designated Vs, nominally +48 V) falls in value, the 9914V continues to operate at lower levels of performance; should the +48V rail ever reduce severely, the +24V rail (which is derived from it) will move to a level which causes a power fail detection.

PWR_FAIL enters the board at P4-12, from the Power Supply board, this signal is combined with RELAY_ON (see later) to generate RLY_ON which causes SERV_RST (servo reset) when active. RELAY_ON is active when RLA is energised (placing a short across both reel motors) to give a regenerative braking action should the control circuits lose effect. Primary power failure also causes regenerative braking.

2.2.3.6 Communication with the Data Control board

a) Outputs

Output messages are sent via two 74LS374 registers, byte by byte (over the 8 bi-directional SVD0-7 lines), handshaking being performed by the Data Control board processor.

Output conditions such as ' servo processor ok ' (SPROC_OK) are transmitted separately over dedicated uni-directional lines to the Data Control board.

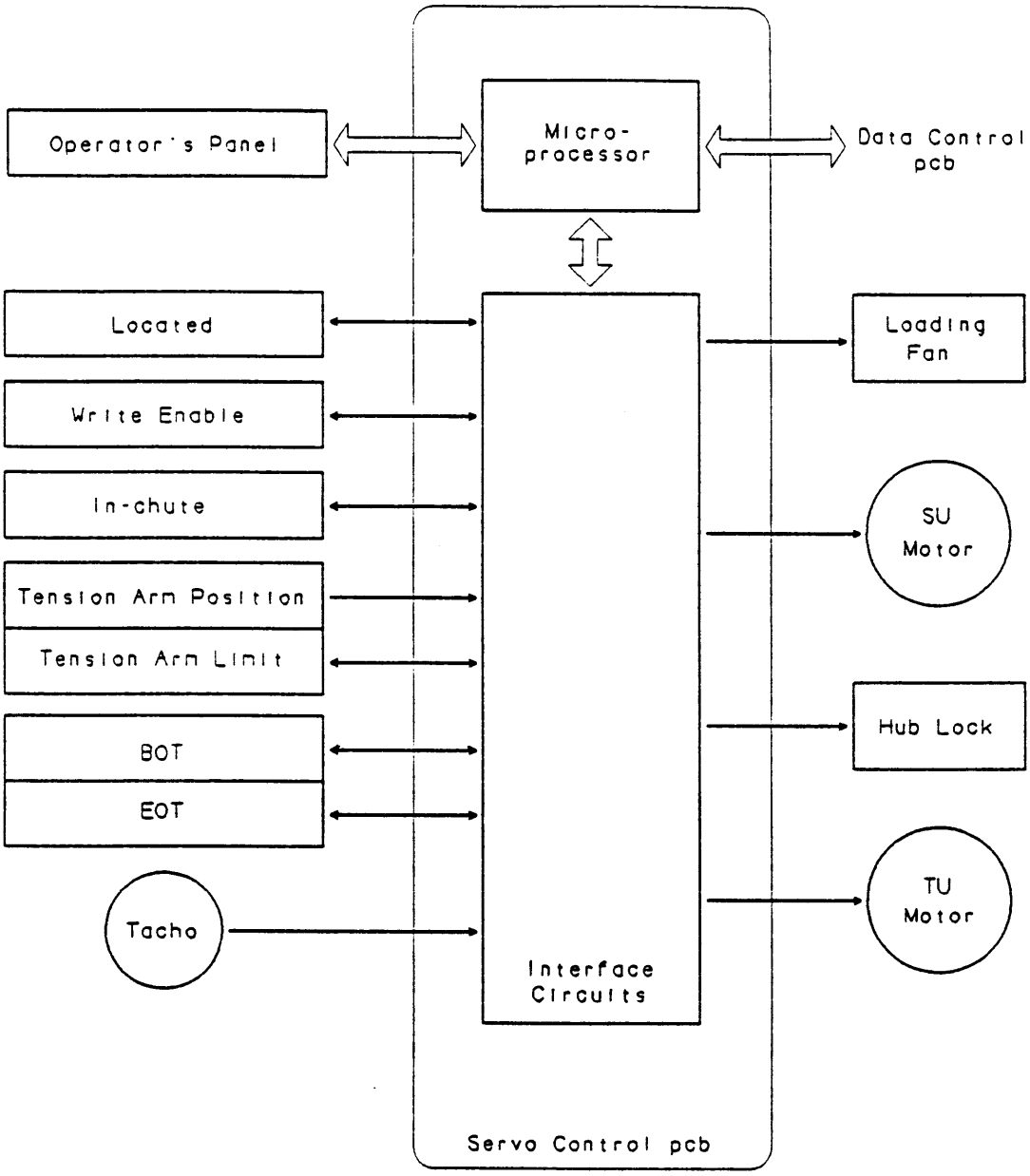

FIGURE 2.2.2 SERVO CONTROL BLOCK DIAGRAM

Signal	Source	Route	Edge Pin
SPROC_OK	IC27.19	-	P4-18
EMPTY	IC3.13	-	P4-24

b) Inputs

Input messages will have been stacked up in the FIFO chips (IC18 & IC32) by the Data Control board, having arrived as a packet via the 8 bi-directional SVD0-7 lines with the SVRD0 & SVRD1 signals.

Input conditions such as ' data processor ok ' (DPROC_OK) are received separately over dedicated uni-directional lines from the Data Control board.

Signal	Edge pin	Route	Destination
SVRD0	P4-4	-	IC24.1
SVRD1	P4-3	-	IC43.1
SVWT	P4-10	IC21.13, IC21.12	IC18.3 & IC32.3
DPROC_OK	P4-15	-	IC18.9

2.2.3.7 Tacho Phases

The tacho produces two phases separated by 90 degrees, both phases are routed via the distribution board to the Servo Control board connector P5. Once on-board, they are buffered and connected directly to the processor for interpretation of tape speed and direction.

Phase	Edge pin	Route	Destination
Tach1	P5-8	IC20.13, IC20.12	IC22.14
Tach2	P5-10	IC20.3, IC20.4	IC22.17 & .2

2.2.3.8 Motor Drives

a) General

The motor drive circuits form part of a reel-to-reel control philosophy, tape speed demand determines the current through the TU motor, while tape tension (measured in terms of tension arm position) determines the current through the SU motor; these two currents are calculated independently by the Servo Control processor.

b) Drive Currents

The processor outputs a digital code representing the motor drive demand, which is converted to an analogue level at IC12. These analogue demand signals SUDEM & TUDEM are processed with other signals which determine the direction of tape motion (SUREV & TUREV), before being converted to switched mode signals (at IC5/IC6) and used to drive the FET H-bridge configuration (eg TR9 - TR12).

c) Feedback

The back EMF from either motor is processed at IC1 to give a voltage level which is converted to a digital code at IC11. The processor uses these feedback values to maintain the motor currents required by the demand voltage, in the presence of any parameter variations in the overall control loop.

2.2.3.9 Operator Panel

a) Buttons

The five operator panel buttons are all momentary action membrane switches; any change in their condition will appear at input port IC28 and be registered by the processor at the next I/O read of that input port.

Button	Edge pin	Route	Destination
DIAG	P6-50	(RN2.2)	IC28.5
LD/ONL	P6-48	(RN2.3)	IC28.6
REW/UNL	P6-46	(RN2.4)	IC28.7
RESET	P6-44	(RN2.5)	IC28.8
DENSITY	P6-42	(RN2.6)	IC28.9

b) Legends

The four back-lit status legends are driven from processor output ports.

Legend	Port	Route	Edge Pin
WT EN	IC38.16	IC42.11, IC42.10	P6-38
ONLINE	IC38.19	IC42.5, IC42.6	P6-40
DIAG	IC41.19	IC42.3, IC42.4	P6-39
EOT	IC41.16	IC42.9, IC42.8	P6-37

c) 8-Character Display

Diagnostic program 72 checks out the operation of all the display elements, run this program before investigating a suspected display fault.

The display is an 8-character LED presentation. Data (DD0 - DD7) is sent to the display from output port IC40 and control signals (DA0 - DA2, SEL, & DWT) from IC38. The display character is selected by signals DA0 thru DA2, the chip is selected by SEL, and the character strobed in by WRT (to be stored in RAM until changed again).

Signal	Port	Route	Edge Pin
DD0	IC40.2	-	P6-28
DD1	IC40.5	-	P6-26
DD2	IC40.6	-	P6-24
DD3	IC40.9	-	P6-22
DD4	IC40.12	-	P6-20
DD5	IC40.15	-	P6-18
DD6	IC40.16	-	P6-16
DD7	IC40.19	-	P6-14
DA0	IC38.2	-	P6-2
DA1	IC38.5	-	P6-4
DA2	IC38.6	-	P6-6
SEL	IC38.9	-	P6-8
DWT	IC38.12	-	P6-7

2.2.3.10 Loading Tape

The sequence of events when loading tape are described here, the sensors which are involved may be checked out by using diagnostic program 45, as described in Section 5.

a) Initiation

The loading procedure is initiated by the operator closing the loading door, by setting power on, or by pressing LD/ONL (configuration option 04 determines which). Door closure is communicated to the processor via IC26.8.

If option byte 04 is set to MAN ONL, it is necessary to press the operator panel LD/ONL button to initiate loading.

When the loading door is not fully closed at the point of initiating load, then the respective IC26 pin is high and a DOOR message is sent to the 8-character display with the loading sequence inhibited until the hold condition is corrected.

Signal	Edge pin	Route	Destination
LD/ONL	P6-48	(RN2.3)	IC28.6
DOOR	P6-10	(R141)	IC26.8
LOCATED	P5-32	IC34.1, IC34.2	IC26.6

b) Locating

In order to check the location of the reel on the supply hub crown, the supply motor rotates the reel slowly anti-clockwise until all three flags are detected as ' down ', during this time the LOCATING message appears on the display. The ' located ' pulses arrive at IC26.6 and are timed by the processor to determine ' fully located ' (all three flags down), or a HUB ERR 1 (or HUB ERR 2) condition whereby one (or two) flags are considered to be absent (ie not interrupting the sensor beam). In practice the 9914V's extremely positive location of the reel on the hub means that an error here is more likely to be a damaged flag than skewed location.

c) Locking

When the reel has been checked for square seating on the supply hub, the locking process has been completed. The operator will have driven the hub mechanism over-centre and locked the reel in the process.

d) Loading

Having driven the reel clamp solenoid, the firmware places the LOADING message in the display and then switches on the loading fan by activating the driver circuit based around TR3 (fan on = 1.0 V, fan off = 24 V). The resulting stream of air normally blows the tape passed the ' in chute ' sensor (P5-4). If tape does not appear in the chute, a fault is flagged and the N I C (not in chute) message is placed in the operator panel display. If the reel was not successfully clamped, the N I C condition may result, alternatively there may be sufficient friction between hub and reel to give an in-chute condition.

Signal	Source	Route	Edge Pin
FAN_ON	IC22.5	IC42.12, TR3	P3-1
CHUTE	IC22.7	IC30.8, TR21	P5-6

After detecting tape in the chute, the SU reel is driven in reverse until tape is no longer ' in chute ' and then forward until it is ' in chute ' for the second time. This manoeuvre is a precaution to detect an inverted reel of tape, if successful the firmware continues to feed tape forward. If the reel was not successfully clamped, this stage will not be accomplished.

Signal	Source	Route	Destination
IN CHUTE	P5-4	IC34.9, IC34.8	IC26.7
LIMIT	P5-28	IC34.3, IC34.4	IC26.5
ARM	P5-24	IC10.6, IC10.7	IC11.26
Tacho		See Section 2.2.3.7	
BOT	P5-20	IC34.13, IC34.12	IC26.3

Next the TU servo is commanded to rotate the TU spool slowly in the forward (ie anti-clockwise) direction so that the tape which is being fed along the tape path will be attracted to the centre of the TU hub and be pulled tight against the tacho. When the firmware has detected several revolutions of the tacho, its output then becomes the source of tape motion information. Forward tape motion is maintained by applying opposing motor torques, but with sufficient imbalance to overcome the tension arm spring.

When the tension arm reaches mid-position, the firmware initiates normal forward tape motion at low speed until the BOT tab is detected (the tension arm output can be checked by the methods described in Section 7). Should tape lodge in the tape path and fail to reach the TU hub, the N T U (not taken up) message is placed in the operator panel display.

After tape has been taken up, the loading fan is switched off.

While running forward to BOT, the processor is able to determine the reel size by relating the tape speed to the number of ' reel located ' pulses per second. The size is indicated in the operator display and stored by the control firmware for servo algorithms.

When BOT is detected, the processor changes the display to BOT and halts the tape. This is the end of the tape transporting portion of the load cycle; if no BOT tab is detected within a certain distance, then the tape is all rewound onto the supply reel (with UNLOAD displayed), awaiting some corrective action by the operator.

When (as is usually the case) option byte 06 is set to enable the analyse function, the tape is next shuffled to and fro while the Data Control attempts to establish the recorded density; the various end results of this are implied in Section 3.

e) Tape Already Threaded

This is a special case of the load procedure, invoked on initial power-up (or power restore) or after manually threading the tape (which should is only necessary following a loading fan failure).

If the control firmware senses that the tape is in-chute, the supply reel is rotated slowly to check that the reel is located (in which case it is also clamped squarely). The tape is then moved forward in search of the BOT marker and stopped with BOT indicated if the marker is found. Otherwise (after about 4 metres search) the tape is moved in reverse at low speed until BOT is found; the low speed is selected for safety because the firmware has not yet been able to determine the reel size.

2.2.3.11 Write Enable

When a supply reel is used with a Write Enable ring fitted, the ring sensor flag is depressed and the output of the sensor (FPTD) appears at P5-34. This signal is used by the processor to drive the WT EN legend, and transferred to the Data Control board to forestall any Write or Erase type commands being carried out.

Signal	Source	Route	Destination
FPTD	P5-34	IC34.5, IC34.6	IC26.2

2.3 Data Control Board Description

2.3.1 Overview

The Data Control board, part number 123638, contains hardware to communicate with the data channel (ADP and DDP) boards, Servo Control board, and the host (ie Pertec) interface. A microprocessor is used to handle the various tasks, namely:

i) to act upon inputs from the operator panel (relayed via a communication link with the Servo Control board), and transfer messages back to the Servo Control board so that their actions are co-ordinated;

ii) to notify the VLSI on the DDP board of the current density;

iii) to set AGC levels on the ADP board, and the gain of the pre-amplifier channels;

iv) to store and decode the standard options and configuration (in EPROM);
to store the current default options and configuration (in NVR);

v) to verify, accept, and decode new commands from the Pertec interface;
to control the signals sent to the Pertec interface;

vi) to co-ordinate the actions of the ADP & DDP boards, in order to execute host commands;

vii) to execute the data-related parts of diagnostic programs.

2.3.2 Micro-processor System

A 64180 8-bit CMOS processor, accessing a non-volatile memory (NVR) for storing user-selectable configuration option settings, and EPROMs for the control data needed to supervise the DDP and ADP board actions. A special ' packet transfer ' message exchange is used to communicate with the Servo Control board, and four encoded mode lines (reflecting tape speed and density) are available to all the other boards.

Extensive use is made of firmware control and I/O bus signals, reducing the amount of gated logic to a small proportion of the circuits.

2.3.3 Communication with the Servo Control Board

The Data Control processor is not allowed to function if the Servo Control processor is not ok, the processor reset input (IC12.7) is held low until the servo processor has completed its self-check.

Communication with the Servo Control board consists of sending message packets over the bi-directional bus SVD0 - SVD7, accompanied by control and strode signals SVWT, SVRD0, and SVRD1. The Servo Control board contains the FIFO chips which store the messages; the operation of the exchange is outlined in Section 2.2.

Signal	Source	Route	Edge Pin
SVRD0	IC45.6	-	P3-12a
SVRD1	IC36.6	-	P3-16b
SVWT	IC45.3	-	P3-10b
DPROC_OK	IC13.10	-	P3-10a

2.3.4 Unbuffered Pertec Interface

Input signals are terminated by 220/330 resistor networks and routed typically to an input port or exceptionally (eg the address and enabling inputs) to gated logic.

Signal	Edge Pin	Route	Destination
IFEN	P2-22b	IC49.1, IC49.2	IC34.3
IFAD	P2-20b	-	IC40.12
ITAD0	P2-19b	-	IC40.13
ITAD1	P2-20a	-	IC40.15
ILOL	P2-32a	-	*not used*
IHISP	P2-24b	IC48.11, IC48.10	IC22.4
IREV	P2-22a	IC49.5, IC49.6	IC22.8
IWRT	P2-25b	IC49.9, IC49.8	IC22.13
IWFM	P2-24a	IC49.11, IC49.10	IC22.14
IEDIT	P2-25a	IC49.13, IC49.12	IC22.17
IERASE	P2-23a	IC49.3, IC49.4	IC22.18
IGO	P2-23b	IC48.1, IC48.2	IC47.2
IWD0	P3-31a		IC57.9
IWD1	P3-30b		IC57.5
IWD2	P3-28a		IC58.6
IWD3	P3-29a		IC57.4
IWD4	P3-32b		IC57.7
IWD5	P3-27b		IC58.7
IWD6	P3-28b		IC57.2
IWD7	P3-29b		IC57.3
IWDP	P3-30a		IC57.6
ILWD	P3-32a	-	IC57.8
IREW	P2-18b	IC48.5, IC48.6	IC31.12

The *M4 Data* interface protocol and command set is configured in the non-volatile memory for verification purposes (the configuration bytes in NVR may be changed to accept non-standard commands or change the functions of input pins).

Incoming commands are accompanied by the host's IGO pulse, which is gated with SEL (IC31.8) and GO_SW (which determines the active edge of IGO). NEW_CMD (IC32.9) sets the processor in motion to verify the command and act accordingly. The foregoing is conditional on the IFEN signal allowing commands to be accepted by the 9914V, ie 'LS74 IC34.6 being high.

During diagnostic program operation, the Read, Write and other commands are generated by the SCSI board, therefore appearing to the other boards as normal Pertec inputs. Output signals are buffered by invertors after being registered at output ports IC26 & IC28 and enabled onto the Pertec bus by SEL (which is inverted to give IONL), denoting that this unit is currently selected).

Signal	Source	Route	Edge Pin
IONL	IC31.8	IC56.3, IC56.4	P2-12a
IRDY	IC50.6	IC56.5, IC56.6	P2-11b
IFPT	IC38.11	IC55.9, IC55.8	P2-15a
ILDP	IC39.8	IC55.3, IC55.4	P2-16a
INRZ	IC39.3	IC55.13, IC55.12	P2-13a
ISPEED	IC51.8	IC54.11, IC54.10	P2-18a
IFBY	IC38.6	IC56.13, IC56.12	P2-11a
IDBY	IC51.11	IC56.9, IC56.8	P2-10a
IIDENT/ICCG	IC51.6	IC55.11, IC55.10	P2-14a
IRD 0-7	DDP board	-	
IRSTR	DDP board	-	
ICER	IC50.11	IC54.13, IC54.12	P2-17b
IHER	IC50.8	IC55.1, IC55.2	P2-15b
IFMK	IC51.3	IC55.5, IC55.6	P2-17a
IWSTR	DDP board	-	
IEOT	IC39.11	IC56.11, IC56.10	P2-10b
IRWD	IC50.3	IC56.1, IC56.2	P2-12b

The Pertec interface lines are present at the option board slot so that the 306 x 195 mm SCSI interface board can be used without modification. Communication with the SCSI board is largely via the Pertec bus, using unallocated command codes of the IREV ... IERASE lines and the otherwise redundant IDGM line.

2.3.5 Mode Selection

4 mode selection signals, MODE0 - MODE3, are available at IC25 for other boards. MODE0, MODE1 & MODE2 select the density while MODE3 selects the speed as shown in Table 2.3.5.

Note that although the 3200 bpi tape speed (62.5 ips) is low by comparison with 125 ips, it is higher than the usual low setting of 42 ips, therefore is returned as High Speed by the Pertec ISPEED status line.

The density can only be changed at BOT, so will remain constant for most operations, speed however can vary from one command to the next; the MODE signals are updated just prior to executing a command.

Signal Meaning Source Edge Pin		MODE0 (NRZ) IC25.2 P1-12b	MODE1 (GCR) IC25.5 P1-12a	MODE2 (3200) IC25.6 P1-13b	MODE3 (Lo Speed) IC25.9 P1-13a
Encoding	*Speed*				
NRZ	low	1	0	0	0
NRZ	high	1	0	0	1
PE 1600	low	0	0	0	0
PE 1600	high	0	0	0	1
PE 3200	low	0	0	1	0
GCR	low	0	1	0	0
GCR	high	0	1	0	1

TABLE 2.3.5 MODE SELECTION SIGNALS

2.4 Analogue Data Paths Board Description

2.4.1 Overview

The ADP board, part number 121710, contains hardware to communicate with the DDP board, the write heads, and the read channels from the pre-amplifier. Its operational parameters (eg read amplifier gain, read threshold and write current settings) are generated by the Data Control board, allowing the processing of data at four densities and two tape speeds. ADP functions may be subdivided into:

a) the write data circuits, which receive formatted digital data from the DDP and convert it to currents suitable for driving the 9-track write head stack;

b) the read data circuits, which receive the analogue signals from the read head stack (after boosting by a local pre-amplifier), amplify them further, digitise them, and pass them to the DDP board for data decoding and de-skewing.

Combinations of speeds from 42 to 125 ips and data densities of 800/1600/200/6250 bpi have been met by digital control of the write current (shape and magnitude), the read gains, and the channel bandwidths.

2.4.2 Write Channels

2.4.2.1 Write Drivers & Buffers

Digital write data signals WDOUT0 through WDOUT7 from the DDP board are routed to the write driver chips (one per channel) and converted to analogue current levels to feed pairs of buffer transistors in common-base configuration. Each transistor drive circuit includes impedance matching components and drives the relevant leg of the channel write winding via the head cable.

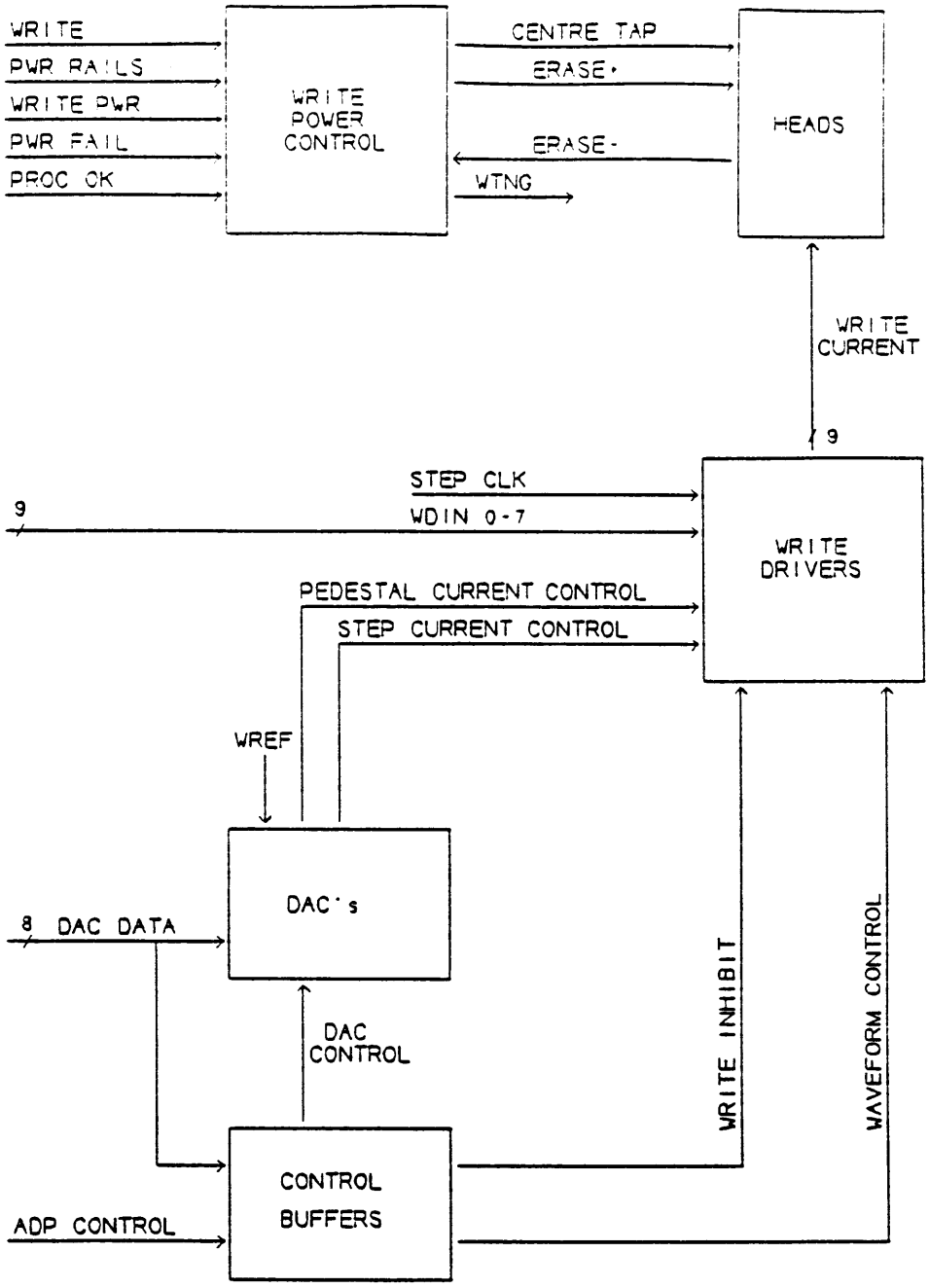

FIGURE 2.4.2(a) ADP WRITE BLOCK DIAGRAM

2.4.2.2 Current Definition

The shape of the write current waveform can be controlled to give either a step and pedestal (in GCR) or a square wave (DPE, PE and NRZ), see Figure 2.3.2(b). The amplitudes of the step and pedestal are separately controlled by voltages from the write control DACs. The timing of the step is controlled by the STEP_CLK signal from the DDP board. The write drivers can be inhibited by a single logic signal, allowing separate switching of the write current and erase current.

Head current is drawn from the +12V rail and returned via a dedicated ground.

2.4.2.3 Write Power Control

This block ensures that current is only supplied to the head windings under specified safe conditions. A UC3903 power supervisory chip is used to monitor the +12V, +5V, and -6V rails to about 15% tolerance, the ok condition enables the series IRF9351 mosfet to allow +12V to the write winding centre-taps (and the erase head) when the WRITE signal is active. The ok condition is:

a) +12V, +5V, and -6V all within +15%, *and*
b) PWR_FAIL (from the Power Supply board) not asserted, *and*
c) SPROC_OK (from the Servo Control board) asserted.

Current flow in the head windings is detected by activity on the ERASE- signal and used to provide the WTNG signal (used by the Data Control board) as an indication that writing is in progress.

2.4.2.4 Write DACs and Control Buffers

An 8-bit data bus (common to the read circuits) and associated control lines are sent from the Data Control board. The control lines provide selection of the DACs and buffers and clocking of the data.

The outputs of the DACs are buffered to provide the correct control voltages for the full range of pedestal and step currents allowed by the write drivers. The control buffers provide signals to inhibit the write drivers, to ensure that the write current is completely switched off when not required, and to control the current waveform shape

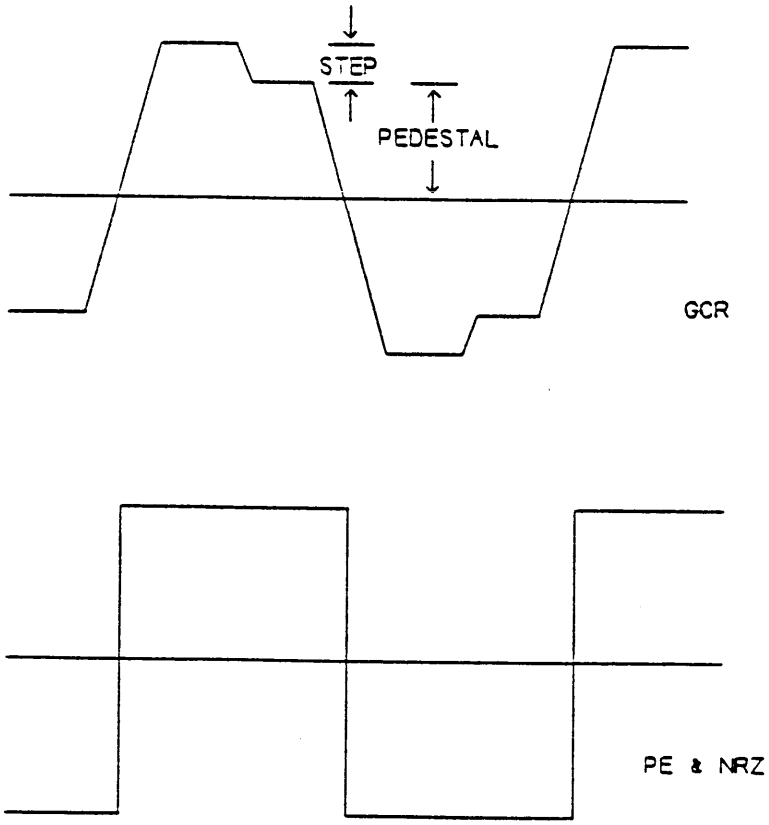

FIGURE 2.4.2(b) WRITE CURRENT WAVEFORMS

2.4.3 Read Channels

Each read channel differential signal from the pre-amplifier (at about 100 mV peak-peak amplitude) is routed to a differentiator based on a NE592 chip on the ADP board. The read signal processing circuits are internally re-configured according to the current density, resulting in two basic modes, GCR/DPE/PE and NRZ. For ease of understanding, the modes are discussed separately.

The read circuits use a mixture of proprietary MSI and LSI analogue ICs including VLSI analogue ASICs, and standard high speed CMOS logic.

2.4.3.1 PE/GCR Densities

The output from the pre-amplifier is taken to the first gain stage. This has a frequency response which can be altered depending on the mode of operation; in PE/GCR mode the response has gain increasing with frequency.

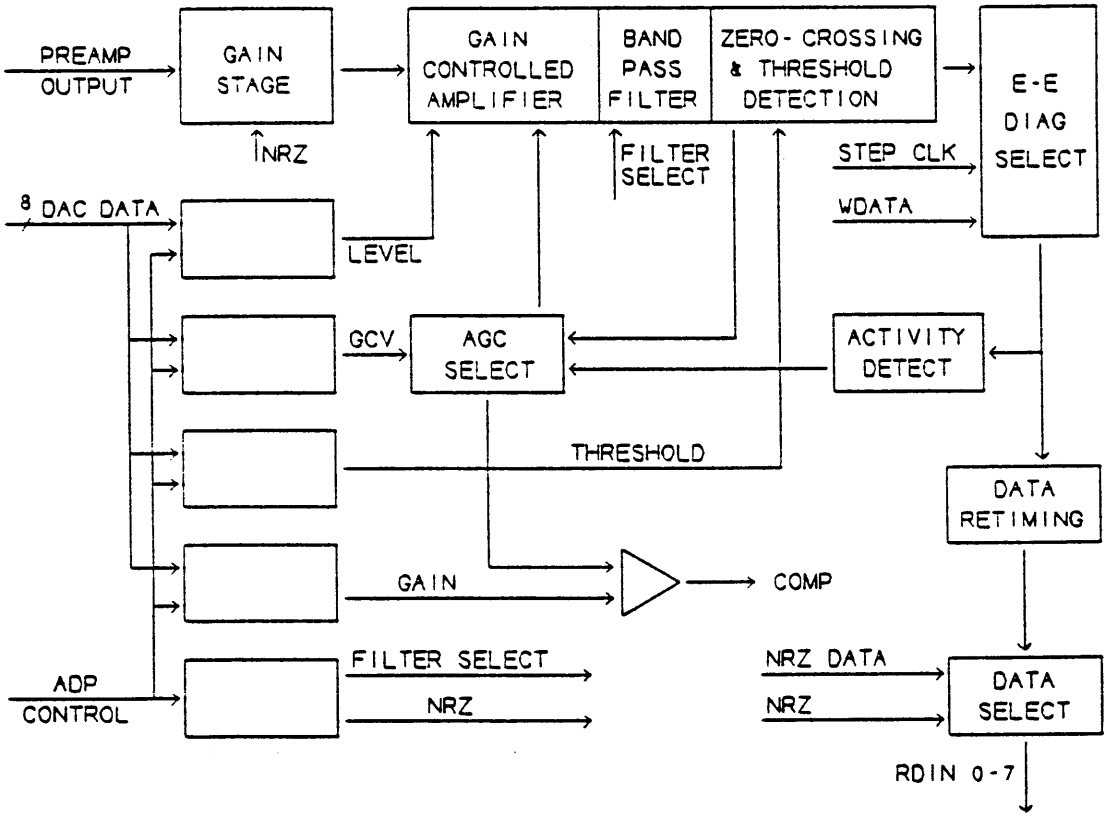

FIGURE 2.4.3.1(a) ADP READ BLOCK DIAGRAM - GCR/PE DENSITIES

The first gain stage output is taken to a gain controlled amplifier (GCA). This has two operating conditions, under fixed gain and under AGC.

Under AGC, the output of the amplifier is set by the LEVEL signal, whereby the output amplitude is detected by the amplitude detector block and fed back through the AGC select block. The amplitude signal is compared with the LEVEL reference and an error signal produced which modifies the amplifier gain to stabilise the output amplitude. The presence of data at the output of the channel is sensed using the activity detect logic. This allows AGC to be selected only during data, preventing the amplifier from ' running away ' during the IBG or when the tape is stationary.

Under fixed gain conditions, the amplitude input to the GCA is taken from a DAC and LEVEL is switched off. This allows the Data Control board to set the amplifier gain and hence the output level. The amplifier is used in fixed gain mode when writing (to ensure that the appropriate standards are met) and during the IBG.

The output from the GCA is band-pass filtered. The filter characteristics required are speed and density dependant and one of four filters can be selected using the filter select lines. The filters themselves are tailored to a specific combination of speeds and densities, allowing the 9914V to be process data from 1600/3200/6250 bpi at speeds from 42 to 125 ips.

The filter output is processed to provide amplitude and zero crossing information. The zero crossing detector outputs a short pulse every time the filtered waveform passes through the zero signal level in either direction. The filtered signal is qualified against a threshold level set by the THRESH signal. This is a bi-directional threshold, requiring the signal to exceed the positive threshold before setting the output and then exceed the negative threshold before resetting. The zero crossing detector output is delayed to ensure the correct phase relationship with the threshold signal for GCR data recovery.

The delayed zero crossing and threshold detector outputs are retimed to recover the GCR/PE data. This is then output through a data selector which can select either PE/GCR data or NRZ data, giving the RDIN* signals for the DDP board.

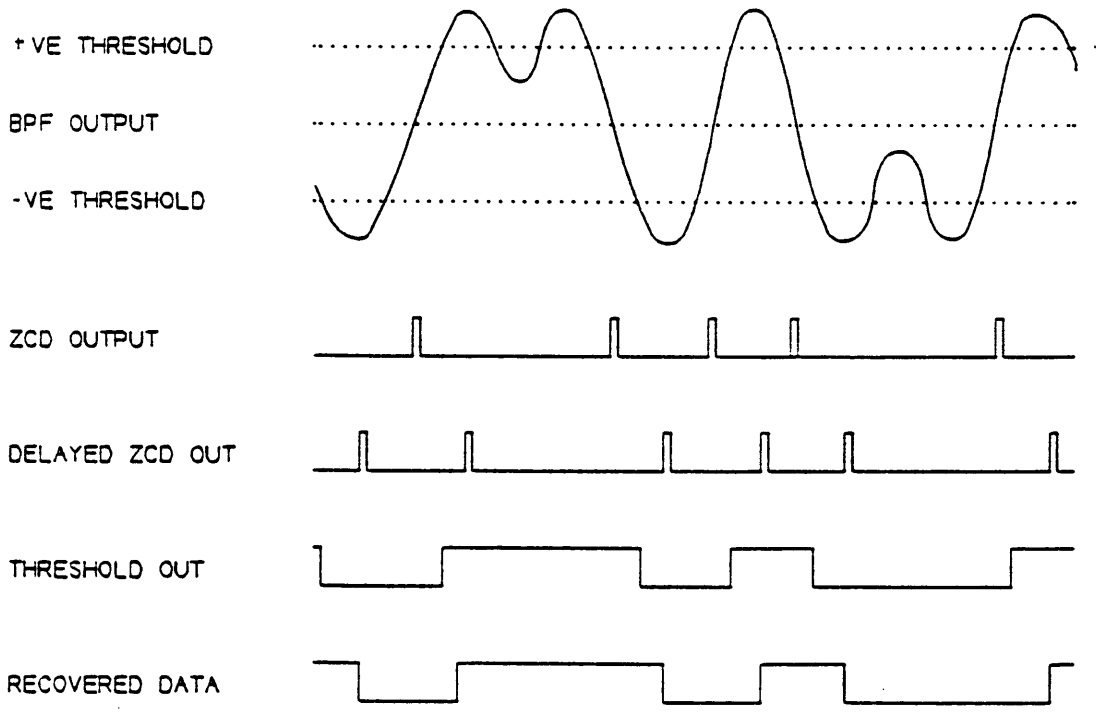

FIGURE 2.4.3.1(b) GCR/PE READ WAVEFORMS

2.4.3.2 NRZ Density

The output from the pre-amplifier is taken to the first gain stage. This has a frequency response which can be altered depending on the mode of operation; in NRZ mode the response is flat over the NRZ operating frequency range.

The first stage output is taken to the gain controlled amplifier. This is used in fixed gain mode under processor control, as described in 2.4.3.1 above. The GCA output is processed in two parallel paths. In one, the signal is band-pass filtered and the amplitude qualified using the threshold detector detailed in 2.4.3.1. In the second, the signal is separately band-pass filtered and then differentiated and the resultant zero crossings detected to extract the peak position information. The zero cross and threshold detector outputs are retimed to recover the NRZ data. This is then output through the data selector, giving the RDIN* signals for the DDP board.

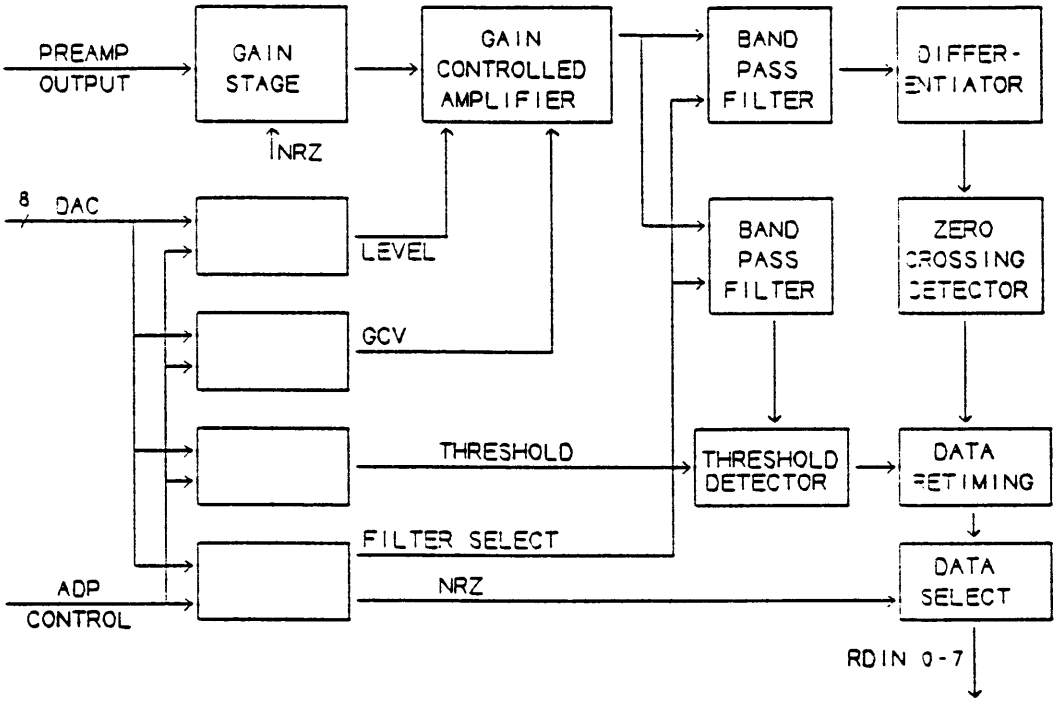

FIGURE 2.4.3.2(a) ADP READ BLOCK DIAGRAM - NRZ DENSITY

2.4.4 E-E Mode

When the diagnostic programs require to check the data handling circuits, without corrupting data already on the tape, the E-E (electronics to electronics) mode of working is adopted. The LOOP signal (from the Data Control board) allows the zero crossing and threshold detector outputs to be replaced with STEP_CLK and WDATA respectively. This enables data checks to be made without energising the write circuits or moving tape. This tests the operation of the activity detect and the data retiming circuits; good or faulty data can thereby be fed to the decoding circuits in order to check that they function correctly.

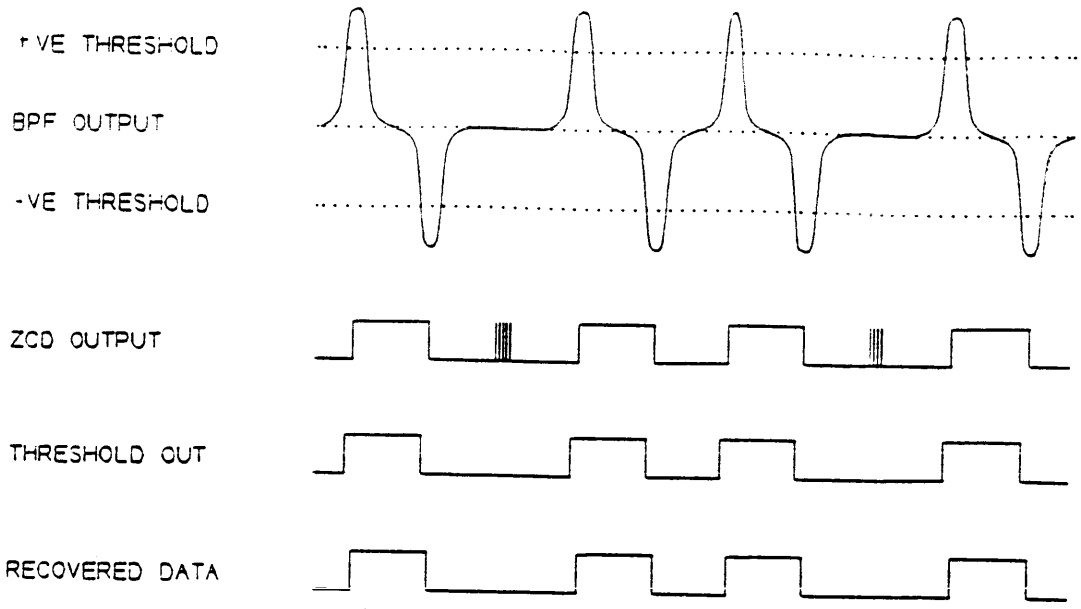

FIGURE 2.4.3.2(b) NRZ READ WAVEFORMS

2.4.4.1 Calibration

The amplitude signal and GCV can be monitored using the GAIN DAC output and comparator, this is used during calibration, which is outlined under diagnostic program 74 in Section 5. Various parameters, including pre-amplifier and ADP channel gains, write currents, and data timing are automatically calibrated, preferably using a dedicated reference tape.

2.5 Digital Data Paths Board Description

2.5.1 Overview

This description applies to the DDP board, part number 123620.

Data from the Pertec interface (IWD0 - IWDP) is picked up by the DDP, to be encoded into the desired format and sent to the ADP to be written to tape.

When reading from tape, data from the ADP board is deskewed, decoded, checked for errors and corrected if necessary. The data is then gated onto the Pertec interface with an accompanying read strobe (IRSTR) for each data character.

The actions of the DDP board at any one time is controlled by the custom VLSI chips. This control can be split into three basic types of operation

a) initialisation,
b) data transfers,
c) diagnostics.

2.5.2 Initialisation

The Data Control board notifies the DDP board of the recording density, which may originate from

- analysis of the tape's recorded density, or
- the configuration byte settings, *or*
- the power-on default, *or*
- a host command.

2.5.3 Write Data Transfers

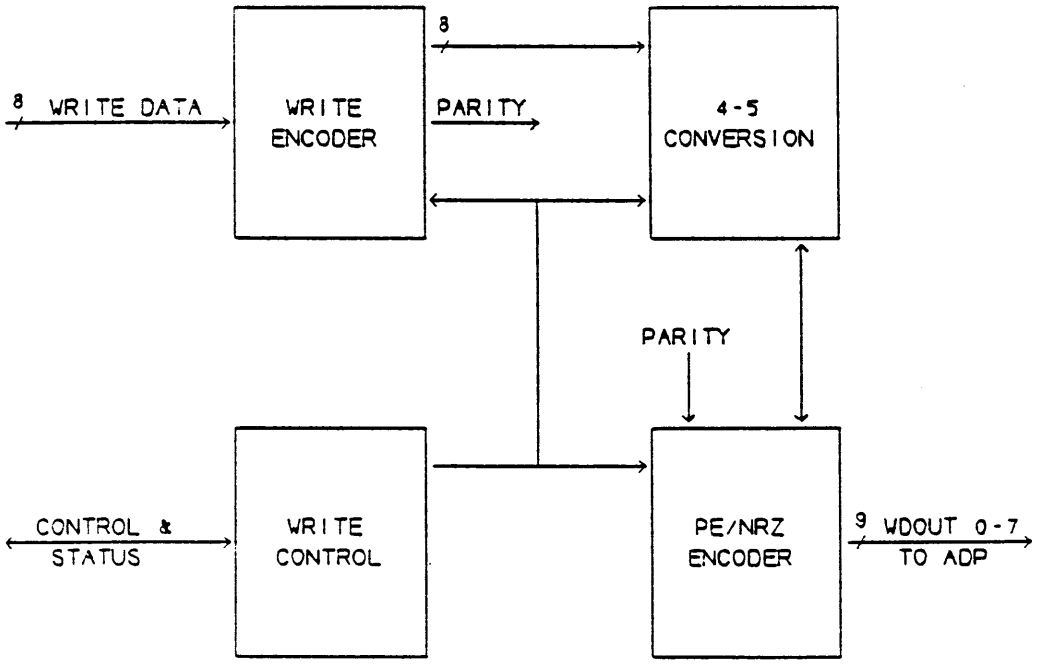

FIGURE 2.5.3.1 DDP WRITE BLOCK DIAGRAM

2.5.3.1 Control Strategy

There are four chips which control and encode the write data, these are shown in Figure 2.5.3.1.

The initialisation or density change procedure sets up the Write Control chip and clears any registers for subsequent processing.

Data from the interface arrives at the input to the Write Encoder chip and is encoded according to the currently selected density. While the encoding method is relatively simple for NRZ and PE densities, at GCR density completely different principles are involved (the encoding is far more complex, and the one-for-one correspondence between data channel and tape track does not apply).

Appendix A contains an outline of the encoding (with respect to the DDP board) and the tape data format resulting from each density.

2.5.4 Read Data Transfers

2.5.4.1 Read Control Strategy

There are four sets of chips which decode and decipher the read data from the ADP board, these sets are shown in Figure 2.5.4.1.

The initialisation or density change procedure sets up the Read Control chip set and clears any registers for subsequent processing.

Data from the ADP board arrives at the input to the Clock Recovery and Deskew chip set and is decoded according to the currently selected density, notified to the Read Control chip set.

2.5.4.2 Functional Blocks

Clock Recovery & Deskew

The clock recovery circuit is based around the phase locked loop, which recovers the data rate clock from the incoming data.
Sync Detect circuits analyse the incoming data and generate the following states for use by the deskew control logic:

(i) sync found;
(ii) data dropout;
(iii) dead track.

The deskewing system employs a first in first out (FIFO) buffer memory to buffer the channel data while deskewing is in progress. As a result of deskewing, the sync subgroups of all data channels are aligned and pass to the 5-4 Decode chip set.

5-4 Decode

Here the deskewed data is processed so that the tape byte characters are converted from the run length limited code back to data. Additionally the control subgroups are detected and track in error (TIE) pointers produced to any erroneous track(s), for use by the EDAC algorithm.

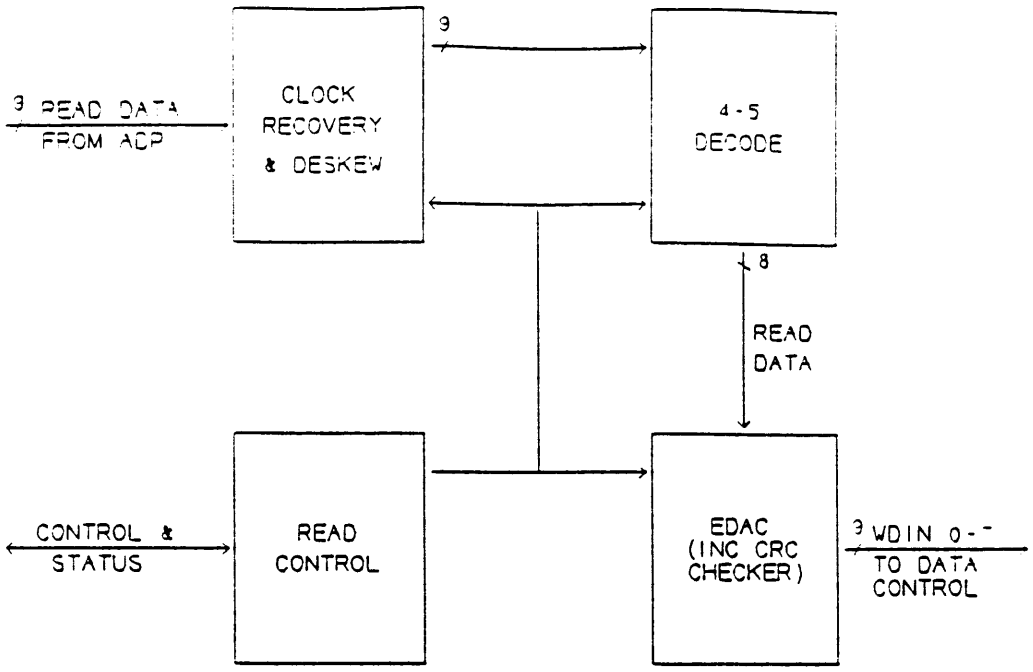

FIGURE 2.5.4.1 DDP READ BLOCK DIAGRAM

EDAC (Error Detection and Correction)

This includes a pattern generator, which creates the parity and error syndrome characters from the incoming data, for use in correcting data errors.
Overall the EDAC logic checks the CRC, Auxiliary CRC, padding and residual characters, in addition to controlling the error correction process, using the TIE pointers and syndrome characters.

Read Control

This chip set supervises and co-ordinates the operation of all the other chip sets.

2.5.5 Data and Strobe Signal pins

Read data (and the Write Data Strobe) appear on the following pins. The ' Pertec Pins ' refer to the two Pertec-style interface connectors at the rear of the 9914V.

Signal	Source	Edge Pin	Pertec Pin
IRD0		D1-19b	P2- 2
IRD1		D1-19a	P2- 3
IRD2		D1-18b	P1-48
IRD3		D1-18a	P1-50
IRD4		D1-17b	P2- 6
IRD5		D1-17a	P2-20
IRD6		D1-16b	P2-10
IRD7		D1-16a	P2- 8
IRDP		D1-15b	P2- 1
IRSTR		D1-14b	P2-34
IWSTR		D2-14b	P2-36

2.6 Pre-Amplifier Description

This small pcb is situated within the tape path assembly and local to the head to minimise noise pick-up, hence avoiding degradation in the signal/noise ratio of the read data signals which are passed to the ADP board. Power for the pre-amplifier board is derived from the ADP board and locally decoupled.

The pre-amplifier consists 9 wide-band low-noise amplifiers, whose gain is controlled in order to accommodate in excess of 40 dB dynamic range in the head output amplitudes. The channel gain (for each particular density and tape speed) is selected by the Data Control processor, via a latch and DAC, as the result of a previous trial read procedure for a particular tape. This philosophy eliminates the need for manual field setting of read parameters.

Read data channel activity at the pre-amplifier input consists of analogue signals varying from 1.5 mV (at 6250 bpi) to 50 mV (at 800 bpi). These are amplified to a range of 50 mV (at 6250 bpi high speed) to 550 mV (at 1600 bpi low speed).

The read data signals are best first investigated at the channel output test points, on the ADP board, where the following voltage levels should be present. Note that the correct level does not in itself prove correct operation.

Density & Speed	Writing V pk-pk	Reading V pk-pk
NRZ Lo	1.4 - 1.8	1.4 - 1.8
NRZ Hi	1.4 - 1.8	1.4 - 1.8
PE Lo	1.4 - 1.8	1.6
PE Hi	1.4 - 1.8	1.6
DPE -	1.4 - 1.8	1.6
GCR Lo	1.4 - 1.8	1.6
GCR Hi	1.4 - 1.8	1.6

2.7 AC Power Supply Description

2.7.1 Introduction

The fuse locations, voltage rail availability points, and connector locations on the ac Power Supply board (part number 123340) are shown in Figure 2.7.2.

2.7.2 Power Supply Overview

The Power Supply board accepts inputs from the secondary windings of the 50/60 Hz mains transformer. Different input voltage settings are available to accommodate four possible input voltages:

100 V, 120 V, (4 A anti-surge supply fuse fitted);
220 V, 240 V. (2 A anti-surge supply fuse fitted).

The mains input is via an IEC 320 plug, Schaffner type FN376-6 (or equivalent), located at the rear of the 9914V. This plug combines a power line filter, 1.25" fuse, and a voltage selector. The live line is taken through the supply fuse, then to the single pole switch (at the front of the 9914V), and back to the voltage selector. Here a rotateable barrel engages contacts which set the mains transformer primary taps to correspond with the desired input setting. Selection of a particular input is described in Section 7 under Mains Transformer and Switch. The present selection is visible in a window within the mains input moulding.

The transformer secondary windings enter the Power Supply board at the 9-pin connector P1, and are used to derive the following dc supplies:

Winding	Regulation	Output		Monitor point
0-18 V	buck	+5.2V	±2%	D1+ ~ C2 junction
"	buck	+12.15V	±3%	L2 ~ C3 junction
"	linear post reg	-12V	±4%	C5- (end nearer L3)
"	linear post reg	-6V	±5%	C6- (end nearer L3)
"	linear post reg	-5V	±4%	D4- (end nearer SK3)
0-35 V	none	+48V	nominal	FS3, end nearer FS2
"	linear	+24V	± 6%	FS2, end nearer P2

The Power Supply board also contains ancillary circuits to provide a 44 kHz servo sync signal, and power-fail detection circuits.

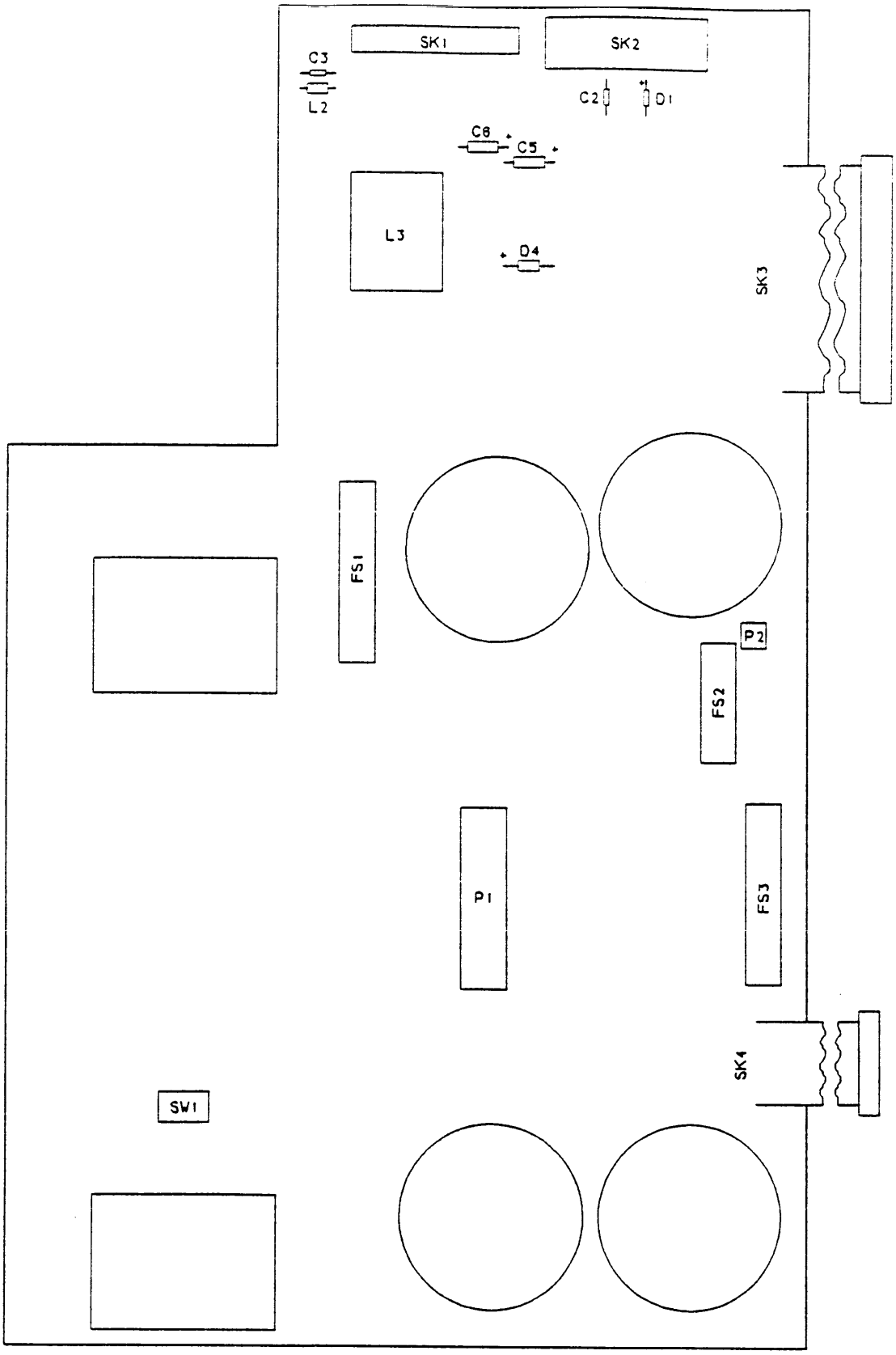

FIGURE 2.7.2 POWER SUPPLY ASSEMBLY

2.7.3 +5V Regulation

This is a step-down, or buck switching regulator controlled by IC3 (UC3524A). R41 and C31 set the oscillator frequency to a nominal regulator switching frequency of 88 kHz.

The rectified and smoothed output from D15 bridge (typically 22.5 V dc) is pulse-width modulated at 88 kHz and gives a resultant average output (nominally +5.2 V) after passing through a low-pass filter comprising L3 and C22, C18, & C4. Feedback from the output is taken from the R3/R2 junction to IC3.2 and monitored by the error amplifier within IC3. The positive input of the error amplifier (IC3.2) is fed with a stable DC reference signal of 2.50 V from the junction of R38 & R39.

The output of the error amplifier is loop-compensated by R40 & C29, enabling IC3 to track input voltage changes and load variations on the output to give excellent regulation of the output voltage and compensate for mains input variations from -15 to +10%.

Over-current limiting (occurring at typically 9 A) is provided by sense resistor (R4) voltage feedback control, such that the supply is restored when the overload is removed, without blowing any fuses. Over-voltage protection is provided by firing an SCR (D38) which blows fuse FS1 and discharges the input capacitor C15.

2.7.4 +12V Regulation

This is also a step-down, or buck switching regulator and is controlled by IC2 (UC3524A). The oscillator frequency is derived from, and synchronised to, IC3.

The rectified and smoothed output from D15 bridge (typically 22.5 V dc) is pulse width modulated at 88 kHz and gives a resultant average output (nominally +12.15 V) after passing through a low pass filter comprising L5 and C32. Feedback from the output is taken from the R50/R51 junction and monitored by the error amplifier within IC2, the positive input of the error amplifier (IC2.1) is fed with a stable DC reference signal of 5.00 V from IC2.16.

The output of the error amplifier is loop compensated by R34 & C27.

Over-current limiting (occurring at typically 2.4 A) is provided by sense resistor (R35, 36 & 37 in parallel) voltage feedback control, such that the supply is restored when the overload is removed, without blowing any fuses. Over-voltage protection is provided by firing an SCR (D38) which blows fuse FS1 and discharges the input capacitor C15.

2.7.5 -12V, -6V, and -5V Regulation

The -12V, -6V, and -5V rails are derived from auxiliary windings on L3, via linear post regulators.

The input to the -12V post regulator, TR2.2, is typically -17.5 V.

The input to the -6V post regulator, TR1.2, is typically -8.25 V.

The -5V supply for the analog switches on the servo pcb is dropped from the -6V supply by two diodes (D3 & D4) in series.

2.8.3 SCSI Interface

The SCSI Controller

The SCSI controller used is the NCR 53C90A, a high performance device which can carry out various SCSI bus related sequences autonomously without processor intervention. Thus, following a single byte command from the processor, it will respond to selection on the SCSI bus, transfer the Identify message, transfer the first byte of the Command Descriptor Block, check which group the command belongs to, then transfer the appropriate number of command bytes before signalling completion to the processor via an interrupt.

The chip is connected to the processor as an I/O device, and can transfer data directly to/from the data buffer under DMA control. All SCSI command, status and message bytes are transferred under programme control, while all SCSI data phase bytes are transferred directly to/from the data buffer.

An on-board 16-byte FIFO simplifies and improves the interfacing between the SCSI bus and the internal data bus. A maximum burst rate in excess of 3 MB/s can be supported on the SCSI bus, although the maximum sustained average rate is limited to 2 MB/s. This will drop further to around 1.2 MB/s if simultaneous tape transfers are taking place.

The Physical Interface

The ANSI SCSI specification allows for 2 possible electrical interfaces, viz. Single-ended or Differential. The board artwork supports both options, but is designed to be supplied to the customer as either one or the other.

In single-ended mode, the SCSI controller connects directly onto the SCSI bus; the chip itself contains the necessary 48 mA driver receivers.

In differential mode, the various SCSI signals are routed via 75176 differential transceiver chips.

On-board terminating resistors (socketed) are provided in both modes.

TERM PWR is provided in both modes via a diode and 1.5 Ampere fuse.

The DIFFSENS signal is utilised to avoid damage if the differential board is connected to a single-ended bus.

The Tape Interface

The SCSI board controls the 9914V via the it's internal bus, which is essentially the normal Pertec bus to a host. Note however that when the 9914V is fitted with a SCSI interface, the Pertec bus is not available outside the unit.

A 16-byte FIFO is utilised on both the write and read data paths to and from the tape unit. This ensures that data is always available for, or can always be accepted from, the unit's synchronous data interface. It also improves DMA efficiency by allowing the DMA channel to burst data at high speed between the FIFOs and the data buffer.

The 9th parity bit of the data buffer is provided to the tape unit as the parity bit (odd) of the Pertec Write Data bus.

In-coming read data from the unit (8 bits & parity) is always checked for correct parity before transferring to the buffer.

This page has no technical content

3. Fault Finding

3.1 Scope of Section 3

This section contains instructions to enable a trained engineer to diagnose faults in the 9914V Tape Unit. The information is designed to locate the common faults and act as a diagnostic aid to finding difficult faults.

A list of service tools and specific FRU functional, location, and servicing information is set out in Section 7.

The tabulated checkout procedures of Section 3.5 are provided to assist fault diagnosis.

3.2 Interlock Override

When the diagnostic mode is entered the interlocks are still effective. If the tape loading door is opened (eg to examine the tape path) tape motions ceases as part of the normal safety facility.

In order to run tape motion programs with the tape loading door open, it is necessary to run diagnostic program 95 - which constitutes interlock override. Tape motion is then enabled until such time as the tape loading door is closed again and the front right-hand thumb-screw secured.

Warning:

Personal injury can be caused by touching the tape path components while the tape is tensioned.

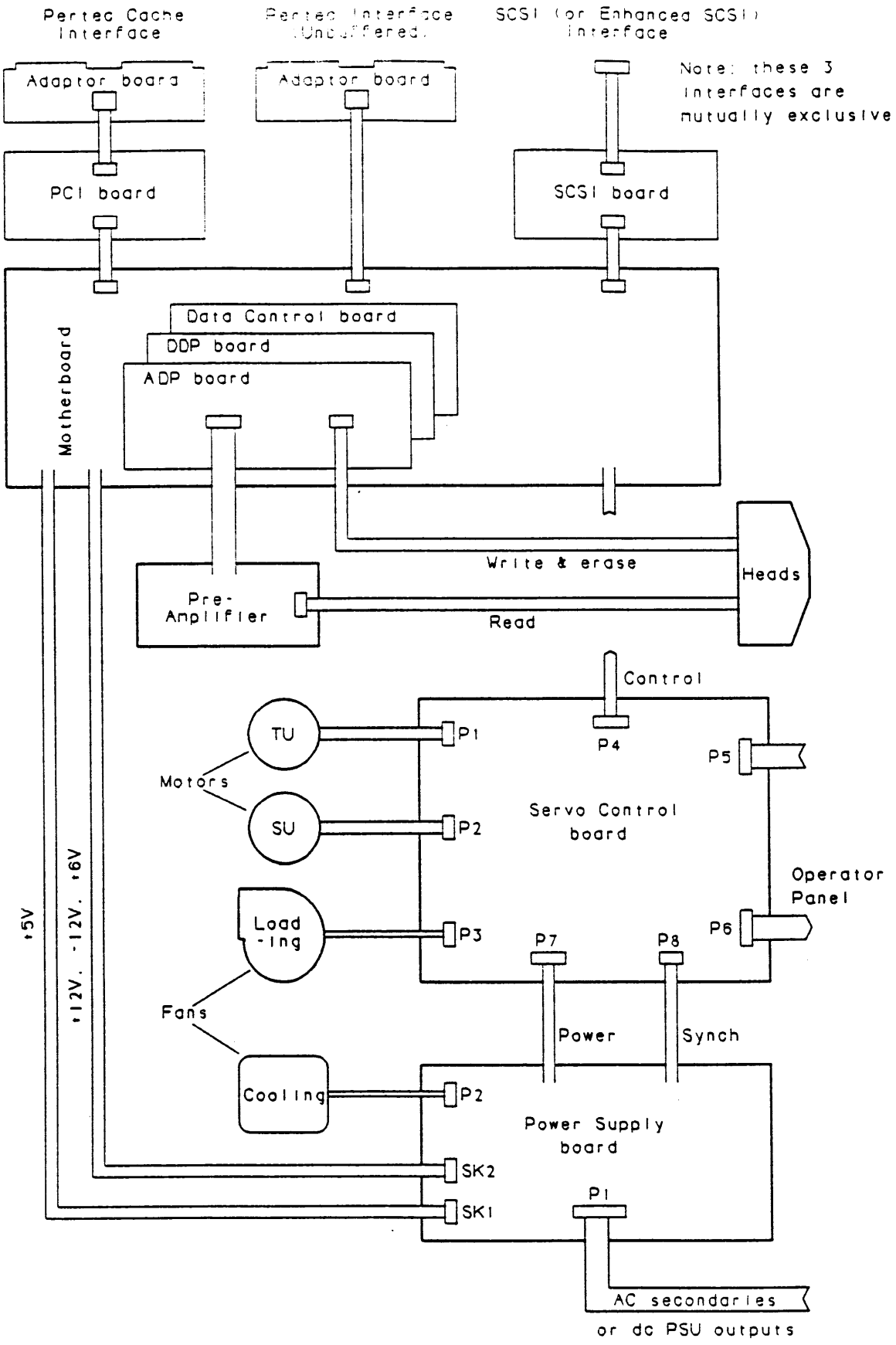

FIGURE 3.3.1 (a) INTERCONNECTIONS

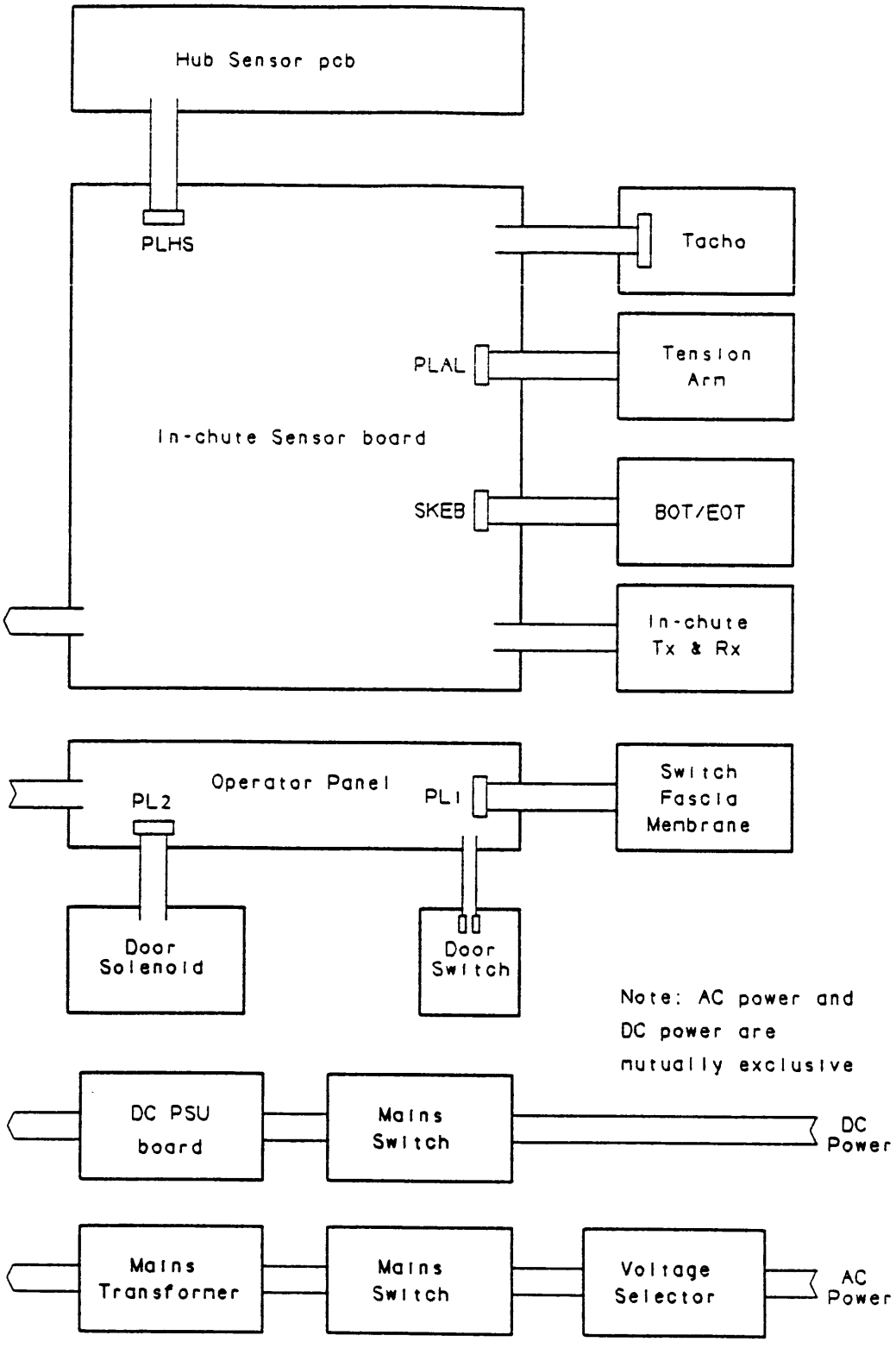

FIGURE 3.3.1 (b) INTERCONNECTIONS

3.3 Fault Messages

3.3.1 Power-on Self-Check

A self-check routine of critical power rails, firmware compatibility, and connector validation is automatically initiated when power is applied to the 9914V, the following is a list of the indications which may appear on the 8-character display, during or after this health check.

The primary suggested remedies are listed with each fault message, attention should be paid to the fault history; if a board or PROM has been substituted, this may result in an ' incompatibility ' message. Any fault could be a connector misplaced or a cable fault, the internal interconnections are shown in Figure 3.3.1. The abbreviations used to denote FRUs are listed on at the start of Section 5.

Most fault indications which are preceded by ' ** ' may be by-passed up to the point where a tape is loaded and/or diagnostic programs are run. The by-pass method is to press either LD/ONL or to press RESET and DENSITY together. By-passing only enables further investigation, the fault cause must be eliminated before the 9914V can be put into on-line use.

Display	Explanation	Suspect FRU
blank display	Mains power is not available, *or* Mains power/input fuse the +5V supply is not present, *or* Servo Control P5 is disconnected, *or* the Servo Control~Data Control bus is faulty. Remedies: check mains input fuse, check PSU fuse (FS2 - 6.0 A or 4.0 A, as marked), check the Servo Control led is illuminated, check that Servo Control connector P5 is plugged in.	PS / SC / DC
** ADP	The Analogue Data Paths board is missing, *or* motherboard fault.	ADP / DC
** ADP1	The COMP lines between the ADP board and the Data Control board are faulty	ADP / DC
** ADP2	The WTNG signal is faulty.	ADP / DDP / DC
** ARM	The output voltage from the tension arm position sensor was well outside limits. Remedy: run diagnostic program 47.	TPA / SC
** BIFF	The buffered interface (SCSI or PCI) board is not responding, but option byte 13 (bit 6) set to indicate it is present. Remedy: if SCSI (PCI) board just removed, replace it, substitute SCSI (PCI) board, substitute Data Control board.	DDP / SCSI / PCI / DC

Display	Explanation	Suspect FRU
* BOT	Servo Control board has completed loading the tape but the Data Control board is unable to confirm BOT.	SC / DC
** CHUTE	Unexpected output from in-chute Rx. Cause: excessive light falling on Rx.	TPA / SC
** CONF	Unable to configure the DDP. Remedy: exchange the DDP board.	DDP / DC
CON VAL 1	Data Control board missing, *or* motherboard disconnected (Servo Control P4).	DC / SC
CON VAL 2	Reel motor disconnected, P1 or P2.	SC
CON VAL 3	Tape path loom disconnected, P5, *or* tension sensor disconnected, PL AL, *or* BOT/EOT sensor disconnected, SK EB.	SC
CON VAL 4	Loading fan disconnected, P3.	L Fan / SC
CON VAL 5	Auxiliary PSU cable disconnected, P8.	PS / SC
CON VAL 6	Door solenoid disconnected, PL2.	Switch Fascia / SC
CON VAL 7	*Not used in the 9914V model.*	Op
** DCom	Data Communication - Data Control board cannot communicate properly with the SCSI board.	SCSI / DC
** DDP	The Digital Data Paths board is missing, *or* motherboard fault.	DDP / DC
** DDP1	The EEPROM lines are faulty.	DDP / DC / ADP
** DDP2	The Data Control ' reset ' is faulty.	DDP / DC
** DN1	No densities available. Connector/cable fault, density configuration options all 0, Remedies: exchange the DDP board, exchange the Data Control board.	DDP / DC
** DN2	Default density not available. Remedies: similar to **DN1.	DDP / DC
** DP1	DDP PROMS are missing, or wrong PROM fitted in location IC9, Data Control board, *or* DDP board just exchanged.	DDP / DC

Display	Explanation	Suspect FRU
** DP2	DDP PROMS are incompatible, *or* wrong PROM fitted in location IC10, Data Control board.	DDP / DC
** DRAM	Data Control processor not functioning, *or* Data Control RAM not functioning, *or* Servo and Data control not communicating, *or* motherboard or cable fault.	DC / SC / PS / ADP
** DROM	A malfunction was found in the Data Control PROM, ie its checksum was incorrect. Remedies: if PROM recently inserted, check lead integrity, *or* if PROM type substituted, check access times is less than 200 ns.	DC
** DPROC	Servo Control board getting no response from the Data Control board.	DC / SC
** FAN	Current not detected in cooling fan.	C Fan / PS
** FAULT	An earlier ' ** ' fault message was by-passed, and an attempt is now being made to place the 9914V on-line. The ' ** FAULT ' message persists for 5 seconds before the display reverts to its former message. Remedy: power cycle to regenerate earlier message.	
** HEAD	Write head disconnected, cable fault, *or* ADP board fault.	TPA / ADP / DC
* LIMIT	Tension arm limit not detected at power-on.	TPA / SC
LOST	Handshaking between the Servo Control board and the Data Control board began but the message transfer was not completed. Remedies: check for connector/cable fault, substitute Servo Control board, substitute Data Control board, substitute motherboard.	SC / DC
** NVR	Data Control board RAM check sum error, *or* partial data RAM failure. Remedy: run diagnostic program 80, then program 74, to re-calibrate the 9914V.	DC / ADP / DDP

Display	Explanation	Suspect FRU
OK	The power-up checks have been successfully completed, *or* the 9914V does not have a fault condition.	
** P AMP	Pre-amplifier disconnected, *or* ADP fault, *or* cable fault.	TPA / ADP / DC
** PR1	Data Control PROMS incompatible with the Servo Control PROMS.	DC / SC
** PR2	SCSI PROMS incompatible with the Data Control PROMS, *or* SCSI bus not terminated, (eg 9914V removed from a system).	DC / SCSI / DDP
POWER	A fault has been found while the presence of the internal power supply lines was being checked, this may be the Power Supply board itself or a ' power fail ' circuit fault. Remedies: press LD/ONL and run diagnostic program 73, check the actual Power Supply output voltages, see Section 7. Check the ' power fail ' circuit on the Power Supply board.	PS / DC
** RAM	A malfunction was found in the Servo Control RAM while all ones, all zeros, and chequerboard patterns were written to and read from the RAM to ensure correct operation.	SC
** SCOM*X*	Servo Communication - Servo Control board cannot communicate properly with the Data Control board.	DC / SC
** SCSI	SCSI board not responding, but option byte 13 (bit 6) set to say it is present. Remedy: if SCSI board just removed, replace it, substitute SCSI board, substitute Data Control board.	SCSI / DC
** SPRING	The tension arm was found not to produce any tension. Remedies: check the spring is connected, run diagnostic program 47.	TPA / SC
** SROM	A malfunction was found in the Servo Control PROM, ie its checksum was incorrect. Remedies: if PROM recently inserted, check lead integrity, *or* if PROM type substituted, check access time is less than 200 ns.	

Display	Explanation	Suspect FRU
* TENS 1	Sufficient SU motor current was applied to move the tension arm outside the limit flag, but the arm was still at its limit. Remedy: check the tension arm is not obstructed.	TPA / SC
* TENS 2	Sufficient SU motor current was applied to bring the tension arm to centre travel, but it did not reach the centre. Remedy: check the tension arm is not obstructed.	TPA / SC
TESTING	The power-on checks are in progress.	

After successful completion of the power-on tests, the display usually shows ' LOCATING ', while the firmware is attempting to centralise the tape reel. Exceptionally the display shows ' OK ', if the auto load feature has been disabled (configuration option 04).
' DOOR ' may appear if the loading door is not securely closed.

3.3.1.1 Faulty Indicators

Faults may occur where an indicator is stuck in one state, eg ' WT EN ' illuminated from immediately after power-on. Program 72 is provided to check out the displays; later firmware flashes the legends in turn while ' TESTING ' is in progress. Indicator faults are listed next.

Legend	Fault Type	Suspect FRU
ONLINE	Always illuminated	SC / SF
	Never illuminated	SC / SF
DIAG	Always illuminated	SC / SF
	Never illuminated	SC / SF
WT EN	Always illuminated	SC / SF
	Never illuminated	SC / SF
EOT	Always illuminated	SC / SF
	Never illuminated	SC / SF

3.3.2 Voltage Rail Failure

Power fail checks are run from time to time, after completion of the power-on checks. If a failure is detected, the POWER message is displayed and further operation is prevented.

3.3.3 Loading Indications

The full list of loading indications is set out in the 9914V User/Diagnostic Manual; the indications which require attention are listed here.

Display	Explanation	Suspect FRU
** BOT	The BOT tab was detected before the tape entered the tape path. Remedy: run diagnostic program 45 and check operation of BOT detector circuit; check operation of Servo Control board.	TPA / SC
OK	Power-up diagnostics are successfully completed. Action: load a tape.	
DOOR	Loading has commenced, but the loading door is not correctly closed. Remedy: close the tape loading door.	
** EOT	The EOT tab was detected before the tape entered the tape path. Remedy: run diagnostic program 45 and check operation of EOT detector circuit; check operation of Servo Control board.	TPA / SC
HUB ERR 1	The tape reel has not been confirmed as fully seated on the supply hub, because the firmware has concluded that only one ' located ' flag is present. Remedy: re-load, or centre the reel before initiating load; persistent ' ERR 1 ' could indicate damaged ' located ' flags or the supply hub adjusted too high. Run diagnostic program 45 to check that 3 flags per revolution are detected.	
HUB ERR 2	The tape reel has not been confirmed as fully seated on the supply hub. because the firmware has concluded that only two ' located ' flags are present Remedy: re-load, or centre the reel before initiating load; persistent ' ERR 2 ' could indicate a damaged ' located ' flag or the supply hub adjusted too high. Run diagnostic program 45 to check that 3 flags per revolution are detected.	
* HUB SOL	The hub lock solenoid has been driven but the activity of the ' located ' flag was not consistent with successful clamping. Remedies: check the hub does clamp the reel, run diagnostic program 45, substitute the Servo Control board.	

Display	Explanation	Suspect FRU
IN LIMIT	Tape tension has been lost (the tension arm has reached the limit of its travel) Remedy: run diagnostic program 47, to check the tension arm position circuits.	TPA / SC
N I C	Not In Chute; tape was not detected in the tape path chute. Remedy: (the tape end is not leaving the bulk, remove any foam pad), run diagnostic program 45, first check that the loading fan is operational, then check the ' in-chute ' circuit.	SC
NO TAPE	The reel locating circuits did not detect a tape reel on the supply hub. Remedy: insert a reel before initiating load, run diagnostic program 45 to check the ' located ' flags.	SC / TPA
N T U	Tape was not gripped onto the take-up spool. Remedy: check that the tape end is not severely damaged, try again, check the take-up hub height setting (if recently altered).	SC / TPA
REEL INV	The tape reel was found to be inserted with the Write Protect ring uppermost. Remedy: re-insert the reel, with the Write Enable ring side down.	TPA / SC
RESET	During the loading sequence, the RESET button was sensed as being permanently depressed. Action: verify the reset signal at the Servo Control board.	SF / SC
** TAB	The BOT tab was not detected near the end of the tape loading sequence. Remedies: check a tab is present, and within ANSI/ECMA distances from the physical end; check operation of BOT detector circuit (diagnostic program 45); check operation of Servo Control board.	TPA / SC
TAPE NOT IN CHUTE	*Scrolled message.*	L Fan / PS / SC
UNLOAD *then* UNLOCK	The BOT marker could not be detected. Remedy: load a different tape, to confirm the detection circuits are functional; check that the marker is present, not too far down the tape.	

3.3.4 On-line Indications

The full list of on-line indications is set out in the 9914V User/Diagnostic Manual; the indications which suggest fault conditions are listed here.

Display	Explanation	Suspect FRU
Blank	A forward Read or Space interface command has been terminated after 9 m (30 ft) of blank tape (ie no data activity was found).	
** Block	Write current present but no read-after-write data seen.	
Deselect	Unit on-line to interface, but not selected by the host computer (ie de-selected), and not at BOT.	
EOTLIM	The tape has passed 3.6 metres (12 feet) beyond EOT and the 9914V has been commanded to move tape further forwards.	
** IDENT	No identifier (compatible with the selected density) found on leaving BOT.	ADP / DDP / DC
Read Only	A a write command has been given to a file protected tape (ie WT EN was not illuminated). If writing is required, the operator must unload the tape and fit a Write Enable ring to the tape reel.	
Reject	The last command received was rejected (for reasons other than File Protect), the reason is flagged in status byte F9. ' Reject ' usually remains displayed until an acceptable command is received; exceptionally (if BOT is found during a Reverse Read) BOT is displayed. Placing the 9914V off-line removes ' Reject ' from the display.	TPA / SC / DC
STUCK!!	The tape appears to be stuck at the heads. Check the cleanliness of the tape path. If clean, consider discarding that tape. Stiction may be caused by tapes stored under humid conditions.	
** Write	No write current was detected in the heads.	TPA / ADP / DC

3.3.5 Operator Diagnostic Indications

These indications convey the status of a diagnostic program while it is running or has been halted by the operator.

Display	Explanation
Dens Err	Density error, NRZ not selected in program 83.
F*XX* Er*YY*	Failure code *YY* while running diagnostic program *XX*.
Halt 45	A diagnostic program has been halted, in this example program 45.
Pass 44	A diagnostic program has run without error, in this example program 44.
Runng 30	A diagnostic program is running, in this example program 30.
6250 Hi	Density and speed at which a diagnostic program error occurred, in this example 6250 bpi at high speed.

3.4 Fault-Finding Routines

3.4.1 Introduction

When a fault is detected by the diagnostics, an error code is displayed which points to a possible faulty FRU.

The flow charts given in this section can be used in conjunction with diagnostic program error codes, to determine the fault cause.

Notes:

i) If a board is changed, reference should be made to Section 7 to determine whether any re-calibration or configuration option settings must be performed.

ii Before changing the tape path assembly, check that the problem is not caused by a head cable fault.

3.4.1.1 Off-line Problems

a) Power-on problems.
b) The Tape Unit does not load, hold, or move tape correctly.
c) Failure during diagnostic programs.

Table 3.5.2 set out the causes of and remedies for some off-line faults.

3.4.1.2 On-line Problems

a) An installation or configuration fault.
b) A host interface or host program fault.
c) A Tape Unit fault, not mentioned in Section 3.4.1.1.
d) Operator misuse.

Table 3.5.3 set out the causes of and remedies for some on-line faults.

Some on-line faults can be diagnosed by use of the 9914V's diagnostic routines, which can be called from the host across the Pertec or SCSI interfaces. The techniques are outlined in Section 5, but detailed use of the diagnostics depends on the host's capabilities.

3.5 Possible Fault Causes/Remedies

3.5.1 Introduction

This section deals with certain less commonly found faults by suggesting possible causes, investigations and/or remedies to cure them. Where appropriate the reader is referred to the relevant section or alternative publication for more detailed information.

The 9914V should be checked for obvious faults such as mechanical damage or missing sub-assemblies before fault finding is commenced.

Note that there is an automatic fault diagnostic routine (described in Section 3.3.1) which is invoked whenever power is connected to the 9914V.

Full details of diagnostic programs and error codes are set out in Section 5.

Notes:

If a board is changed, reference should be made to Section 7 to determine whether any re-calibration or option settings must be performed.

Before changing the tape path assembly, check that the problem is not caused by a head cable fault.

3.5.2 Off-line Faults

Table 3.5.2 lists the faults in order from switching on the 9914V, through auto-thread, to the analyse function and setting 'on-line'. Remedies which suggest checking power supply rails also imply checking the fuse if the output is dead.

3.5.3 On-line Faults

Table 3.5.3 lists the faults in order from placing the 9914V on-line, through density and speed changes, to using the SCSI interface.

Fault / Possible causes	Investigation / remedy	Reference	Suspect FRU
1 Cooling fan inactive			
No mains power.	Check source is present		
	Check 9914V is powered on	Front panel switch	
	Check input fuse	4.0 A (120 V in) 6.0 A (240 V in)	
Power Supply fuse blown.	Replace with correct value & type	Section 2 - Power Supply Description	PS
+24V rail faulty.	Check +24 V arrives at fan	Section 2 - Power Supply Description	PS
2 8-character display blank (just after power-on, cooling fan active)			
Power Supply fault.	Measure output voltages	Section 7	
Connector fault.	Check placement & security	Figure 3.3.1	
Servo Control fault.	Check ' proc ok ' led	On = processor ok	
Switch Fascia pcb fault.	Substitute board	Section 7	
Faulty display chip.	Substitute board	Section 7	
3 8-character display extinguishes (previously functional)			
+5 V rail failed.	Check @ Power Supply board	Section 2 - Power Supply Description	PS
Mains supply failed.	Check fuse / restore power	See (1.) above	
4 Display indicates ' POWER '			
Power Supply fault (excl +5V).	Run diagnostic program 73	Section 5	PS
	Check at @ Power Supply board	Section 2 - Power Supply Description	PS

TABLE 3.5.2(a) OFF-LINE FAULTS

Fault / Possible causes	Investigation / remedy	Reference	Suspect FRU
5 Display active but not indicating ' LOCATING ' or ' OK ' after power-on diagnostics			
General fault	Check / substitute FRU	Section 3.3.1	
Switch Facia board fault.	Check / substitute board	Sections 2 & 7	
Servo Control board fault.	Check / substitute board	Sections 2 & 7	
6 Loading fan always on			
Drive circuit fault.	Servo Control board	Section 2.3	SC / L Fan
7 LD/ONL button not effective (ie no ' LOCATING ' indicated)			
Button / board fault.	Check @ Servo Control board	Section 2	
8 Door closure not effective (ie no ' LOCATING ' indicated)			
Switch / board fault.	Check @ Servo Control board	Section 2	SC
Door solenoid fault.	Diagnostic program 45	Section 5	SC
Switch Fascia pcb fault	Through connections		Switch Fascia
9 Other buttons not effective			
As (8)	Check @ Servo Control	Section 2	

TABLE 3.5.2(b) OFF-LINE FAULTS

Fault / Possible causes	Investigation / remedy	Reference	Suspect FRU
10 ' LOCATING ' indicated but no reel motion			
SU motor disconnected.	Diagnostic program 49	Section 5	
Servo Control board fault.	Checkout	Section 7	SC
11 Tape not feeding from supply reel			
End attraction to bulk.	Make longitudinal pinch at end		
Loading fan fault.	Manual load	Section 3	
Servo Control board fault.	Check driving ability (diagnostic program 04)	Section 5	SC
Excessive air leak.	Check tape path cover, or load manually	Section 3	
12 Take-up spool static (during load)			
TU motor fault.	Check continuity / brushes	Section 7	
Servo Control board fault.	Check driving ability (diagnostic program 49)	Section 5	SC
13 Tape forming concertina in tape path			
Caps missing.	Check fixed guide caps are fitted	Section 8	TPA
Servo Control board fault.	Check roller caps are fitted		
14 Tension arm off-centre (tape tensioned)			
Tension spring obstructed.	Remove / reposition obstruction		
Position sensor fault.	Check output at mid-position	Section 7	

TABLE 3.5.2(c) OFF-LINE FAULTS

Fault / Possible causes	Investigation / remedy	Reference	Suspect FRU
15 DIAG not illuminating			
LED faulty / disconnected.	Diagnostic program 72		
DIAG button faulty.	Servo Control board checkout	Section 7	
Servo Control board fault.	Control panel checkout	Section 7	
16 Data tests give frequent errors			
Likely causes:			
Tape quality.	Substitute known good tape		
Dirty tape path.	Routine cleaning schedule	User/Diagnostic Manual	
ADP (or other) board fault.	Substitute & re-calibrate	Diagnostic program 74	
Unlikely causes:			
Tape path fault.	Identity faulty component	Section 7	
Inter-block transitions.	Should be < 4% of nominal	ECMA / ANSI	
Modulation.	Check tape speed	Section 3	
	Check tape path	Section 7	
Channel imbalance.	Part of re-calibration	Diagnostic program 74	
	Examine head profile		
Low read amplitude.	Part of re-calibration	Diagnostic program 74	
	Examine head profile		

TABLE 3.5.2(d) OFF-LINE FAULTS

Fault / Possible causes	Investigation / remedy	Reference	Suspect FRU
17 Unstable tension arm (more than 10 mm travel during tape motion)			
Tension arm damping poor.	Diagnostic program 48	Section 5	
Servo gain incorrect.	Diagnostic program 04	Section 5	
Tape tension low.	Check tension	Section 3	
18 BOT not found			
Leader too short.	Manual load	Section 3	
Marker not detected.	Check detection circuit	Section 7	
No BOT marker.	Attach marker	ANSI / ECMA	
19 Density cannot be changed			
Tape not at BOT	Reverse to BOT		
Configuration option	Operator change forbidden	Config byte 16	

TABLE 3.5.2(e) OFF-LINE FAULTS

Fault / Possible causes	Investigation / remedy	Reference	Suspect FRU
1 ONLINE status does not latch (ie legend goes out)			
Tape not loaded.			
DIAG illuminated.	Cancel		
RESET active.	Check @ Servo Control		
LD/ONL button fault.	Check @ Servo Control		
'Off-line' host command.			
Loading door opened	Close and secure all turnbuckles		
IFEN not asserted.	Config byte 08	Section 4	
2 ONLINE status indicated, but subsequently drops out			
Loading door opened	Press LD/ONL		
Door switch fault	Check its operating point		
Tape tension loss	Diagnostic program 52 or 55		
Run off EOT end of tape	Check options/host software		
Interface fault	Try again/examine host software		
3 9914V not responding to any commands			
Not on-line.	If ONLINE not illuminated, press LD/ONL		
Incorrect configuration.	Examine Config bytes		
Incorrect connections.	Check Pertec SK1/SK2 are not interchanged or inverted		
Incorrect address.	Check Config byte 08 or 15	Section 4	
Unsuitable interface		Product Specification, M G8105-A	

TABLE 3.5.3(a) ON-LINE FAULTS

Fault / Possible causes	Investigation / remedy	Reference	Suspect FRU
4 Density selection ineffective			
Density not available. 3200 bpi available.	Config byte 18 Config byte 16, bit 4	Section 4 Section 4	
5 Speed selection ineffective			
Operator panel enabled. (inhibits interface).	Config byte 13, bit 3	Section 4	
6 9914V not responding to specific commands			
Invalid command. Unsuitable interface.	INV CMD displayed Non-standard command	CM 1077 Config byte 16 Product Specification, M G8015-A	
7 Hard error on every block			
3200 bpi tape, without ident burst.	Analyse selected 800 bpi	Set density to 800 bpi, review Config byte 09, bit 0	

TABLE 3.5.3(b) ON-LINE FAULTS

Fault / Possible causes	Investigation / remedy	Reference	Suspect FRU
8 Data transfer not reliable			
See off-line faults, Item 15			
Unreliable interface. Unsuitable interfacing.	Unsuitable/misplaced interface connector	Product Specification, M G8105-A	
9 Tape does not move forward			
Head > 3.6 m beyond EOT *Note: block may be only partially written*	Rewind or reverse motion		
10 Unable to read a particular tape			
Tape is unreadable	Try on another machine Try a known readable tape		
Circuit fault	Substitute DDP board	Section 4	
11 Does not go off-line after pressing RESET			
Tape in motion	Wait until it stops		
Data still in SCSI (or PCI) buffer	Wait until buffer is cleared		
Host is powered off	Wait about 10 seconds		

TABLE 3.5.3(c) ON-LINE FAULTS

Fault / Possible causes	Investigation / remedy	Reference	Suspect FRU
12 6250 bpi active after 3200 bpi selected			
Alternative '6250 bpi' code	Byte 16, bit 4 = 1	Section 4	
13 Read Strobes cease, part way through a block			
Error in block	Byte 07, bit 1	Section 4	
14 Host's SCSI bus unable to communicate with any unit			
9914V powered off, is last physical unit on the bus, and term pwr is set to 'int'	Arrange for 9914V power on, *or* review termination method	SCSI User Manuals	
15 SCSI option switches are ineffective			
Byte 13, bit 4 = 1	Options taken from NVR, not switches. Configure from NVR, *or* review 9914V's configuration	Appendices C or E, *or* SCSI User Manuals	

TABLE 3.5.3(d) ON-LINE FAULTS

3.6 Manual Tape Threading

Since the 9914V is designed for fully automatic threading it is not normally necessary (or desirable) to manually thread the tape except under fault conditions such as a failed loading fan.

Set power off, open the loading door, place the tape reel centrally on the supply hub, push it until it is firmly seated on the hub tape, then thread tape through to the take-up hub. Wind on about two anti-clockwise turns (an access hole is provided to facilitate take-up) until the tape is pulled through when the tape-up reel is rotated by hand.

When the tape has been laced, close the loading door, set power on, and close the door. Wait until the display indicates ' TESTING ', then ' LOADING '. The loading firmware will sense that tape is already threaded and proceed to, tension the tape and search for BOT without the operator taking any further action.

3.6.1 Switching off with Tape Laced

Always ensure that the tape is returned to BOT, or unloaded before switching off. The servos are designed with a dynamic braking effect to prevent tape loops forming following power failures or accidental switching off.

3.6.2 Switching on with Tape Already Laced

If power is removed with the tape under tension, press LD/ONL if ' LOCKING ' is not indicated within a few seconds of power being restored. The control firmware will sense that tape is already laced and move it to BOT without operator intervention.

This feature is effective whether before or after BOT.

If the loading door is unintentionally opened with the tape already laced, secure it again and press LD/ONL if auto-thread does not commence within a few seconds.

3.7 Azimuth Checking/Setting

The azimuth setting is fixed at the factory, when the head mounting block, which is a cantilever arrangement, is fitted to the head plate. The adjusting screw (which is visible in the tape path, near the tacho) has a differential thread to enable fine adjustment of azimuth.

The modified M8 cap screw (visible from under the head plate) must on no account be turned, since this has been set to determine the initial location of the adjusting screw.

3.8 Tape Tension Checking/Setting

Tape tension resulting from the tension arm spring is pre-determined and not adjustable; perform the following tension check if this parameter is suspect.

i) Set power off, examine the tension spring area for obstruction or fouling and remedy if necessary.

ii) Raise the tape path cover.

iii) Use the spring balance to apply force at the roller axis and perpendicular to length of the arm. With the arm in its mid-travel position, alternately pull and release the arm by a few mm. The average force indicated should be 270 gf ±30 gf.

If the tension is out of limits, check that the spring anchor pillar is not bent; when there is no pillar distortion, examine the spring assembly for wear or damage, otherwise replace the spring.

As alternative method, a length of tape with a loop at either end may be attached to the final roller and threaded back through the tape path to the supply reel chamber. A spring balance may then be attached to the SU end of the loop and tension applied until the tension arm is at mid-position (with the tape touching the first roller). Two readings should be taken, with the arm centered from both directions, the average reading is the tape tension.

3.9 Tape Speed Checking

3.9.1 Average Tape Speed

i) Set power off

ii) Hinge the chassis up, and monitor IC20.13 (or R151 - heatsink end) on the Servo Control board with a frequency counter (or an oscilloscope if a counter is not available).

iii) Set power on, select the required speed and density (diagnostic programs 11/12, 41/42/43/44) and record the tacho frequency while running programs 63/64/65/66.
Note: any speed error is likely to be the result of a digital circuit malfunction, giving a gross error which is easily detected by an oscilloscope.

v) The tacho pulse frequency should be within 2% of the nominal value:

Density *(bpi)*	NRZ 800		PE 1600		DPE 3200	GCR 6250	
Speed *(ips)*	41.66	125	41.66	125	62.5	41.66	125
Freq *(kHz)*	10.42	31.25	10.42	31.25	15.63	10.42	31.25

TABLE 3.9 9914V TACHO FREQUENCIES

3.9.2 Tape Speed Variations

No adjustment is provided for tape speed because it is determined by the servo processor deriving servo demand from the tacho pulses. If the tacho pulses are jittering or not of the correct frequency the following may contribute:

a) tacho surface slippery, clean as described in the 9914V User/Diagnostic Manual;

b) poor tape path, resulting in heavy edge contact and speed jitter;

c) erratic reel motors, caused by worn brushes;

d) tape fouling against the take-up hub flange, reset the TU hub height (see Section 7).

3.10 Re-calibration

Re-calibration of the 9914V should only be necessary following:

a) replacement of the Tape Path assembly (including the pre-amp);

b) replacement of the ADP board;

c) replacement of the Data Control board.

Diagnostic program 74 re-calibrates the 9914V data channels at all densities, without the need for special tools or test leads.

Note: artwork issue 1 ADP boards will give error 52, this is normal because these boards require the monostables to be reset. ADP boards later than issue 1 should pass program 74 without errors and require no re-setting. 9914Vs were not fitted with issue 1 ADPs at the factory.

The procedures for setting up the ADP monostables is set out in Appendix B.

4. Basic Configuration Options

Most options are held in non-volatile RAM, which can be examined or altered by running diagnostic program 67.

The configuration bytes which are available in every 9914V, regardless of options or interfaces, are described in this section and tabulated at the end.

Configuration bytes 14, 15, 17 & 19, which are specific to particular interfaces, are set out in the appendices.

4.1 Configuration Bytes 01 to 05 - Operator Options

These bytes are displayed under diagnostic program 67 as abbreviated messages which may be examined and/or altered as described in Section 5.

Byte	Function
01	DNSDIS-1 = Density displayed until ' run/stop ' pressed DNSDIS-0 = Density displayed for 5 seconds only
02	AutoOpen = *Option not applicable to the 9914V model* Man Open =
03	Aut ONL = 9914V is automatically on-line after threading tape Man ONL = 9914V is on-line only after ' LD/ONL ' is pressed
04	AutoLoad = 9914V threads tape to BOT on closing the loading door Man Load = 9914V threads tape when ' LD/ONL ' button is pressed
05	Unit *XX* = Where *XX* is the current unit address (valid in the range 0 to 7)

Configuration bytes 06 onwards are displayed under diagnostic program 67 in hexadecimal notation; they may be examined and/or altered as described in Section 5.

4.2 Configuration Byte 06 - Host Interface Options A

Bit	Interpretation
7	1 = EOT latched until passed again in reverse 0 = EOT pulsed every time the marker is detected (except in rewind)
6	1 = IOFL sets streamer off-line, no other action 0 = IOFL sets streamer off-line, rewinds to BOT, unthreads tape
5	1 = All forward commands rejected after EOT limit is set 0 = No command restrictions after EOT limit is set (user must ensure that physical end-of-tape is not reached)
4	1 = Incoming write data checked for odd parity, IHER set if error (and bit 0 in status byte F7); used with bit 3 below 0 = Incoming write data parity ignored, odd parity generated
3	1 = DPE/PE or NRZ write data parity is written to tape, even if wrong; enables even parity tapes, but R-A-W data causes IHER to set (GCR ignores incoming parity, for writing to tape) 0 = DPE/PE or NRZ write data parity is corrected before writing to tape
2	1 = Automatic density analysis (at conclusion of threading) is inhibited (default density - byte 16 - is assumed) (GCR read auto-calibration is not operative) 0 = Automatic density analysis is enabled
1	1 = Pertec INRZ interface line is set when GCR density is selected (valid after IDBY set during first command from BOT) 0 = INRZ has NRZ density meaning only
0	If the density is changed after analyse: 1 = read @ analyse density, write from BOT @ new density 0 = read @ analyse density, write from BOT @ new density; if no previous read, write at analyse density. See Figure 4.2.

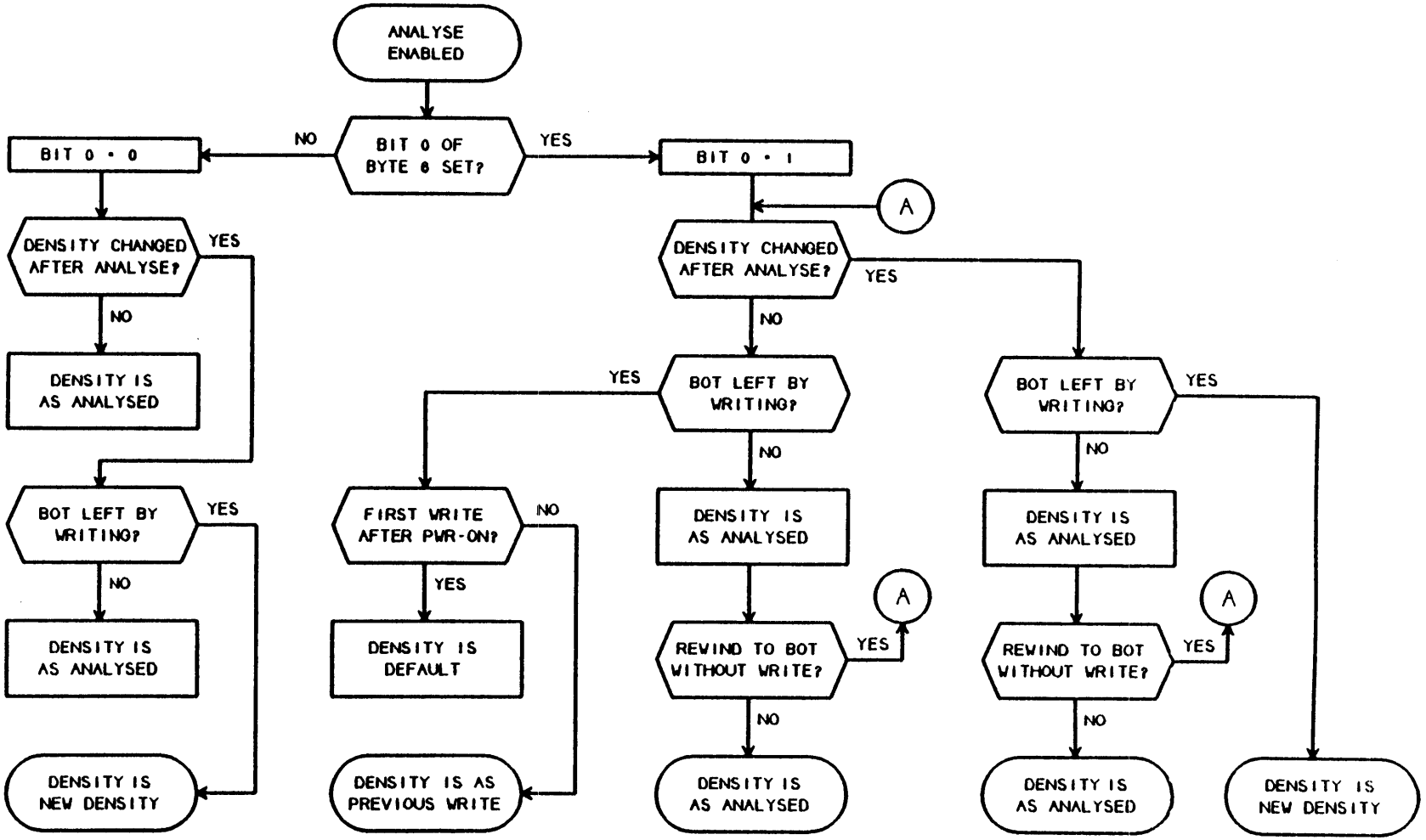

FIGURE 4.2 BYTE 6, BIT 0 DENSITY POSSIBILITIES

4.3 Configuration Byte 07 - Host Interface Options B

Bit	Interpretation
7 - 4	1 = Gap *before* a file mark is normal IBG 0 = Gap *before* a file mark is 3.5 inches Bit 7 = GCR gap Bit 6 = PE 1600 gap Bit 5 = DPE 3200 gap Bit 4 = NRZ gap Note: when streaming, the gap *after* a file mark may be longer than normal, when byte 12 is set for Variable Gap.
3	1 = IRSTR strobes generated with NRZ LRC & CRC characters 0 = IRSTR strobes not generated with NRZ LRC & CRC characters
2	1 = ICER true (in GCR write) for double-track error correction 0 = ICER true (in GCR) for single or double-track correction Default = 1; note: this option affects ICER in GCR density only
1	Note: this feature requires revision 05 DDP firmware and assembly state 25 Data Control board 1 = Read strobes continue after multi-track errors in PE densities, but beware that the MTE read tracks will be set to zero 0 = Read strobes cease after multi-track errors in PE densities
0	Note: this feature requires revision 05 DDP firmware and assembly state 25 Data Control board 1 = AGC on while writing, as well as while reading 0 = AGC on while reading only. *Recommended setting = 0*

4.4 Configuration Byte 08 - Host Interface options C

Bit	Interpretation
7	Note: this feature requires assembly state 26 Data Control board 1 = PE and GCR CERs flagged as HERs only 0 = CERs flagged as CERs
6	1 = IFBY clears immediately after IDBY clears (facilitates streaming by hosts which re-instruct from IFBY) 0 = IFBY clears after the re-instruct time has expired
5	1 = IFBY set true on the leading edge of the command strobe IGO 0 = IFBY set true on the trailing edge of the command strobe IGO Note: the PCI board has its own edge selecting option
4	1 = 9914V responds to the host irrespective of IFEN state, but IFEN going high terminates the current command 0 = IFEN must be asserted before on-line status is possible, even if correctly addressed by host, or placed on-line at the front panel IFEN must be asserted for commands to be accepted Note: pulsing IFEN clears IHER & ICER, either option setting
3	Note: this feature requires assembly state 27 Data Control board 1 = Set IHER on long blocks, ie after several seconds. This avoids reading to EOT if a tape with continuous data (eg certification patterns or diagnostic data) is loaded 0 = IHER timeout is not active
2 - 0	Unit address settings: *b2* *b1* *b0* 0 0 0 Unit address 0 0 0 1 Unit address 1 .. and so on ... 1 1 1 Unit address 7

4.5 Configuration Byte 09 - Host Interface options D

Bit	Interpretation
7	1 = Disable 3200 bpi IDENT when reading (no interface IIDENT even if one is present) 0 = Enable 3200 bpi IDENT reporting across interface
6	1 = Disable 3200 bpi IDENT when writing 0 = Enable 3200 bpi IDENT when writing
5	1 = IHER & ICER pulsed at end of block (no need to justify errors with IDBY) 0 = IHER & ICER set until cleared
4	1 = Ignore read IDENT error from BOT and read first block 0 = tape halted if IDENT error from BOT during read, ' ** IDENT ' displayed, IHER set, bit 7 of status byte F10 set Note: when writing from BOT, IDENT error is flagged as for ' 0 ' setting
3	1 = An illegal command sequences IDBY & IFBY as normal 0 = An Illegal command sets and clears IFBY, IDBY unaffected, (host informed of reject command without reference to status bytes) (Rejected commands set bit 7 of status byte F7, regardless of this option)
2	1 = 3200 bpi read commands enabled, write commands rejected 0 = 3200 bpi read commands & write commands enabled
1	1 = Density mismatch sets IHER, and bit 2 of F14 0 = Density mismatch sets bit 2 of F14, but does not set IHER
0	Analyse density setting if no ident burst is found; if no data activity is found in the first 25 feet of tape, the density defaults to the config byte 16 setting. 1 = Analyse density default is 3200 or 800 bpi if no ident burst is found depending on the data activity in the first 25 feet 0 = Analyse density default is 800 bpi when no ident burst is found

4.6 Configuration Byte 10 - Conditions which set Incomplete

Note: ' incomplete ' is bit 6 of status byte F7.

Bit	Interpretation
All	1 = the status byte INCOMPLETE bit is set and IHER is asserted 0 = the status byte REJECT bit is not set (IHER is not asserted), (but another status byte bit may be set)
7	No read-after-write data detected during writing (RWFAIL)
6	BOT detected during Read Reverse (RRD @ BOT)
5	BOT detected during File Search Reverse (FSR BOT)
4	Blank tape found during Read (BLANK TAPE)
3	IFEN asserted during an operation (IFEN)
2	A data glitch was found, but not a valid data block
1	There was an unexpected gap in the R-A-W data
0	No erase current detected during a write operation (/WTNG)

4.7 Configuration Byte 11 - Conditions Which Set Reject

Note: ' reject ' is bit 7 of status byte F7.

Bit	Interpretation
All	1 = the status byte REJECT bit is set and IHER is asserted 0 = the status byte REJECT bit is not set (IHER is not asserted), (but another status byte bit may be set)
7	-
6	-
5	-
4	Forward motion requested when tape is at EOT limit (EOTLIM CMD (applies only if bit 5 of config byte 06 is set)
3	Command code was not recognised - eg invalid combination (INV CMD)
2	Reverse command received while at BOT (REV @ BOT)
1	Write command received, to a file-protected tape (FPTD)
0	Set density command received while away from BOT (DENS /BOT)

4.8 Configuration Byte 12 - IBG Size

When the 9914V is streaming, byte 12 determines the gap which follows a block of data (or a file mark). When set to a variable code, the gap ceases when a new command is received, should this not happen before the maximum gap, a reposition cycle is entered and the resulting inter-block gap is of normal length (assuming the new command is Write).

If the 9914V repositions on every block, the resulting tape thus contains IBGs of normal length, regardless of the setting of byte 12.

Bit	Interpretation	
7 - 4	Most significant nibble, GCR gap size	
	Hex code	*Normal GCR*
	0 -	0.3
	1 -	0.4
	2 -	0.6
	3 -	1.0
	4 -	1.5
		Variable GCR
	5 -	0.3 - 0.6
	6 -	0.3 - 1.0
	7 -	0.3 - 1.5
	8 -	0.3 - 2.0
	9 -	0.4 - 1.0
	A -	0.4 - 1.5
	B -	0.4 - 2.0
	C -	0.4 - 2.5
	D -	0.4 - 3.0
	E -	0.4 - 4.0
	F -	0.4 - 6.0

Bit	Interpretation	
3 - 0	Least significant nibble, PE/NRZ gap size	
	Hex code	*Normal PE/GCR*
	- 0	0.5
	- 1	0.6
	- 2	1.0
	- 3	1.5
	- 4	2.0
		Variable PE/GCR
	- 5	0.5 - 1.0
	- 6	0.5 - 1.5
	- 7	0.5 - 2.0
	- 8	0.6 - 1.0
	- 9	0.6 - 1.5
	- A	0.6 - 2.0
	- B	0.6 - 2.5
	- C	0.6 - 3.0
	- D	0.6 - 3.5
	- E	0.6 - 4.0
	- F	0.6 - 6.0

4.9 Configuration Byte 13 - Miscellaneous Options A

Bit	Interpretation
7	1 = All rewinds performed at the slower (archive) speed 0 = All rewinds performed at the maximum speed (3,600 feet in less than 100 seconds)
6	1 = SCSI (or PCI) is fitted 0 = SCSI (or PCI) is absent (data diagnostics do not run)
5	Reserved for customer option *(each specific customer is aware of this function)*
4	1 = SCSI (or PCI) options determined by NVR contents (ie bytes 14, 15 & 17) 0 = SCSI (or PCI) options determined by board switches
3	1 = Speed selection enabled via the operator panel (see below) 0 = Speed selection enabled via the host interface note: operator panel selection prevents interface selection
2	1 = Speed sets to high on power-up 0 = Speed sets to low on power-up
1	Reserved for customer option *(each specific customer is aware of this function)*
0	Reserved for customer option *(each specific customer is aware of this function)*

Operator Speed Selection

When the 9914V is on-line, press DIAG momentarily while the tape is stationary to display the current speed setting. If a speed change is required, hold the DIAG button depressed until the indication changes, then release it immediately.

If bit 3 is 0, the DIAG button is ignored.

If the tape is in motion, the DIAG button is ignored.

If the 9914V is off-line, the DIAG button invokes diagnostic mode.

4.10 Configuration Byte 16 - Density

Bit	Interpretation			
7 - 5	Power-up default density:			
	b7	*b6*	*b5*	
	0	0	x	800 bpi NRZ
	0	1	x	1600 bpi PE
	1	0	x	3200 bpi DPE
	1	1	x	6250 bpi GCR
4 - 2	Host interface selection:			
	b4	*b3*	*b2*	
	x	0	x	Standard encoded commands
	x	1	x	Option A encoded commands
	x	x	0	IHIDEN on PL1-36, IHISP on PL2-50
	x	x	1	IHIDEN/IHISP exchanged
	1	x	x	*Reserved*
1 & 0	Density change enable:			
	b1	*b0*		
	1	0		Via the interface only
	0	1		Via the front panel only
	1	1		Via the interface or front panel

4.11 Configuration Byte 18 - Miscellaneous B

Bit	Interpretation
7 & 6	Unused
5	1 = High speed disabled when on-line 0 = High speed allowed when on-line
4	1 = Low speed disabled when on-line 0 = Low speed allowed when on-line
3	1 = 6250 bpi density disabled when on-line 0 = 6250 bpi density allowed when on-line
2	1 = 3200 bpi density disabled when on-line 0 = 3200 bpi density allowed when on-line
1	1 = 1600 bpi density disabled when on-line 0 = 1600 bpi density allowed when on-line
0	1 = 800 bpi density disabled when on-line 0 = 800 bpi density allowed when on-line

This page has no technical content
The config bytes begin on page 14

Option	Meaning
01	DNSDIS-1 = Density displayed until ' run/stop ' or ' tens ' pressed DNSDIS-0 = Density displayed for 5 seconds only
02	AutoDor = Man Door = *Option not applicable to the 9914V model*
03	Aut ONL = 9914V automatically goes on-line after threading has completed Man ONL = 9914V is on-line only after ' LD/ONL ' is pressed
04	AutoLoad = 9914V automatically threads tape to BOT on closing the door Man Load = 9914V threads tape when ' LD/ONL ' button is pressed
05	Unit *XX* = Where *XX* is the current unit address (valid in the range 0 to 7)

	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
06 HOST I/F A	EOT LATCHED	OFFLINE, NO REWIND	REJECT FWD AT EOT LIMIT	IWDP CHECKED, IHER IF ERROR	PE/NRZ IWDP WRITTEN	ANALYSE INHIBITED	INRZ SET IF GCR ACTIVE	WRITE AT NEW DENSITY
07 HOST I/F B	GCR <—	PE FM GAP IS NORMAL IBG	DPE	NRZ —>	NRZ LRC & CRC, WITH STROBES	GCR ICER IF 2-TRK ERR	IRSTRs AFTER PE ERROR	AGC ON WRITE
08 HOST I/F C	PE/GCR CERs FLAG AS HERs	IFBY CLEARS EARLY	LDG EDGE IGO SETS IFBY	IFEN HIGH RESETS CMD	SET IHER IF LONG BLOCK	MSB <—	Bit 1 UNIT ADDRESS	LSB —>
09 HOST I/F D	3200 IDENT NOT READ	3200 IDENT NOT WRITTEN	IHER & ICER PULSED	BOT IDENT ERR IGNORED	INV CMD CYCLES IDBY & IFBY	3200 bpi READ ONLY	DEN MISMATCH SETS IHER	NO IDENT ASSUMES 3200

TABLE 4(a) BASIC CONFIGURATION OPTIONS

10 'INCOMPLETE'	NO R-A-W DATA	BOT DURING READ REV	BOT DURING FILE SCH REV	BLANK TAPE DURING READ	IFEN ASSERTED DURING CMD	DATA GLITCH NO BLOCK	GAP IN R-A-W DATA	NO ERASE CURRENT
11 'REJECT'	-	-	-	FWD CMD AT EOT LIMIT	INVALID COMMAND	REV CMD AT BOT	WRITE TO FP TAPE	SET DEN AWAY FROM BOT
12 IBG SIZE	GCR <— —			Detailed in the text of Section 4	PE/NRZ — —>			
13 MISC A	REWIND AT SLOWER SPEED	BUFF I/F FITTED	customer option	BUFF OPTIONS FROM NVR	SPEED SELECT VIA OP PANEL	HIGH SPEED AT POWER-ON	customer option	customer option
14, 15 & 17 SCSI/PCI	See the appendices							
16 DENSITY	POWER-UP DEFAULT <— —			see tables below	HOST INTERFACE SELECTION — —>		HOST I/F CHANGE ENABLED	FRONT PANEL CHANGE ENABLED
18 MISC B	-	-	HIGH DISABLE ON-LINE SPEEDS	LOW	6250 bpi	3200 bpi	1600 bpi	800 bpi
19 SCSI	Customer options, not provided with earlier PROM revisions							

Power-up default:

b7	b6	b5	
0	0	x	800 bpi NRZ
0	1	x	1600 bpi PE
1	0	x	3200 bpi DPE
1	1	x	6250 bpi GCR

Host interface selection:

b4	b3	b2	
x	0	x	Standard encoded commands
x	1	x	Option A encoded commands
x	x	0	IHISP PL2-50, IHIDEN PL1-36
x	x	1	IHISP/IHIDEN exchanged
1	x	x	Pertec code 10111 = select 6250, not 3200

Note: functions are as stated when the bit is set to '1'.

TABLE 4(b) BASIC CONFIGURATION OPTIONS

This page has no technical content

5. Diagnostic Programs

This section gives specific diagnostic program information which is related to servicing purposes.

Detailed instructions of how to operate the diagnostic programs are set out in the 9914V User/Diagnostic Manual.

5.1 Common Error Codes

Error codes numbered 89 and above are common to many diagnostic programs, these codes and any further checks are described next.

5.1.1 Error Code 89 - No Write Ring

Follow the flowchart of Figure 5.1.1, run diagnostic program 45 to check the Write Enable sensor.

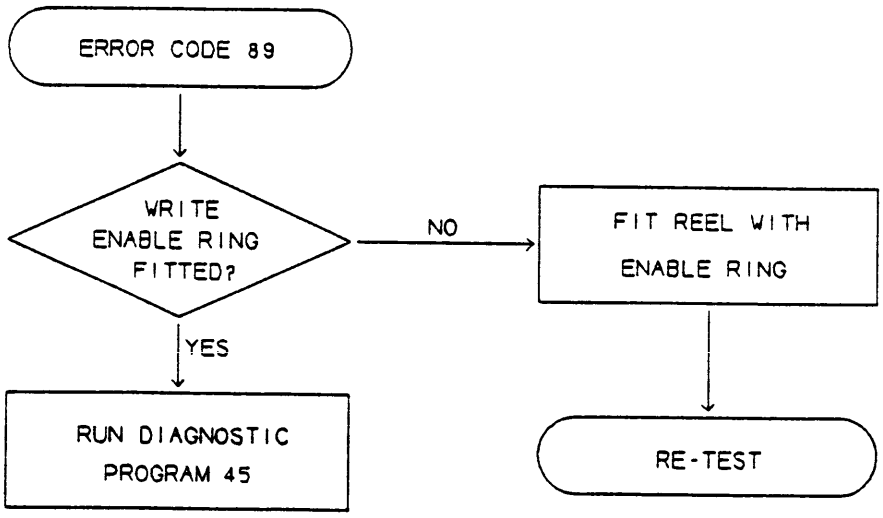

FIGURE 5.1.1 ERROR CODE 89

5.1.2 Error Code [illegible]ite Current

Follow the flowchart of Figure 5.[illegible].

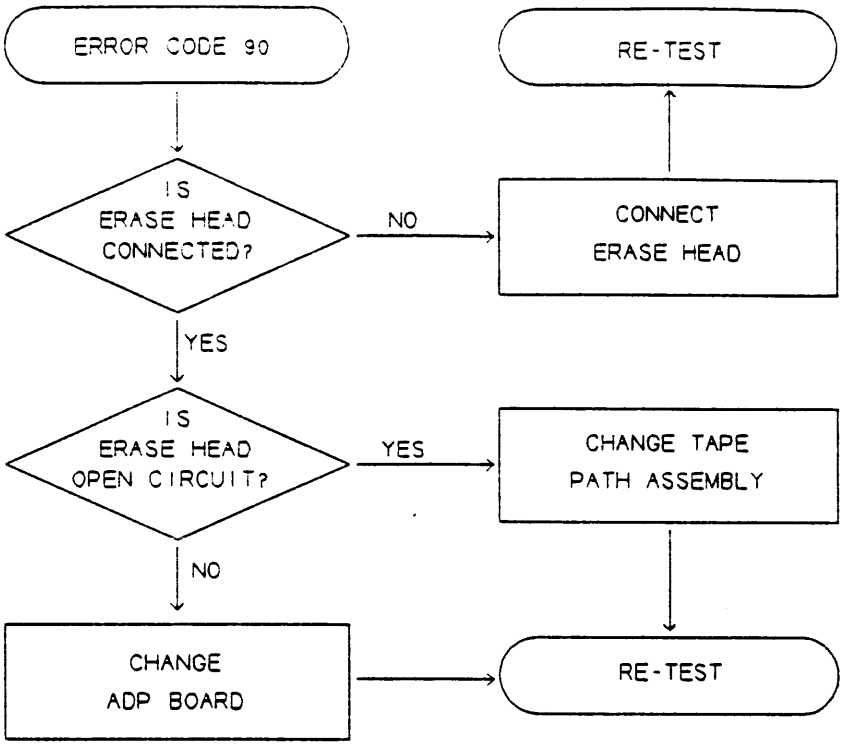

FIGURE 5.1.2 ERROR CODE 90

5.1.3 Error Codes 98 & 99

Error Codes 98 and 99 result from faulty communication between the Data Control and SCSI boards.

Code	Explanation
98	Data Control time-out elapsed while waiting for a response from the SCSI board.
99	Data Control time-out elapsed while waiting for a result from the SCSI board.

5.2 Program Descriptions and Error Codes

Diagnostic programs can be divided into groups, each designed to assist with a certain area of investigation:

Function(s)	Relevant programs
Parameter set-up	10 - 24, 41 - 44
Tape path sensors	45 - 48
Servo tests	04, 49
Tape motion	50 - 55
Data channels*	05 - 09
Configuration / status	67, 68, 70, 81, 93
Initialising	69, 80
Data transfer*	25 - 33
Service facilities	72, 73, 74, 78 - 84, 95
Stack manipulation	01, 97, 98, 99.

* These programs require a buffered interface to be fitted:

- an SCSI board, with terminations, *or*
- a PCI board.

Where the cause of a fault code is not self-evident, the FRU(s) most likely to contribute to that fault are listed; the abbreviations are:

ADP	Analogue Data Paths board, or the heads
DC	Data Control board
DDP	Digital Data Paths board
Fw	Firmware revision (usually of previously mentioned board)
Op	Operator error
PS	Power Supply board
PCI	Pertec Cache Interface board
SC	Servo Control board
SCSI	SCSI board
Tape	Tape (quality)
TPA	Tape Path Assembly (sensors or tape guidance) Check cleanliness of the head before changing

No.	Function	No.	Function
00	NULL PROGRAM	50	STEP FORWARD (*low speed*)
01	CONFIDENCE CHECK	51	STEP REVERSE (*low speed*)
02	RUN STACK FROM HOST	52	ALTERNATE FWD / REV (*low speed*)
03	ILWD LINE CHECK	53	STEP FORWARD (*high speed*)
04	AUTO SERVO CHECK	54	STEP REVERSE (*high speed*)
05	DATA CHANNELS CHECK (*non-corruptive*)	55	ALTERNATE FWD / REV (high speed)
06	DATA CHANNELS CHECK (*corruptive*)	56	
07	ADP E-E	57	
08	DDP E-E	58	
09	DATA CHANNEL ERROR REPORTING	59	
10	SET PARAMETERS OF PROGRAM 01	60	ERASE TO EOT
11	SET HIGH SPEED	61	
12	SET LOW SPEED	62	WRITE ALL ONES TO EOT
13	SET N	63	READ FWD TO EOT (*low speed*)
14	SET BLOCK LENGTH	64	READ FWD TO EOT (*high speed*)
15	SELECT NON-STREAMING	65	READ REV TO BOT (*low speed*)
16	SELECT STREAMING	66	READ REV TO BOT (*high speed*)
17	FAILURE SKIP	67	EXAMINE / MODIFY OPTIONS
18	INCREMENT LOOP COUNTER	68	EXAMINE STATUS BYTES
19	IRD* & IWD* LINE CHECKS	69	INITIALISE STATUS BYTES
20	SET ALL ZEROS DATA	70	EXAMINE PROM REVISIONS
21	SET ALL ONES DATA	71	EXAMINE / MODIFY LANGUAGE
22	SET ALTERNATE 1/0 DATA	72	OPERATOR DISPLAY CHECK
23	SET PSEUDO RANDOM DATA	73	INTERNAL VOLTAGE CHECK
24	SET FAIL LIMITS	74	DATA CHANNELS AUTO CALIBRATION
25	WRITE, BACKSPACE, READ (*N blocks*)	75	
26	WRITE N BLOCKS	76	
27	SPACE REVERSE N BLOCKS	77	
28	READ FORWARD N BLOCKS	78	MANUAL WRITE SET-UP
29	READ REVERSE N BLOCKS	79	MANUAL READ SET-UP
30	REWIND	80	SET DEFAULT NVR VALUES
31	WRITE & CHECK FILE MARK	81	EXAMINE / MODIFY NVR VALUES
32	SPACE FORWARD N BLOCKS	82	NRZ READ SKEW MARGINS CHECK
33	WRITE IDENT	83	NRZ WRITE SKEW MARGINS CHECK
34	COMMAND TRACE	84	READ-WRITE CROSS-FEED
35	LOG SENSE DATA	85	
36		86	
37		87	
38		88	
39		89	
40		90	
41	SET 800 bpi	91	
42	SET 1600 bpi	92	
43	SET 3200 bpi	93	EXAMINE LOOP COUNT
44	SET 6250 bpi	94	CLEAR LOOP COUNT
45	SENSORS CHECK	95	ENTER SERVICE KEY
46	FILE PROTECT CHECK	96	
47	TENSION ARM POSITION	97	MODIFY PROGRAM STACK
48	TENSION ARM RESPONSE	98	CLEAR PROGRAM STACK
49	SERVO SETTINGS CHECK	99	RUN PROGRAM STACK

Program 00 **Null Program**

Description — Useful for entering on the stack with a view to later alterations (eg placed first for later substitution by Failure Skip, program 17) or to delete previous unwanted entries using program 97.

Error Codes — *None*

Program 01 **Machine Integrity Test**

Note — The operator should be aware that the last program in this stack clears the stack. Therefore program 01 should be added to the end of a stack with caution.

Description — A pre-defined sequence of programs (to check the functionality of the 9914V) which are placed in the stack. Programs 73, 4 & 30 are run, the following data tests are then run with pre-set parameters:

(GCR) 44, 05, 03, 19,
44, 12, 05, 26, 29, 28, 11, 05, 26, 29, 28;
(DPE) 43, 11, 05, 26, 29, 28;
(PE) 42, 12, 05, 26, 29, 28, 11, 05, 26, 29, 28;
(NRZ) 41, 12, 26, 29, 28, 11, 26, 29, 28.

Exit — When program 01 passes, the pre-set parameters remain and the stack is cleared.

Error Codes — *See individual programs.*

Notes
- If an SCSI (or PCI) board is not fitted, program 01 runs but omits the data-related parts.
- If an SCSI (or PCI) board is not fitted, program 01 should not be run continuously.
- Earlier firmware did not run the initial programs 44, 05, 03 & 19 in GCR.

The SCSI system bus must be properly terminated:
- by resistor packs within the 9914V, or
- by maintaining power on the terminating unit, *or*
- by a customer-specific procedure (peculiar to his configuration).

Program 02 **Run Stack From Host**

Note — Cannot be run from the front panel.
If called up by the operator, ' No test ' is displayed.

Description — Used by the host to run the 9914V program stack, previously entered across the Pertec interface.

The DIAG legend illuminates for the duration of the program stack.

Program 03 **ILWD Line Check**

Note — Program 03 is not provided with all firmware revisions, in which case ' No Test ' is displayed when ' run/stop ' is pressed.

Description — Verifies the operation of the ILWD signal (which is part of the unbuffered Pertec interface) by writing a block in E-E mode and applying a timeout during which ILWD must respond.

Error Codes:

01	SCSI board not detected, *or* incompatible with Data Control firmware	SCSI / Fw / DC
03	DDP fault	DDP / ADP / DC
12	Command error	DC / SCSI
14	Timeout waiting for command (from SCSI)	DC / SCSI
23	ILWD occurred early	DC / SCSI
24	ILWD not received	DC / SCSI

Program 04 **Auto Servo Check**

Description — Verifies the performance of the servo system, a tape needs to be loaded, but not necessarily at BOT.

Error Codes — *None allocated*

Program 05 **Data Channels Check** (Non-Corruptive)

Notes
- The SCSI board must be installed for program 05 to run.
- Any SCSI bus must be properly terminated, see program 01 notes.
- Program 05 does not apply to NRZ density.

Description — Incorporates self-contained tests, designed to check the data channel and isolate a faulty sub-assembly (ie the ADP or the DDP) by writing data patterns via E-E paths through the analogue and digital electronics sections. Data is not written to tape.

The status which is flagged by two dead tracks is determined by config byte 07.

When there are no errors, tests equivalent to program 09 are automatically carried out.

Error Codes:

01	SCSI (or PCI) board not detected, *or* incompatible with Data Control firmware	SCSI / PCI / Fw / DC
03	DDP fault	DDP / ADP / DC
04	ADP fault	ADP / DDP
12	Interface command not Write	SCSI / PCI / DC / DDP
13	Timeout waiting for block	DC / DDP / SCSI / PCI / ADP
14	Timeout waiting for command (from SCSI / PCI) May be improper SCSI bus termination	SCSI / PCI / DC Op
15	ADP fault - no CER status on 1-track kill	ADP / DC
16	DDP fault - no CER status on 1-track kill	DDP / DC
17	ADP fault - HER status on 1-track kill	ADP / DC
18	DDP fault - HER status on 1-track kill	DC / SCSI / PCI / DDP

19	ADP fault - no HER status on 3-track kill	ADP / DC
20	DDP fault - no HER status on 3-track kill	DC / SCSI / PCI
21	NRZ selected	Op
22	IFBY reset unexpectedly	DC
89	No write ring	Op / SC / DC
90	No write current	ADP / DC / PS

Program 06 **Data Channels Check** (Corruptive)

Notes
- The SCSI board must be installed for program 06 to run.
- Any SCSI bus must be properly terminated, see program 01 notes.
- Program 06 does not apply to NRZ density.

Description

Incorporates self-contained tests, designed to check the data channel and isolate a faulty sub-assembly (ie the ADP or the DDP) by writing data patterns via E-E paths through the analogue and digital electronics sections and to tape.

The status which is flagged by two dead tracks is determined by config byte 07.

When there are no errors, tests equivalent to program 09 are automatically carried out.

Error Codes:

01	SCSI board not detected, *or* incompatible with Data Control firmware	SCSI / PCI / Fw / DC
02	Head or pre-amplifier fault (or ADP / tape path fault)	TPA / ADP
03	DDP fault	DDP / DC
04	ADP fault	ADP / DC
12	Interface command not Write	SCSI / PCI / DC
13	Timeout waiting for block	SCSI / PCI / DC
14	Timeout waiting for command (from SCSI)	SCSI / PCI / DC
	May be improper SCSI bus termination	Op
15	ADP fault - no CER status on 1-track kill	ADP / DC
16	DDP fault - no CER status on 1-track kill	DDP / DC
17	ADP fault - HER status on 1-track kill	ADP / DC
18	DDP fault - HER status on 1-track kill	DDP / DC
19	ADP fault - no HER status on 3-track kill	ADP / DC
20	DDP fault - no HER status on 3-track kill	DDP / DC
21	NRZ selected	Op
22	IFBY reset unexpectedly	DC
89	No write ring	Op / SC / DC
90	No write current	ADP / DC / PS

Program 07 **ADP E-E Check** (not applicable to NRZ)
Program 08 **DDP E-E Check**

Description

When run from the front panel, these programs place the relevant board in E-E (electronics-to-electronics) mode and set the 9914V to on-line status (which is not indicated at the front panel), in anticipation of one or more interface Write commands. The program ends when ' run/stop ' is pressed, with relevant board taken out of E-E mode, and the 9914V set off-line to the interface.

When run on-line, the programs expect one interface Write command. Programs 07 & 08 are designed for use with the SCSI board removed, because the external Pertec bus is used.

Error Codes:

01	NRZ density selected *(program 07 only)*	Op
02	Interface command not Write	DC
03	Timeout waiting for block	DC
04	6-second timeout elapsed while waiting for new command	DC

Program 09 Data Channel Error Reporting

Notes
- The SCSI board must be installed for program 09 to run.
- Any SCSI bus must be properly terminated, see program 01 notes.

Description

The ADP board is placed in E-E (electronics-to-electronics) mode and each track is killed in turn while a block is written; CER error is expected, but not HER. If the error status is incorrect, the test is repeated with the DDP in E-E mode. Three tracks are then killed while a block is written, HER status is expected. On error, the DDP is placed in E-E mode to isolate the faulty board.

The status which is flagged by two dead tracks is determined by config byte 07.

Error Codes:

01	SCSI board not detected, *or* incompatible with Data Control firmware	SCSI / PCI / Fw / DC
12	Interface command not Write	SCSI / PCI / DC
13	Timeout waiting for block	SCSI / PCI / DC
14	Timeout waiting for command (from SCSI)	SCSI / PCI / DC
	May be improper SCSI bus termination	Op
15	ADP fault - no CER status on 1-track kill	ADP
16	DDP fault - no CER status on 1-track kill	DDP
17	ADP fault - HER status on 1-track kill	ADP
18	DDP fault - HER status on 1-track kill	DDP
19	ADP fault - no HER status on 3-track kill	ADP
20	DDP fault - no HER status on 3-track kill	DDP
21	NRZ selected	Op
22	IFBY reset unexpectedly	DC

Program 10 Set Parameters of Program 01

Description

Allows the number of blocks, block length, and data pattern used by program 01 to be selected for its use.

The pre-set parameters of program 01 are listed below.

Program	Condition(s)
13	N = 50
14	Block length = 4K
15	Set non-streaming
23	Pseudo random data
24	W Rty = 4, W Err = 4, R Rty = 0, R Err = 0.

The value of N is first presented, to be changed (by the method of program 13) or skipped by pressing DENSITY; the block length is presented second, to be changed (by the method of program 14) or skipped by pressing DENSITY; the data pattern is presented third, to be changed by pressing ' units ' until the required pattern is displayed before pressing DENSITY or ' run/stop ' to set that pattern.

Error Codes *None*

Notes:
- Once program 10 has been run and the data pattern set, program 01 uses that pattern until power is removed, even if programs 20 - 23 are run.
- No purpose is served by running program 10 across the interface, since all its features are available separately.

Program 11 Set High Speed

Note 125 ips tape speed is not available at 3200 bpi density.

Description Sets the higher tape speed, prior to starting other programs. When run ' Hi speed ' is displayed for 1 second.

Error Codes *None*

Program 12 Set Low Speed

Description Sets the lower tape speed, prior to starting other programs. When run ' Lo speed ' is displayed for 1 second.

Error Codes *None*

Program 13 Set N

Note Should not be entered onto the stack because operator intervention is required.

Description Allows the operator or host to set N to a new value, which may be in the range of 1 to 255_{10}.

Operator: Allows the operator to update N, which is indicated on the display, by the use of DIAG, ' tens ', or ' units ' buttons. The ' run/stop ' button is pressed when the desired value is displayed. N is set from the time of update, not just when the stack is subsequently run.

Host: The host effectively updates N when certain SCSI commands are sent, as described in the SCSI User Manual. The new value of N is active while the SCSI command is running, but N reverts to its previous value afterwards.

Error Codes *None*

Program 14 **Set Block Length**

Description Sets the length of subsequent data blocks for programs which write data to tape. Blocks may normally be from 1 byte up to 32 Kbytes long, in increments of powers of two. Some programs restrict the block length.

When run from the front panel, the display indicates (say) LEN = 16K, to increase the block size, use the ' tens ' button, to decrease the size, use the ' units ' button.

Error Codes *None*

Program 15 **Select Non-Streaming**

Description Sets the 9914V write and read programs so that the tape is repositioned after each block is traversed.

Error Codes *None*

Program 16 **Select Streaming**

Description Sets the 9914V write and read programs so that the tape is kept in motion after each block is traversed (ie streaming mode).

Error Codes *None*

Program 17 **Failure Skip**

Note Is only effective when entered in a program stack.

Description Causes subsequent failing programs to be aborted, thus allowing a stack to skip to the next program without stopping on errors.
Status bytes F4 (and C4) are incremented up to FF_{16} (255_{10}) when an error occurs.

Error Codes *None*

Program 18 **Increment Loop Counter**

Description When entered in a program stack, program 18 increments a counter, typically to record the number of times the stack loops (assuming program 99 is at the end of the stack). The user may subsequently use programs 93/94 to examine/clear the loop counter.
The counter increments up to 9,99910, then holds without overflowing.

Error Codes *None*

Program 19 **IRD* & IWD* Line Checks**

Notes
- Program 19 is not provided with all firmware revisions, in which case ' No Test ' is displayed when ' run/stop ' is pressed.
- The SCSI (or PCI) board must be installed for program 19 to run.

Description: Verifies the operation of the read and write data lines (which are part of the unbuffered Pertec interface) by executing a write-rewind-read sequence and comparing the data.

Error Codes:

01	SCSI board not detected, *or* incompatible with Data Control firmware	SCSI / Fw / DC
02	IFBY line in error	DC / SCSI
03	IRD* or IWD* line(s) in error	DC / ADP / SCSI
04	Timeout waiting for IDBY false	DC / ADP / SCSI
89	No write ring	Op / SC / PS

Program 20 **Set All Zeros Data**
Program 21 **Set All Ones Data**
Program 22 **Set Alternate 1/0 Data**
Program 23 **Set Pseudo Random Data**

Note: The SCSI board must be installed for programs 20 - 23 to run.

Description: Set the preset data bytes, prior to running other programs, to the stated pattern.

Error Codes:

01	SCSI board not detected, *or* incompatible with Data Control firmware	SCSI / PCI / Fw / DC

Program 24 **Set Fail Limits**

Description: Sets the number of errors which are encountered before programs 25, 26, 28, or 29 are deemed to have failed, when run from the front panel. When writing, any error causes a ' backspace & erase ' so that each re-try takes place over a fresh piece of tape until the re-try limit is reached or writing is successful.

When run, the limits may be changed by means of the ' tens ' and ' units ' buttons:
W Rty = number of write re-tries per block, before the test fails
W Err = number of block failures before the test fails
R Rty = number of read re-tries per block, before the test fails
R Err = number of read failures before the test fails.

The various re-try results are treated as follows.
If no error occurs on any read/write attempt, the test proceeds to the next block.
If an error occurs, and the number of re-tries has not reached the W Rty/R Rty limit, a re-try is executed on the current block but a re-try register is incremented.
The test fails if the re-try register count reaches W Err/W Err, or if the W Rty/R Rty count is reached in any one block.

Error Codes: *None*

Program 25 **Write, Backspace, Read**

Notes
- An SCSI (or PCI board) must be installed for program 25 to run.
- Any SCSI bus must be properly terminated, see program 01 notes.

Description
Writes N blocks of data with:
- speed as selected by program 11 or 12;
- N as set by program 13;
- block length as set by program 14;
- streaming/non-streaming as set by program 15 or 16;
- data pattern as set by programs 20 - 23;
- density as selected by programs 41 - 44.

The program then reverse-spaces, and reads the blocks.

Error Codes:

01	SCSI board not detected, *or* incompatible with Data Control firmware	SCSI / PCI / Fw / DC
02	HER - status byte has detail	ADP / DDP / DC
03	CER - status byte has detail	ADP / DDP / DC
89	No write ring	Op / SC / DC
90	No write current	ADP / DC / PS

Program 26 **Write N Blocks**

Notes
- An SCSI (or PCI board) must be installed for program 26 to run.
- Any SCSI bus must be properly terminated, see program 01 notes.

Description
Writes N blocks of data with:
- speed as selected by program 11 or 12;
- N as set by program 13;
- block length as set by program 14;
- streaming/non streaming as set by program 15 or 16;
- data pattern as set by programs 20 - 23;
- density as selected by programs 41 - 44.

Error Codes:

01	SCSI board not detected, *or* incompatible with Data Control firmware	SCSI / PCI / Fw / DC
02	HER - status byte has detail	ADP / tape / DC / DDP
03	CER - status byte has detail Note: if error 02/03, run program 05; if ok Data Control is not the cause	tape / ADP / DC / DDP
89	No write ring	Op / SC
90	No write current	ADP / DC / PS

Program 27 **Space Reverse N Blocks**

Notes
- An SCSI (or PCI board) must be installed for program 27 to run.
- Any SCSI bus must be properly terminated, see program 01 notes.

Description
Spaces reverse over N blocks with:
- speed as selected by program 11 or 12;
- N as selected by program 13;
- streaming/non streaming as set by program 15 or 16;
- data content being ignored.

Error Codes:	01	SCSI board not detected, *or* incompatible with Data Control firmware	SCSI / PCI / Fw / DC

Program 28 Read Fwd N Blocks

Notes
- An SCSI (or PCI board) must be installed for program 28 to run.
- Any SCSI bus must be properly terminated, see program 01 notes.

Description

Reads forward N data blocks while looking for status errors, with;
- speed as selected by program 11 or 12;
- N as set by program 13;
- streaming/non streaming as set by program 15 or 16;
- density as selected by programs 41 - 44.

Error Codes:	01	SCSI board not detected, *or* incompatible with Data Control firmware	SCSI / PCI / Fw / DC
	02	HER - status byte has detail	ADP / tape / DC / DDP
	03	CER - status byte has detail	ADP / DC / DDP

Program 29 Read Reverse N Blocks

Notes
- An SCSI (or PCI board) must be installed for program 29 to run.
- Any SCSI bus must be properly terminated, see program 01 notes.

Description

Reads N data blocks in reverse while looking for status errors with:
- speed as selected by program 11 or 12;
- N as set by program 13;
- density as selected by programs 41 - 44.

Error Codes:	01	SCSI board not detected, *or* incompatible with Data Control firmware	SCSI / PCI / Fw / DC
	02	HER - status byte has detail	ADP / DC / DDP
	03	CER - status byte has detail	tape / ADP / DC / DDP

Program 30 Rewind

Description

Tape is rewound to BOT, may be used for positioning the tape prior to running other programs.

Error Codes

None

Program 31 Write & Check Filemark

Description

Writes a file mark to tape in the current density format, checking the File Mark pattern is read as the tape passes.

Error Codes:	01	Timeout waiting for Block True	DC / DDP / ADP
	02	Timeout waiting for Block False	DC / DDP / ADP
	03	No ' end of file ' status	DC / DDP / ADP
	89	No write ring	Op / SC / DC
	90	No write current	ADP / DC / PS

Program 32 Space [illegible] Blocks

Notes
- An SCSI (or PCI board) must be installed for program 32 to run.
- Any SCSI bus must be properly terminated, see program 01 notes.

Description Spaces forward over N blocks with:
- the speed selected by program 11 or 12;
- N as selected by program 13;
- streaming/non streaming as set by program 15 or 16;
- data content being ignored.

Error Codes:

01	SCSI board not detected, *or* incompatible with Data Control firmware	SCSI / PCI / Fw / DC

Program 33 **Write Ident** (& rewind)

Description Writes an ident burst (appropriate to the selected diagnostic density) to tape, then rewinds to BOT.

Error Codes:

01	Error writing ident at lo speed	DDP / ADP / DC
02	Error writing ARA level burst at lo speed	DDP / ADP / DC
03	Error writing ARA ID burst at lo speed	DDP / ADP / DC
10	Density error, status byte F10 defines detail	DDP / ADP / DC
11-13		As 01-03, at high speed
20	Density error, status byte F10 defines detail	
89	No write ring	Op / SC / DC
90	No write current	ADP / DC / PS

Program 34 **Command Trace**

Note Program 34 is not provided with all firmware revisions, in which case ' No Test ' is displayed when ' run/stop ' is pressed.

Description Allows the last 16 SCSI commands to the 9914V to be examined using the front panel display.

The displayed format is G-cHJsKL interpreted as follows:

Display	Meaning	Notes
G	G = table number	0 = most recent 1 = next previous; press ' tens ' to advance the table number
cHJ	c = command HJ = command code	FFh = no command
sKL	s = status KL = completion status	FFh = no completion status

Program 35 **Log Sense Data**

Note

Program 35 is not provided with all firmware revisions, in which case ' No Test ' is displayed when ' run/stop ' is pressed.

Description

Allows the SCSI SENSE/LUN status trace buffer held by the 9914V to be examined using the front panel display.

The displayed format is M-NP QR interpreted as follows:

Display	Meaning	Notes
M	M = table number	0 = most recent 1 = next previous; press ' tens ' to advance the table number
NP	NP = table entry	press ' units ' to advance the table entry
QR	QR = contents of entry NP	

There are 8 tables in the format of Table P35.

Program 41 **Set 800 bpi**
Program 42 **Set 1600 bpi**
Program 43 **Set 3200 bpi**
Program 44 **Set 6250 bpi**

Description

Changes the data encoding circuits to handle the stated density. When non-diagnostic mode is restored, the density remains at this new setting.

Error Codes:

01	Selected density not available	Op / DDP / DC
02	DDP fault	DDP

byte	(hex)	bit 7	6	5	4	3	2	1	0
byte 0	00	SCSI Command							
byte 1	01	Completion Status							
byte 2	02	0	0	0	0	0	Initiator ID		
byte 3	03	0	0	0	0	0	Target ID		
byte 4	04	SCSI Sense Byte 0							
byte 5	05	SCSI Sense Byte 1							
byte 6	06	SCSI Sense Byte 2							
byte 7	07	SCSI Sense Byte 3							
byte 8	08	SCSI Sense Byte 4							
byte 9	09	SCSI Sense Byte 5							
byte 10	0A	SCSI Sense Byte 6							
byte 11	0B	SCSI Sense Byte 12							
byte 12	0C	SCSI Sense Byte 13							
byte 13	0D	9914V Status Validity (00 = valid)							
byte 14	0E	9914V Status Byte F5							
byte 15	0F	9914V Status Byte F6							
byte 16	10	9914V Status Byte F7							
byte 17	11	9914V Status Byte F8							
byte 18	12	9914V Status Byte F9							
byte 19	13	9914V Status Byte F10							
byte 20	14	9914V Status Byte F11							
byte 21	15	9914V Status Byte F12							
byte 22	16	9914V Status Byte F14							

Table P35 STATUS TRACE FORMAT

Program 45 **Sensors Check**

Note Tape should not be loaded.
If tape is at BOT, the program will unthread, otherwise rewind the tape first.

Description Indicates the state of the tape path sensors which are used during tape threading and tape motion, each display letter should be interpreted as in the table opposite. The sensor outputs are picked up by the Servo Control board at connector P5 and routed to IC34 (use IC34.7 as an earth point).

Additionally the operator may check the operation of the fan drive circuit by pressing ' enter '.

Letter	C	R	B	E	W	L
Sensor	in-chute	reel seated	BOT	EOT enable	write limit	tension
Meaning of letter	chute clear	flag detected	marker present	marker present	flag detected	not in limit
P5 pin	4	32	20	18	34	28
IC34 pin	9	1	13	11	5	3
On (V) Off (V)	<1.0 pulsed	<1.0 >2.0	<0.30 3.4-4.7	<0.30 3.4-4.7	<1.0 >2.0	<1.0 >2.0

Table P45 TAPE PATH SENSORS CHECK

When running the program, check the indications as follows:

C place an opaque object in the chute, ' C ' should disappear while the chute is blocked, when examining the transmitter output the High pulses are seen to switch between 4 and 5 volts.

R rotate the supply hub slowly for a complete revolution, ' R ' should remain displayed; place a reel of tape on the hub and rotate again, ' R ' should disappear three times per revolution.

B place a reflective tape marker tab about 3 mm away from the BOT/EOT block, ' B ' should appear only when the reflection is picked up. If marker detection problems have occurred and this test fails, check the operation of the detector circuits as described in Section 7 under Tape Path Assembly.

E similar to B.

W remove the Write Enable ring from a reel of tape, place the reel on the supply hub and rotate slowly for a complete revolution, ' W ' should not appear at all. Fit a Write Enable ring to the tape reel, replace it on the hub and rotate slowly for a complete revolution, ' W ' should appear once per revolution.

L should not be displayed with the tension arm at rest: moving the arm away from its rest position should cause ' L ' to appear until the far travel limit is reached, when ' L ' should disappear.

The WT EN legend is lit when the flag is detected.

Error Codes *None*

Program 46 **File Protect Test**

Note Tape should not be loaded.
If it is at BOT, the program will unthread, otherwise rewind the tape first.

Description After unthreading any tape and opening the loading door, the operator is requested to remove the write enable ring, insert the tape reel, and then press the ' tens ' button. The program then checks that no ring has been detected.

The operator is next requested to fit the write ring and then press ' tens '. The program then checks that the ring has been detected.

Error Codes			
	01	Ring detected, but no ring fitted	TPA / SC / DC
	02	Ring not detected, but ring fitted	TPA / SC / DC
	03	*Not applicable to the 9914V model*	Op

Program 47 **Tension Arm Position**

Note Tape should not be tensioned for this test.

Description The display first indicates ' LIMIT *XXX* ', where *XXX* is a three-digit number related to the output from the tension arm position sensor.

As the arm is moved away from its rest end, the LIMIT part of the message should disappear (denoting that the arm is no longer at its travel limit) and the number *XXX* should increase from about 80 to about 180 as the far end limit is encountered, when LIMIT should re-appear.

This sequence verifies that the tension arm output and limit flags are visible to the Servo Control processor; the quoted *XXX* values should not be regarded as defining acceptable performance but as an indication of symmetry of the tension arm sensor. Acceptable performance is an output variation from +1.0 (±0.2) V to -1.0 (±0.2) V at IC1.7 on the tension arm board.

Error Codes *None*

Program 48 **Tension Arm Response**

Note — Program 48 is only used when problems have been encountered with the tension arm going into limit (ie tension being lost). When this happens, the tape tension should be checked (see Section 3) and only if it is within limits should program 48 be run.

Description — Displays the fly time of the tension arm, between the limit flags, under the influence of the tension arm spring.

Unthread the tape, move the arm against the spring, through its full travel towards the head, release the arm and allow it to fly to the rest position unimpeded.

The display indicates the fly-time of the arm (in milli-seconds), a value between 20 and 30 is acceptable, but only values below 20 or above 40 are likely to affect the 9914V's performance.

Error Codes — *None.*

Program 49 **Servo Settings Check**

Warning — Only a trained service engineer should run this program, after removing any tape from the machine.

Description — Input stimuli are applied to the Servo Control motor drive circuits, in order to allow an engineer to probe around the circuits and investigate whether the response is correct or otherwise. The various display responses are set out in Table 5.2.2.

Error Codes — *None.*

Program 50 **Step Forward** (low speed)

Description — The tape is stepped forward at low speed to EOT.
The size of the steps may be altered by holding the ' tens ' or ' units ' button.

Error Codes — *None*

Program 51 **Step Reverse** (low speed)

Description — The tape is stepped in reverse at low speed to BOT.
The size of the steps may be altered by holding the ' tens ' or ' units ' button.

Error Codes — *None*

EXIT	Denotes the first exit point of the program after pressing ' run/stop ', the normal operator action is to press ' DIAG ' here.
LEVEL .1	Level 1 test mode has been selected (where the operator calls full or zero demand on either servo circuit). Press ' run/stop '.
RUN 49.1	Level 1 test mode is now active. Press ' tens ' to place full demand on the TU servo circuit; press ' units ' to place full demand on the SU servo circuit; press ' enter ' to place zero demand on both servo circuits (but with both output stages energised); press ' run/stop ' to switch off the output stage. Press ' DIAG ' when level 1 mode is no longer required.
LEVEL .2	Level 2 test mode has been selected (where the operator calls for the current demand to ramp on either servo circuit). Press ' run/stop '.
RUN 49.2	Level 2 test mode is now active. Press ' tens ' to slowly ramp up the current demand to the TU servo, after which the demand slowly ramps down through zero to full demand in the opposite direction. Pressing ' tens ' a second time holds the current level, pressing ' tens ' a third time resumes the ramp. Press ' enter ' to place zero demand on both servo circuits (output stages energised). Press ' units ' to place ramp current demand on the SU servo, in a similar manner to that described for the TU servo. Press ' run/stop ' to switch off the output stage and exit from level 2. Press ' DIAG ' to move on to level 3.
LEVEL .3	Level 3 test mode has been selected (where the operator calls for the speed demand to ramp on either servo circuit). Press ' run/stop '.
RUN 49.3	Level 3 test mode is now active. Press ' tens ' to slowly ramp up the speed demand to the TU servo, after which the demand slowly ramps down through zero to full demand in the opposite direction. Pressing ' tens ' a second time holds the speed demand, pressing ' tens ' a third time resumes the ramp. Press ' enter ' to place zero speed demand on both servo circuits, but leave the speed servo action running and the output stages energised. Press ' units ' to place ramp speed demand on the SU servo, in a similar manner to that described for the TU servo. Press ' run/stop ' to switch off the output stage and exit from level 3. Press ' DIAG ' to display the exit mode.
EXIT	Denotes the last exit point of the program, press ' run/stop ' here.
TEST 49	Denotes the end of diagnostic program 49.

TABLE P49 PROGRAM 49 RESPONSES

Program 52 **Alternate Forward/Reverse** (low speed)

Description The tape is run alternately forward/reverse, at the low speed
The size of the steps may be altered by holding the ' tens ' or ' units ' button.

Error Codes *None*

Program 53 **Step Forward** (high speed)

Description The tape is stepped forward at high speed to EOT.
The size of the steps may be altered by holding the ' tens ' or ' units ' button.

Error Codes *None*

Program 54 **Step Reverse** (high speed)

Description The tape is stepped reverse at high speed to BOT.
The size of the steps may be altered by holding the ' tens ' or ' units ' button.

Error Codes *None*

Program 55 **Alternate Forward/Reverse** (high speed)

Description The tape is alternated at high speed
The size of the steps may be altered by holding the ' tens ' or ' units ' button.

Error Codes *None*

Program 60 **Erase to EOT & Rewind**

Description The tape is erased to EOT at the speed selected by program 11 or 12.
The tape is rewound when EOT is reached.

Error Codes

89	No write ring	Op / SC / DC
90	No head current	ADP / DC / PS

Program 62 **Write All Ones to EOT & Rewind**

Description All 1s data is written to EOT, with;

- speed as selected by program 11 or 12;
- density as selected by programs 41 - 44.

The tape is rewound when EOT is detected.

Error Codes

89	No write ring	Op / SC / DC
90	No head current	ADP / DC / PS

Program 63 **Read Forward to EOT** (low speed)
Program 64 **Read Forward to EOT** (high speed)

Description The tape is run forward to EOT, with the read circuits enabled.

Error Codes *None, these programs only produce tape motion.*

Program 65 **Read Reverse to BOT** (low speed)
Program 66 **Read Reverse to BOT** (high speed)

Description The tape is run reverse at low speed to BOT, with the read circuits enabled.

Error Codes *None, these programs only produce tape motion.*

Program 67 **Examine/Modify Options**

Description Displays all the config bytes, indicating as follows at the various steps:

OPT 01	Indicated upon first entering diagnostic program 67, the desired option number (which flashes) can now be changed by depressing the ' units ' button.
OPT 05	When the desired option is displayed, press DIAG.
UNIT 01	Indicated after the desired option has been selected, and DIAG has been pressed. This example is a typical setting of config byte 05.
	If config byte 05 is to be altered, use the ' tens ' and ' units ' buttons to display its new setting, otherwise proceed to the next step.
UNIT 02	When the required option setting is displayed, press DIAG to revert to displaying option numbers.
OPT XX	If no further configurations are to be changed, press ' run/stop ' to exit diagnostic program 67, otherwise repeat the procedure for other configuration(s).
	The displays associated with the config bytes 01 to 05 are:
	Config 01 (Duration of density display)
DNSDIS-1	Density displayed until ' run/stop ' or ' tens ' pressed
DNSDIS-0	Density displayed for 5 seconds only.
	Config 02 (Door opening after an unthread)
AutoOpen	*Option does not apply to the 9914V model.*
Man Open	
	Config 03 (Auto on-line)
Aut ONL	9914V automatically goes on-line after threading has completed.
Man ONL	9914V is on-line only after ' LD/ONL ' is pressed.
	Config 04 (Auto load)
AutoLoad	9914V automatically threads tape to BOT on closing the door.
Man Load	9914V threads tape when ' LD/ONL ' button is pressed.
	Config 05 (Unit address)
UNIT XX	Where *XX* is the current unit address (valid in the range 0 to 7).
	Config bytes 06 to 19 are described and tabulated in Section 4 (basic options) or in the appendices (SCSI & PCI options).

Warning — Changing configuration bytes 06 to 19 may affect the response of the 9914V to the host, and/or the format of recorded data; they should only be altered in the full knowledge of the result.

Configuration bytes 06 to 19 are displayed in hexadecimal notation, pressing the ' tens '/' units ' button changes the most/least significant four bits respectively; pressing DIAG updates the displayed config. Pressing ' run/stop ' causes a halt, pressing ' DIAG ' causes an exit from program 67.

configuration byte 06	host interface options A;
configuration byte 07	host interface options B;
configuration byte 08	host interface options C;
configuration byte 09	host interface options D;
configuration byte 10	conditions which set Incomplete;
configuration byte 11	conditions which set Reject;
configuration byte 12	write gap size;
configuration byte 13	miscellaneous A;
configuration byte 14	SCSI options A, or PCI options A;
configuration byte 15	SCSI options B, or PCI options B;
configuration byte 16	density options;
configuration byte 17	SCSI options C, or PCI options C;
configuration byte 18	miscellaneous B;
configuration byte 19	SCSI options D.

Error Codes — *None*

Program 68 **Examine Status Bytes**

Description — Displays all the full status bytes (F1 to F17) by a method similar to program 67, the display indicates as follows at the various steps:

SNS F01	Indicated upon first entering diagnostic program 68, during this Byte Selection phase, the desired status byte number can now be changed by using the ' tens ' and ' units ' buttons.
SNS F05	When the desired byte is displayed, press DIAG.
11000100	Typical indication after the desired byte has been selected, and DIAG has been pressed. This is the current setting of status byte F05 (left digit is most significant). Press DIAG again to return to the Byte Selection phase.
SNS F05	If no further bytes are to be examined, press ' run/stop ' to exit diagnostic program 68, otherwise repeat the procedure for the next status byte.

Error Codes — *None*

Program 69 **Initialise Status Bytes**

Description Clears most of the status bytes to zero, or (where otherwise applicable) presets them to the correct value.
All error logs are thereby cleared, ensuring that future status byte contents do not reflect past operations.

Error Codes *None*

Program 70 **Examine PROM Revisions**

Description Displays the installed Servo Control, Data Control, DDP, and SCSI PROM revisions, in the form of a scrolled message.
If DENSITY is held depressed when the message has begun to scroll, the creation date and time are displayed.

Error Codes *None (hardware faults are indicated at power-up).*

Program 71 **Examine/Modify Language**

Note The language may have been previously set via the interface, which may subsequently over-ride any setting made with program 71.

Description The current language appears on the display. The language of the display messages may be changed by pressing:

' tens '	next available language;
' units '	previous language.

When the chosen language has been selected, press ' run/stop ' to exit program 71 with that language.

Error Codes *None*

Program 72 **Operator Display Check**

Description Causes all the legends and display segments on the control panel to illuminate in turn; the alpha-numeric display cycles through its character set.

Error Codes *None*

Program 73 **Internal Voltage Check**

Description Measures the internal regulated voltage lines to ensure that they are present.
This assumes the presence of +5V and avoids having to probe inside the machine.

Error Codes

01	+12 V	PS / SC
02	-12 V	PS / SC
03	*Reserved*	
04	-5 V	PS / SC
05	+24 V	PS / SC

The voltages used by the main assemblies are listed in the table, switching on without a particular assembly may remove a short which was affecting that rail.

	Servo Control	Data Control	DDP	ADP	SCSI	Tape Path (& pre-amp)	Tacho
+12	y	-	-	y	-	y	-
-12	(y)	-	-	y	-	y	-
-5	y	-	-	-	-	-	-
+24	y	-	-	-	-	-	-

Program 74 Data Channels Auto Calibration

Warning

Program 74 should only be run in response to a specific fault diagnosis, and after any hardware fault has been cleared, recalibration for its own sake merely overwrites a good set of parameters.

Note

The service key is required for program 74.
A standard output tape is recommended for calibration. This is a tape where the recording characteristics are traceable back to NBS references; while most tapes do not depart significantly from these, the use of an unknown tape may cause parameters to be set which cause known tapes to give marginal performance.

The head and tape path must be clean before calibration is attempted. The head outputs are affected by oxide deposits and debris on tape path components may contaminate a good tape.

The small-signal circuits (eg the ADP read channels) require a warmup time of about 15 minutes before their parameters settle. If program 74 is run with the intention of setting the full range of precise parameters, the 9914V should have been previously powered up with its set of boards for 15 minutes.

Description

Re-calibrates the data channels at all densities, re-setting the:

- read channel monostables;
- write currents;
- pre-amplifier gain;
- read gains;
- read-after-write NRZ skew delays.

While read calibration is active, the density and pass number is indicated; a pass constitutes two sets of measurements, if the results are diverse, the pass is repeated. The Poor Tape error code denotes that 5 passes produced diverse results.

Error Codes

01	ADP [illegible]ble calibration error	ADP / DC
02	DDP density set-up error	DDP / DC
03	Dead track found during ADP write cal, lo speed	ADP / DDP
04	Out-of-range error during ADP write cal, lo speed	TPA / ADP / DDP
05	Dead track found during ADP write cal, hi speed	TPA / ADP / DDP
06	Out-of-range error during ADP write cal, hi speed	TPA / ADP / DDP
11	Dead track found during ADP read cal, lo speed	TPA / ADP / DDP
12	Channel 4 gain signal out of range - ADP read cal, lo sp	ADP / DDP
13	Channel 6 gain signal out of range - ADP read cal, lo sp	
14	Channel 0 gain signal out of range - ADP read cal, lo sp	
15	Channel 1 gain signal out of range - ADP read cal, lo sp	
16	Channel 2 gain signal out of range - ADP read cal, lo sp	
17	Channel P gain signal out of range - ADP read cal, lo sp	
18	Channel 3 gain signal out of range - ADP read cal, lo sp	
19	Channel 7 gain signal out of range - ADP read cal, lo sp	
20	Channel 5 gain signal out of range - ADP read cal, lo sp	
21	Channel 4 GCV signal out of range - ADP read cal, lo sp	ADP / DDP
22	Channel 6 GCV signal out of range - ADP read cal, lo sp	
23	Channel 0 GCV signal out of range - ADP read cal, lo sp	
24	Channel 1 GCV signal out of range - ADP read cal, lo sp	
25	Channel 2 GCV signal out of range - ADP read cal, lo sp	
26	Channel P GCV signal out of range - ADP read cal, lo sp	
27	Channel 3 GCV signal out of range - ADP read cal, lo sp	
28	Channel 7 GCV signal out of range - ADP read cal, lo sp	
29	Channel 5 GCV signal out of range - ADP read cal, lo sp	
31	Dead track found during ADP read cal - hi sp	
32	Channel 4 gain signal out of range - ADP read cal, hi sp	ADP / DDP
33	Channel 6 gain signal out of range - ADP read cal, hi sp	
34	Channel 0 gain signal out of range - ADP read cal, hi sp	
35	Channel 1 gain signal out of range - ADP read cal, hi sp	
36	Channel 2 gain signal out of range - ADP read cal, hi sp	
37	Channel P gain signal out of range - ADP read cal, hi sp	
38	Channel 3 gain signal out of range - ADP read cal, hi sp	
39	Channel 7 gain signal out of range - ADP read cal, hi sp	
40	Channel 5 gain signal out of range - ADP read cal, hi sp	
41	Channel 4 GCV signal out of range - ADP read cal, hi sp	ADP / DDP
42	Channel 6 GCV signal out of range - ADP read cal, hi sp	
43	Channel 0 GCV signal out of range - ADP read cal, hi sp	
44	Channel 1 GCV signal out of range - ADP read cal, hi sp	
45	Channel 2 GCV signal out of range - ADP read cal, hi sp	
46	Channel P GCV signal out of range - ADP read cal, hi sp	
47	Channel 3 GCV signal out of range - ADP read cal, hi sp	
48	Channel 7 GCV signal out of range - ADP read cal, hi sp	
49	Channel 5 GCV signal out of range - ADP read cal, hi sp	

50	Poor tape (too many high-error areas)	tape
51	Skew out of range	TPA
52	ADP monostables uncalibrated (cal. otherwise complete)	ADP / DC
53	Read cal. out of limits	ADP / TPA / DC
54	Read cal. out of range - pre-amp @ maximum gain	ADP / TPA / DC
55	Read cal. out of range - pre-amp @ minimum gain	ADP / TPA / DC
56	not used	
57	Range error when calibrating pre-amp	ADP / TPA / DC
89	No write ring	Op / SC / DC
90	No write current	ADP / DC / PS

Variations — The byte at address 812A in the NVR may be reset during program 81 to omit parts of the calibration procedure.

From Data Control firmware 4C, location 812A has been set to the value 08, the bit allocations are:

b7	b6	b5	b4	b3	b2	b1	b0
GCR	DPE	PE	NRZ	preamp	write channels	read gains	- -

In both instances a 1 causes that part to be inhibited.

Note — Address 812A should be reset to its original value (40 or 08) before the 9914V is returned to online use (the stated values are not power-on defaults).

Program 78 **Manual Write Set-up**

Note — The service key is required for program 78.

Description — Allows the service engineer to vary the data channel parameters while writing data to tape continuously; an oscilloscope is required.

Error Codes

89	No write ring	Op / SC / DC
90	No write current	ADP / DC / PS

Program 79 **Manual Read Set-up**

Note — The service key is required for program 79.

Description — Allows the service engineer to vary the data channel parameters while reading data from a continuously written tape; an oscilloscope is required. The AGC is switched on/off at 1 kHz.

Program 80 **Set Default NVR Values**

Note — The service key is required for program 80.

Description — Allows the service engineer to replace all the current bytes in the non-volatile RAM area by go/no-go values which are held in EPROM. This should only be done after a catastrophic failure, because the 9914V is thereby completely re-initialised with go/no-go NVR values (including the read/write parameters and the configuration option bytes). The user should therefore be well aware that all current values in the NVR are destroyed by program 80, and that suitable values must afterwards be re-created by running program 74 before re-entering the configuration bytes (including the SCSI settings).

When program 80 is initiated, the service key code must be entered a second time before NVR value replacement proceeds.

Program 81 **Examine/Modify NVR Values**

Note — The service key is required for program 81.

Description — Allows the service engineer to display and alter any of the bytes in the non-volatile RAM area. The bytes are displayed in hexadecimal notation.

Program 82 **NRZ Read Skew Margins Check**

Notes — The service key is required for program 82.
A pre-recorded skew tape is required.

Description — The skew tape is run forward while reading data with a reduced Character Assembly Time (CAT). Any non ' all 1s ' data detected causes the display count to increment. The NVR skew delays are not changed.
When EOT is detected, the tape is returned to BOT and the test passes.

Caution — If the program is stopped before EOT is reached, the skew tape should be returned to BOT at low speed (as recommended by the tape manufacturer) using diagnostic program 65.

Error codes — *None: if NRZ is not selected, ' Dens Err ' appears on the display.*

Program 83 **NRZ Write Skew Margins Check**

Note — The service key is required for program 83.

Description — After switching to NRZ density, the tape is run forward writing ' all 1s ' data using a reduced Character Assembly Time. Any non ' all 1s ' data detected causes the display count to increment. The NVR skew delays are not changed.
The test passes when EOT is detected.
If NRZ is not selected, ' Dens Err ' appears on the display.

Error Codes

89	No write ring	Op / SC / DC
90	No head current	ADP / DC / PS

Program 84 **Write-Read Cross-Feed**

Note — The service key is required for program 84.

Description — Writes an ' all 1s ' data without moving the tape, to enable the service engineer to measure the cross-feed between the write and read heads.

Error Codes

89	No write ring	Op / SC / DC
90	No write current	ADP / DC / PS

Program 93 **Examine Loop Count**

Description — Displays the loop count (described under program 18) in decimal.

Error Codes — *None*

Program 94 **Clear Loop Counter**

Description — Clears the loop counter (described under program 18).

Error Codes — *None*

Program 95 **Enter Service Key**

Description — The basic function is to allow the user to enter the service key combination, which (if correct) causes PASS to be displayed.
Programs which require the service key may then be run, until the power is turned off.

Interlock — The interlock override is implemented by running program 95, allowing operation with the tape path cover open. When the turnbuckle nearest the front panel is next secured, interlock override reverts to inhibiting tape motion while the tape path cover is open.

Revisions — The diagnostic code revision and compatibility number may examined (without the service key) by depressing ' run/stop ', ' DIAG ', and then ' enter ', strictly in that order.
The code revisions are displayed as a message of the type:
C/R 0302 SCSI 0301,
the two leading numbers (in each group of four) are compatibility numbers (in this example 03), and must be identical; while the second two numbers are revisions at that compatibility level.

Error Codes — *None*

Program 97 **Modify Operator Stack**

Note — Program 97 should not be entered onto the stack.

Description — Allows the operator to step through the existing operator stack by pressing the ' enter ' button. Substituting a program number (using the ' tens '/' units ' buttons) may be carried out prior to pressing the ' enter ' button. A program in the stack may be effectively deleted by changing it to program 00.

Error Codes — *None*

Program 98 **Clear Operator Stack**

Description Program 98 clears the current program stack.

Error Codes *None*

Program 99 **Run Operator Stack**

Description When called, the current program stack is run sequentially, starting at the first program entered.

If program 99 is entered onto the program stack it causes the stack to loop back to the first entry and repeat.

Error Codes *See details of individual programs entered onto the stack.*

6. The Status Bytes

As an extension of the status signals at the Pertec interface, a block of 17 8-bit status bytes (F1 to F17) is available . A condensed status byte block (C1 to C9) is also available.

These bytes can be

- examined at the operator's panel (using diagnostic program 68), *or*
- accessed via the unbuffered Pertec or PCI interfaces (using either the Access Full Status Bytes or the Access Condensed Status Bytes command), *or*
- accessed via the SCSI interfaces (using the Receive Diagnostic Results command).

The following table lists the actions which initialise each block, while the following sections list the functions of the constituent bits The status bytes are tabulated at the end of each descriptive set.

Status Byte Initialisation

The status bytes are cleared, or set, under the circumstances described below.

Power-up	Clears most bytes, except F15, F16 (& C9) which are set according to the configuration bytes.
Tape Motion	Acceptance of a tape motion interface command clears bytes F5 to F12.
Diagnostic Program 69	Clears most bytes, except F15 (& C9) which are set according to the currently selected density.

6.1 Status Byte F1

All on-line write hard and correctable errors are logged in status byte F1.
Bit 0 is the least significant bit.

6.2 Status Byte F2

All on-line hard read errors are counted in status byte F2. Bit 0 is the least significant bit.

6.3 Status Byte F3

When a diagnostic program is called across the interface, its number (in bits 0 to 4, bit 0 being the least significant bit) is logged in status byte F3. If Failure Skip (diagnostic program 17) is not set, F3 therefore reflects the failed program number (and F4 contains the failure code).

When a diagnostic program is called from the control panel, its number (in bits 0 to 6) is always logged in status byte F3.

6.4 Status Byte F4

When an on-line diagnostic test fails, status byte F4 contains the error code associated with status byte F3 (zero denotes no error).

When the 9914V is off-line, status byte F4 contains the error count when Failure Skip (invoked by diagnostic program 17) is active. In either case, bit 0 is the least significant bit.

6.5 Status Byte F5

When on-line, status byte F5 contains track-in-error information which may be useful when a single-track error has been reported. A single-track error with no bit set in status byte F4 indicates a parity track error. Bit 7 corresponds to track 7, through to bit 0 corresponding to track 0.

6.6 Status Byte F6

Status byte F6 should be examined after a hard error has been reported.

The interpretation of each bit depends on the current density setting.

a) Status byte F6, definitions for GCR and PE densities:

Bit	Name	Meaning
7	NRZ	Status byte F6 has GCR/PE meaning when this bit is zero; ie NRZ density is not active.
6	IDENT FOUND	Identification found. This bit is set if a properly formatted GCR/PE ident burst or ARA burst or ARA ident is found during any read forward operation which expects a properly formatted data block.
5	CER	Corrected error status; this does not set the Pertec interface IHER line, error correction has taken place.
4	VPE	Vertical parity error with no single-track dropout.
3	SKEW	Greater than 8 bits of track-to-track data skew detected.
2	MTE	Uncorrectable multiple track dropout. Note: GCR encoding enables the correction of two-track errors.
1	FALSE POSTAMBLE	False postamble detected.
0	FALSE PREAMBLE	False preamble detected. In PE densities this also sets the False Postamble bit.

b) **Status byte F6, definitions for NRZ density:**

Bit	Name	Meaning
7	NRZ	Status byte F6 has NRZ meaning when this bit is set; ie NRZ density is active.
6 - 3	-	-
2	LRCE	Longitudinal redundancy check error.
1	CRCE	Cyclic redundancy check error.
0	VPE	Vertical parity error.

6.7 Status Byte F7

Status byte F7 contains supplementary error and status information which should be read in conjunction with status byte F6.

Bit	Name	Meaning
7	REJECT	The 9914V was unable to accept a command, further detail may be gained by referring to status byte F9 (note: accessing only the condensed status byte block will not reveal the cause).
6	INCOMPLETE	The 9914V accepted a command, but was unable to complete in the manner expected; the reasons are flagged in status byte F8. *Note: following this error, the tape may be positioned incorrectly for the next operation.*
5	EOT LIMIT	Set when the tape has passed well beyond the EOT reflective marker in the forward direction. Further forward tape motion is inhibited (by a configuration option) because of the possibility of running to the physical end of tape. The user should ensure that data is not lost when tape moves beyond EOT limit.
4	EARLY EOT	Sets when the tape is approaching the EOT tab, remains set while the tape is beyond EOT. Early EOT is used by the SCSI or PCI to control the data buffer.
3	DENSITY ERROR	An error has been found in the density ident area, the reason is expanded in status byte F10.
2	EOT	Set when the tape has passed the EOT reflective marker in the forward direction, clears when the EOT marker is detected in the reverse direction.
1	FILE MARK LAST BLOCK	The last block traversed had file mark status.
0	INTERFACE WRT PARITY	Interface write parity; sets if the External Write Parity option is set, and a parity error is detected on the interface Write Data lines (IWD0 - IWD7).

6.8 Status Byte F8

Status byte F8 expands the INCOMPLETE bit of status byte F7.

Bit	Name	Meaning
7	RWFAIL	No read-after-write data was detected during a write operation. The operation was terminated and the INCOMPLETE bit set.
6	RRD BOT	BOT was detected prior to, or during, a Read Reverse or Space Reverse operation.
5	FSR BOT	BOT was detected prior to the first file mark during a File Search Reverse operation.
4	BLANK TAPE	More than 30 ft (9 m) of tape were traversed without encountering any data during a forward Read, File Search, or Space operation.
3	IFEN	The interface IFEN signal was activated during an operation.
2	DATA GLITCH NO BLOCK	Data activity was found, but did not conform to any expected tape format rules.
1	GAP IN R-A-W DATA	An unexpected gap was found in the Read-After-Write data.
0	NOT WRITING	No current was sensed in the erase head, during a Write or Erase operation.

6.9 Status Byte F9

Status byte F9 expands the REJECT bit of status byte F7.

Bit	Name	Meaning
7 - 5	-	-
4	EOTLIM CMD	A forward command was received while the tape was beyond the EOT limit.
3	INV CMD	The command code was not recognised (ie an illegal combination).
2	REV @ BOT	A reverse motion command (other than rewind) was received at BOT.
1	WRT FPTD	A write command was received, but the tape is not write enabled.
0	DENS /BOT	A density change was attempted, but the tape was not at BOT.

6.10 Status Byte F10

Status byte F10 expands the DENSITY ERROR bit of status byte F7.

Bit	Name	Meaning
7	NO IDENT	(GCR/PE only) No ident burst was detected during a read from BOT by the time the BOT tab had traversed the head.
6	NO ARA	(GCR only) No ARA burst was detected during a read from BOT, but the ident burst was detected.
5	NO ARA ID	(GCR only) No ARA ident was detected during a read from BOT, but the ident and ARA bursts were detected.
4	-	-
3	IDENT WRT	(GCR/PE only) It was not possible to write a continuous identifier to tape during a write operation from BOT.
2	ARA WRT	(GCR only) It was not possible to write a correctly formatted ARA burst without error during a write operation from BOT.
1	ARA ID WRT	(GCR only) It was not possible to write a correctly formatted ARA ident without error during a write operation from BOT.
0	CONFIG	Configuration error; sets if a Set Density command is received and an error is detected while attempting to configure to the new density.

6.11 Status Byte F11

Status byte F11 expands some GCR errors.

Bit	Name	Meaning
7	ACRC	Error in the auxiliary CRC character.
6	CRC	Error in the CRC character.
5	UNCER	Uncorrectable error.
4	2-TRACK ERROR	Two-track error correction performed.
3	1-TRACK ERROR	Single-track error correction performed.
2	CRC GROUP ERROR	One or more of the CRC characters in the CRC group is incorrect. If the CRC bit is not set, then the first character of the group is correct and therefore the data is almost certainly correct.
1	RCHAR ERROR	Residual character error.
0	PCHAR ERROR	Padding character error.

6.12 Status Byte F12

Status byte F12 contains the detail of some GCR errors.

Bit	Name	Meaning
7 - 4	-	-
3	FORMAT ERROR 1	MARK 1 was not found at the start of the data groups.
2	FORMAT ERROR 2	MARK 2 was not found when expected.
1	NOT SYNCH	At least one track was not synchronised.
0	-	-

6.13 Status Byte F13

This byte refers to GCR status, it is reserved for future use.

6.14 Status Byte F14

Bit	Name	Meaning
7 & 6	DENSITY SOURCE	Encoded with bit 6 to denote the derivation of the density setting. *b7* *b6* *Meaning* 0 0 Density recognised during analyse. 0 1 Default density, analyse detected blank tape. 1 0 Default density, analyse detected unrecognisable format.
5 - 2	-	-
1	DENSITY MISMATCH	Set if a read command follows a Set Density command which altered the density concluded by the analyse function at load time.
0	-	-

6.15 Status Byte F15

Bit	Name	Meaning
7 & 6	DENSITY SELECTED	Encoded to denote which density is currently selected: *b7* *b6* *Density* 0 0 1600 bpi PE 0 1 3200 bpi DPE 1 0 800 bpi NRZ 1 1 6250 bpi GCR
5 & 4	-	-
3	GCR	6250 bpi GCR available.
2	NRZ	800 bpi NRZ available.
1	3200	3200 bpi DPE available.
0	1600	1600 bpi PE available.

6.16 Status Byte F16

Bit	Name	Meaning
7 - 4	MODEL	Encoded to denote the base model type:

b7	*b6*	*b5*	*b4*	
0	0	0	0	9800
0	0	0	1	9903
0	0	1	0	8900
0	0	1	1	8924
0	1	0	0	*reserved*
0	1	0	1	9914

3 & 2	-	-
1	BUFFER FITTED	The embedded SCSI or PCI interface is fitted.
0	-	-

6.17 Status Byte F17

This byte is reserved for future use.

This page has no technical content.
The full status byte table begins on page 12.

	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
F1 WRITE ERROR LOG	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
F2 READ ERROR LOG	2^7	2^6	2^5	2^4	2^3	2^2	2^1/	2^0
F3 DIAG PROG No	-	2^6	2^5	2^4	2^3	2^2	2^1	2^0
F4 DIAG ERR CODE	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
F5 TRACK IN ERR (PE)	TIE 7	TIE 6	TIE 5	TIE 4	TIE 3	TIE 2	TIE 1	TIE 0
F6 H ERR (PE/GCR)	0 (always)	IDENT FOUND	CER	VPE	SKEW	MTE	FALSE POSTAMBLE	FALSE PREAMBLE
F6 HARD ERR (NRZ)	1 (always)	-	-	-	-	LRCE	CRCE	VPE
F7 SUPP TO F6	REJECT	INCOMPLETE	EOT LIMIT	EARLY EOT	DENSITY ERROR	EOT	FILE MARK LAST BLOCK	INTERFACE WRT PARITY
F8	RWFAIL	RRD BOT	FSR BOT	BLANK TAPE	IFEN	DATA GLITCH NO BLOCK	GAP IN R-A-W DATA	NOT WRITING
F9	-	-	-	EOTLIM CMD	INV CMD	REV @ BOT	WRT FPTD	DENS /BOT

TABLE 6.1(a) STATUS BYTES F1 TO F9

	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
F10 EXP OF DENSITY	NO IDENT	NO ARA	NO ARA ID	-	IDENT WRT	ARA WRT	ARA ID WRT	CONFIG
F11 GCR STATUS 1	ACRC	CRC	UNCER	2-TRACK ERROR	1-TRACK ERROR	CRC GROUP ERROR	RCHAR ERROR	PCHAR ERROR
F12 GCR STATUS 2	-	-	-	-	FORMAT ERROR 1	FORMAT ERROR 2	NOT SYNCH	-
F13 *reserved*	-	-	-	-	-	-	-	-
F14	DENSITY SOURCE (see below)		-	-	-	-	DENSITY MISMATCH	-
F15 IDENT BYTE 1	DENSITY SELECTED (see below)		-	-	6250 bpi	800 bpi	3200 bpi	1600 bpi
					(densities available)			
F16 IDENT BYTE 2	BASE MODEL TYPE (see Section 6.16)				-	-	SCSI (or PCI) FITTED	*reserved*
F17 *reserved*	-	-	-	-	-	-	-	-

Byte F14 encoding:

bit 7	bit 6	
0	0	Analyse found known density
0	1	Default density, blank tape
1	0	Default density, alien format
1	1	No assigned meaning

Byte F15 encoding:

bit 7	bit 6	
0	0	1600 bpi PE
0	1	3200 bpi PE
1	0	800 bpi NRZ
1	1	6250 bpi GCR

TABLE 6.1(b) STATUS BYTES F10 TO F17

6.18 Condensed Status Bytes

The 9914V status bytes C1 to C9 are near-equivalents to sense bytes A to I from the older *M4 Data* 8900/9800/9903/9905 series of tape units.

Condensed status bytes C1 to C9 are almost identical in content and function to analogous full status bytes, but C7, C8 and C9 are notable exceptions which are defined next and tabulated at the end of the section.

Condensed Status Byte	Full Status Byte	Old Status Byte
C1	F1	A
C2	F2	B
C3	F3	C
C4	F4	D
C5	F5	E
C6	F6	F
C7	(F7)	G
C8	*None*	-
C9	(F15)	I

6.18.1 Status Byte C7

Bit	Name	Meaning
7	RWFAIL	As status byte F8, bit 7.
6	INCOMPLETE	As status byte F7, bit 6.
5	REJECT	As status byte F7, bit 7.
4	BLANK TAPE	As status byte F8, bit 4.
3	DENSITY ERROR	As status byte F7, bit 3.
2	EOT	As status byte F7, bit 2.
1	FILE MARK LAST BLOCK	As status byte F7, bit 1.
0	NOT WRITING	As status byte F8, bit 0.

6.18.2 Status Byte C8

Bit	Name	Meaning
7 & 6	DENSITY SOURCE	As status byte F14, bits 7 & 6.
5 - 2	-	-
1	DENSITY MISMATCH	As status byte F14, bits 7 & 6.
0	INTERFACE WRT PARITY	As status byte F7, bit 0.

6.18.3 Status Byte C9

Bit	Name	Meaning
7 & 6	DENSITY SELECTED	As status byte F15, bits 7 and 6.
5	EOT LIMIT	As status byte F7, bit 5.
4	-	As status byte F7, bit 4.
3 - 0	DENSITIES AVAILABLE	As status byte F15, bits 3 to 0.

	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
C1 WRITE ERR LOG	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
C2 READ ERR LOG	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
C3 DIAG PROG No	-	2^6	2^5	2^4	2^3	2^2	2^1	2^0
C4 DIAG ERR CODE	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
C5 TRACK IN ERR	TIE 7	TIE 6	TIE 5	TIE 4	TIE 3	TIE 2	TIE 1	TIE 0
C6 H ERR (PE/GCR)	0 (always)	IDENT FOUND	CER	VPE	SKEW	MTE	FALSE POSTAMBLE	FALSE PREAMBLE
C6 HARD ERR (NRZ)	1 (always)	-	-	-	-	LRCE	CRCE	VPE
C7 SUPP TO C6	RWFAIL	INCOMPLETE	REJECT TAPE	BLANK ERROR	DENSITY	EOT	FILE MARK LAST BLOCK	NOT WRITING
C8 EXTRA STATUS	DENSITY SOURCE (see byte F14)		-	DATA GLITCH NO BLOCK	GAP IN R-A-W DATA	-	DENSITY MISMATCH	INTERFACE WRT PARITY
C9 DENSITIES	DENSITY SELECTED (see byte F15)		EOT LIMIT	EARLY EOT	6250 bpi	800 bpi	3200 bpi	1600 bpi
					(densities available)			

TABLE 6.2 STATUS BYTES C1 TO C9

7. Sub-Assemblies

This Section provides sufficient information to familiarise a service engineer with the 9914V's sub-assemblies. For ease of reference, each sub-assembly is divided up under the following titles:

- function;
- location;
- checkout;
- setting/re-calibration;
- removal and replacement.

Fault-finding procedures are provided in Section 3.
Functional descriptions are provided in Section 2.
Diagnostic programs are described provided in Section 5.

7.1 Service Equipment and Procedures

7.1.1 General Notes

a) Most screws used in the 9914V are UNC.

b) For the removal of some sub-assemblies it is necessary to cut the cable tie wrap. A fresh tie wrap must be fitted after replacement has been effected.

c) For the removal of some sub-assemblies it is necessary to disconnect earth bonding straps. These may appear to perform no electrical function, but they must be re-connected in order to maintain good protection against electro-static discharge.

d) Sub-assembly locations are illustrated in Section 8.

7.1.2 ESD Precautions

9914V sub-assemblies contain electronic components which use Metal Oxide Silicon (MOS) technology. Such components are more sensitive to Electro Static Discharge (ESD) than the older bipolar technology components, and should be treated with special precautions to avoid damage and subsequent circuit failure.

Servicing personnel should be familiar with the general principles of ESD precautions, which are stated next.

a) Anyone handling ESD sensitive components should avoid wearing Nylon clothing (cotton is preferred), and stand on an anti-static mat.

b) Anyone removing, handling, re-working, or replacing ESD sensitive sub-assemblies should be grounded by a conductive wrist strap.

c) Circuit boards should only be handled by their edges, be stored in anti-static bags, and not be allowed to slide over any surface.

d) Freshly photocopied documents may have considerable static build-up, therefore they should not be introduced into board handling areas.

7.1.3 Electrical Servicing Equipment

a) Moving coil multimeter: dc voltages from 100 mV fsd to 50 V fsd,
dc current from 100 mA to 10 A,
ac voltages from 5 V to 250 V.

b) Dual trace oscilloscope: bandwidth not less than dc to 50 MHz,
time base 500 ns/cm - 0.1 s/cm,
X10 and X1 probes.

c) Digital frequency counter: up to 1 MHz.

7.1.3.2 Mechanical Servicing Equipment

a) Spring Balance (0-0.5 N, 0-1 lb).

b) Camera Lens Cleaner (rubber bulb puffer).

c) Sets of Allen Keys: Imperial 1/16" to 1/4" AF, in 1/32" steps,
preferably with a screwdriver handle,
3 mm for Supply Hub height adjustment.

d) Screwdrivers: flat small; flat medium; Pozidriv 0, 1 and 2 points

e) Potentiometer Adjustment Tool.

f) Tape Path Cleaning Material: TexPads (or equivalent non-CFC, IPA-moistened pads)

g) Take-up Hub Height Setting Tool, T6007.

7.1.4 Tapes

a) Work Tape. A good quality tape known to have no data drop-outs. The tape should not contain data of any consequence so as to be available for write checks/tests. The supply reel must be fitted with a Write Enable ring.

b) Master Alignment Reference Tape: IBM Reference 432640 (600 ft),
(Skew Tape) available from Pericomp.

c) Master Amplitude Reference Tape: IBM Reference 432152,
available from Graham Magnetics.

d) Length of tape (approximately 300 mm (12 in)), with loops, which will pass over rollers, formed at each end using adhesive tape.

e) A special tape, fitted with an EOT marker positioned 5 cm (2 in) from a BOT marker (NOT back-coated tape).

f) A good quality tape, free from edge damage and known to track correctly, to be used exclusively for tape path checks/settings (see Section 7.8).

g) Reel of adhesive reflective tape markers 6.5 x 25.4 mm (0.25" x 1")
(eg as manufactured by 3M under the ' Scotch ' brand name).

7.1.5 Settings After FRU Replacement

If an FRU is replaced, restoration of full operational performance may be conditional on checks or adjustments, as tabulated next.

FRU replaced	Checkout	Adjustments
Servo Control	Diagnostic program 04	*None*
Data Control	Link options (Section 3) NVR values (program 80) Re-calibrate (program 74) Configuration options (§ 3) Power cycle	*None*
Analogue Data Paths	Re-calibrate (§ 3)	
Digital Data Paths	*None*	*None*
SCSI board	Switch/NVR options	*None*
PCI board	Switch/NVR options	*None*
Mains Transformer	Input setting	*None*
Power Supply	Outputs	*None*
Switch facia pcb	*None*	*None*
Tape Path assembly	Re-calibrate (§ 3)	*None*

TABLE 7.1.5 SETTINGS AFTER FRU REPLACEMENT

7.2 Mains Transformer and Switch

The mains transformer is only fitted to ac-powered 9914Vs; the same mains switch is common to ac- and DC-powered units.

7.2.1 Function

The mains transformer incorporates tapped input windings so that the specified range of input ac supply voltages can be accommodated.

Secondary windings match the ac Power Supply board's input requirements, so it can to generate various dc voltages for internal use.

AC-powered 9914Vs have a single-pole switch connected into the mains supply at the mains voltage selector; when set ' off ', it disconnects the live line from the mains transformer.

DC-powered 9914Vs have a single-pole switch connected into the negative line, to isolate it from the DC PSU board.

7.2.2 Location

The mains transformer is attached to the back of the mounting tray, near the top and on the right hand side.

The mains switch is located on the upper left of the mounting frame, and is marked with ' 0 ' & ' 1 ' designations.

7.2.3 Checkout

If there is no activity on the operator's display, and no sound of the cooling fan running, with the 9914V switched ' on ', the dc outputs from the Power Supply may be absent, suggesting that the mains fuse (FS1) at the rear of the 9914V may have blown or the mains supply has failed.

The transformer low-voltage outputs appear at a 10-way socket (P1) on the Power Supply pcb at the back of the mounting tray; these voltages at nominal mains input are tabulated in Table 7.2.3, no tolerances are given because these outputs are likely to be either present or absent.

In the case of dc-powered 9914Vs, similar voltages are generated by the DC PSU board and appear at P1.

Between pins	ac voltage
4 and 5	9.2
4 and 6	9.2
7 and 8	36
2 and 3	15
1 and 3	15

TABLE 7.2.3 MAINS TRANSFORMER VOLTAGES TO PSU

7.2.4 Setting

The only setting associated with the mains transformer is the input voltage selection.

Ensure that the input voltage selection setting is compatible with the site supply voltage. Four ac settings are possible, 100/120 V or 220/240 V, the input frequency may be between 48 and 62 Hz.

Note: when the 9914V is to be connected to a 110 V supply, use the 100 V input setting.

To change the ac voltage selection:

i) **Set power off**, unplug the mains lead at the rear of the 9914V.

ii) Insert a flat-bladed (5 mm) screwdriver where illustrated in Figure 7.2.4 and hinge the panel open.

iii) Withdraw the barrel-shaped voltage selector mechanism and re-insert with the new voltage facing outwards, do not attempt to rotate the selector barrel in-situ.

iv) Withdraw the fuse holder and install the new fuse, rated as follows:

for 100/120 V settings, FS1 is a 4 A slow-blow fuse (eg Littelfuse type 313);

for 220/240 V settings, FS1 is a 2 A slow-blow fuse (eg Littelfuse type 313).

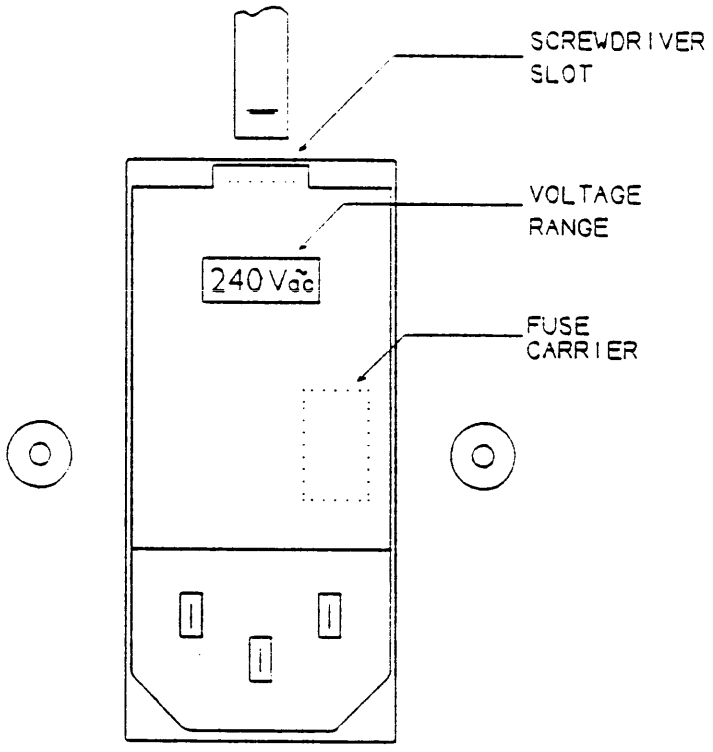

FIGURE 7.2.4 VOLTAGE SELECTION

The dc voltage selection

The dc input voltage specification allows for a range from 40 to 57 volts, there is no provision for setting a different range.

7.2.4.1 Wiring the AC Supply Plug

Warning - the 9914V must be earthed

The moulded IEC socket on the supply lead fits a chassis-mounted plug located at the rear of the 9914V. When the other end of the supply lead is unterminated, a suitable plug must be attached.

As the colours of the cores in the 9914V mains lead may not correspond with the coloured markings identifying the terminals in your plug, the following sections relate core colour to pin identification.

(a) Outside the USA

Note: 2-pin plugs are not suitable. The earth wire must be ' grounded ' for safety reasons.

The following translations of pin functions and colours is given.

English	Francais	Deutsch
LIVE (brown)	LIGNE (Brun)	POSITIV (Braun)
NEUTRAL (Blue)	NEUTRE (Bleu)	NEGATIV (Blau)
EARTH (Green/Yellow)	TERRE (Vert/Jaune)	ERDE (Gelb/Grün)

Connect the cores as tabulated in Table 7.2.4.1.

Core which is coloured:	Must be connected to the terminal in the plug which is:
green and yellow	marked with the letter E, *or* coloured green and yellow, *or* marked with the earth symbol (⏚)
blue	marked with the letter N, *or* coloured black
brown	marked with the letter L, *or* coloured red

Table 7.2.4.1 PLUG WIRING - OUTSIDE THE USA

iii) Release the deck captive screw and, with the loading door closed, lower the deck casting to the horizontal position.

iv) Remove the cover over the dc PSU board.

v) Disconnect the earth connections on the cover; disconnect the chassis earth connection.

vi) Disconnect the lead from the DC PSU to the power input switch, at the switch end.

vii) Disconnect the flying lead from the DC PSU to the AC PSU, P1 at the AC PSU end.

viii) Release the 7 screws which secure the pcb to the chassis (early dc PSUs had 6 screws).

ix) Disconnect the earth lead, at the pcb end.

x) Lift off the DC PSU board.

xi) If the AC PSU board is also to be removed, refer the AC-Powered Machines paragraphs immediately previous.

When replacing the DC PSU board, reverse the above removal procedure.

Upon completion, power up and check that the display does not indicates a fault condition (Section 3 details the possible display indications).

7.4 Servo Control Board

7.4.1 Function

The Servo Control board controls all tape motion and drives the operator's panel display, a circuit description appears in Section 2.

7.4.2 Location

The Servo Control board is mounted on supports at the back of the enclosure.

7.4.3 Checkout

A reasonable checkout of the Servo Control board involves loading a scratch tape to BOT and running diagnostic program 04; this procedure assumes that other sub-assemblies (obviously including the operator panel) are fully functional; but the Data Control, Analogue Data Paths, Digital Data Paths, and pre-amplifier boards need not be installed or fully functional.

Diagnostic program 04 is an automatic checkout of the servo performance, to pre-determined limits.

If the Servo Control board has not previously been installed in this machine, run diagnostic program 04 and, if it fails, run diagnostic program 49. Diagnostic program 49 is a series of input stimuli which exercise the motor drive circuits while an oscilloscope is used to examine the circuit response.

7.4.4 Setting

The Servo Control performance may be checked by running diagnostic program 49, there are no adjustments in the servo control loops.

7.4.5 Removal and Replacement

Note: the Servo Control board is ESD sensitive, see Section 7.1.2 for handling precautions.

i) **Set power off** (depending on the supply type and connection method) either:

- with an ac supply, unplug the mains lead at the rear of the 9914V, *or*
- with a spade-connected dc supply, unplug the connectors at the rear of the 9914V, *or*
- with a plug-and-socket dc supply, unplug the 3-pin connector at the rear of the 9914V.

ii) Release the deck captive screw and, with the loading door closed, lower the deck casting to the horizontal position.

iii) Release connectors as follows:
30-way (P4) to the motherboard;
5-way (P3) to the cooling fan;
5-way (P1) to the TU motor;
5-way (P2) to the SU motor;
7-way (P8) to the AC Power Supply board;
14-way (P7) to the AC Power Supply board;
38-way (P5) to the In-Chute sensor board;
50-way (P6) to the operator panel.

iv) Release the Servo Control board by lifting it off the 4 locating supports which secure it to the enclosure.

When replacing the Servo Control board, reverse the above removal procedure until all the connectors are in place, then power up and check that the display does not indicate a fault condition (Section 3 details the possible display indications).

7.5 Operator's Panel

The buttons and indicators are laid out as shown in Figure 7.5.1.

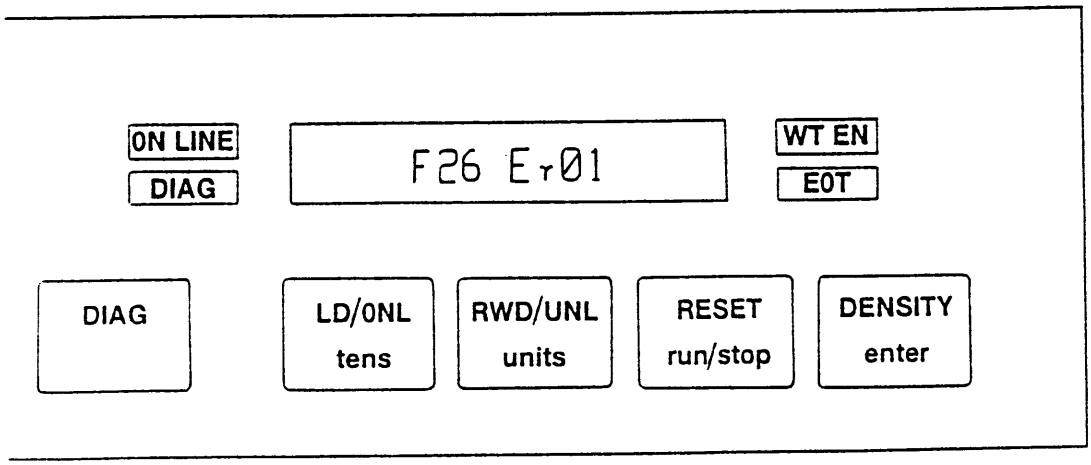

FIGURE 7.5.1 OPERATOR PANEL BUTTONS AND INDICATORS

7.5.1 Function

The operator's panel includes a switch membrane, mounted on the lower front face of the 9914V, and a set of displays. The switch membrane includes five switches (usually referred to as ' buttons ') used by the operator to control the 9914V. The legends consist of the four back-lit indicators which show permanent status to the operator. The 8-character display (which shows temporary status messages to the operator) and the legend light sources are mounted on the switch fascia pcb, the control and power for which is derived from the Servo Control board.

7.5.2 Location

The switch fascia pcb is mounted behind the operator's panel, low on the right hand side (as illustrated in Section 8). It is connected to the Servo Control board by a 50-way ribbon cable, fixed at the operator panel end and plug-in at the Servo Control board end.

7.5.3 Checkout

In order for the operator's panel to function it must receive +5V from the Servo Control board, if the 8-character display is blank with power switched on, the Power Supply may be faulty, refer to Section 7.3.

The 8-character display and the back-lit legends may be checked by running diagnostic program 72, which illuminates all parts of the display panel in turn.

The control buttons can be checked out by invoking their functions and verifying the response (with a known good Servo Control board installed) a recommended procedure is to follow Table 7.5.3 in sequence.

Function checked	Action	Correct response
Power-on sequence, DIAG legend	Switch on, wait for a few seconds	DIAG legend flashes, then display shows ' TESTING '
	Wait for ' LOCATING '	
RESET button	Press RESET twice	Display shows ' OK '
DIAG button	Press DIAG button	DIAG legend illuminates (display shows ' Test 00 ')
' tens ' & ' units ' buttons	Momentarily depress each button, until ' Test 72 ' is displayed	Display increments, once per depression
' run/stop ' button & 8-character display	Press ' run/stop ' once	Display continuously scrolls the ' quick brown fox ' message, and illuminates each legend
' enter ' button	Press ' enter ' once	Display shows ' Enter 72 '
Suspend diagnostic	Press ' run/stop ' once	Display reverts to ' Test 72 '
Exit diagnostic mode	Press DIAG once	Display reverts to OK

See notes overleaf . . .

TABLE 7.5.3 OPERATOR PANEL BUTTONS CHECKOUT

Notes to Table 7.5.3:

i) dual-function buttons are only checked in one function, because interpretation of the input takes place at the Servo Control board;

ii) functions shown in italics are not specifically operator panel functions, but are a necessary step towards some test pre-condition;

iii) the Servo Control to operator panel signal paths are listed in Section 2;

iv) more detailed instructions for operating diagnostic programs is set out in the 9914V User/Diagnostic Manual.

7.5.4 Setting

There are no electrical or mechanical settings associated with the operator's panel or the signals which drive it.

7.5.5 Removal and Replacement

Note: the operator's panel, and the switch fascia pcb, are both ESD sensitive; see Section 7.1.2 for handling precautions.

i) **Set power off** (depending on the supply type and connection method) either:

- with an ac supply, unplug the mains lead at the rear of the 9914V, *or*
- with a spade-connected dc supply, unplug the connectors at the rear of the 9914V, *or*
- with a plug-and-socket dc supply, unplug the 3-pin connector at the rear of the 9914V.

ii) Release the deck captive screw and, with the loading door closed, lower the deck casting to its horizontal position.

iii) Disconnect the 50-way cable at P6 on the Servo Control board, free the cable from it's securing clips back to the operator's panel.

iv) Remove the interface tray, as described in Section 7.15 (or 7.17).

v) Remove the switch fascia cable from its retaining clips; lower the card cage.

vi) Raise the deck casting until fully closed, ensuring no cables or connectors are trapped.

vii) Open the tape loading door.

Warning: do not open the deck casting while the loading door is open.

viii) Remove the 5 screws (accessed from below the 9914V) which secure a locating piece to the 9914V's mounting frame.

ix) Remove the 2 screws which secure the operator's panel to the 9914V frame.

x) Carefully ease out the operator's panel. Note that the control buttons and switch fascia pcb are parts of the operator's panel.

xi) Disconnect the earth strap.

xii) If required, separate the switch fascia pcb from the operator's panel.

Replacement is essentially the reverse the removal procedure.

7.6 Supply Hub

7.6.1 Function

The supply hub incorporates three toggles which clamp the reel square to the axis of rotation. The hub body contains the mechanism to achieve this by ensuring that all three toggles are driven at the same time by pressure on the reel from the operator's fingers, even if the pressure is not evenly distributed or not along the axis of rotation.

7.6.2 Location

The supply hub is clamped onto the SU motor shaft, it is visible from the front and is the upper of the two hubs.

7.6.3 Checkout

Note: the hub height is pre-set at manufacture and should not require adjustment unless a replacement hub or motor has been fitted.

i) Locate a full 10.5" reel of work tape on the SU hub, check that the reel is squarely seated.

Rotate it to check that the flanges are not distorted,
note: any wave, at the edge of either flange, which is visible to the naked eye is probably cause to reject that reel. **It is essential that the reel used for this check is undistorted.**

ii) Set POWER on; thread the tape, load to BOT.

iii) Run the tape forward at low speed (diagnostic program 63) and check that the tape does not rub on either flange of the SU reel. Continue until (say) an inch of tape is packed onto the take-up reel.

iv) Run the tape in reverse to BOT at low speed (diagnostic program 65) and check that the tape does not rub on either flange.

When the tape has fully rewound, look for equal gaps on either side of the pack. Note: the nominal gap between tape and flange is 0.32 mm.

v) If this checkout is unsatisfactory, note whether the smaller gap is on the inside or outside of the pack, then adjust the hub as detailed in Section 7.6.4.

7.6.4 Adjustment

The hub height may be successfully adjusted by trial and error. The hub is illustrated in Figure 7.6.4.

i) Disconnect the hub sensor pcb cable at the In-Chute Sensor pcb end.

ii) Remove hub and SU motor as one assembly, a mounting plate is attached to the motor body.

iii) Use a 3 mm Allen key to slacken the hub ejector button retaining screw (located behind one of the toggle arms, as illustrated in Figure 7.6.4) until the ejector button springs forward.

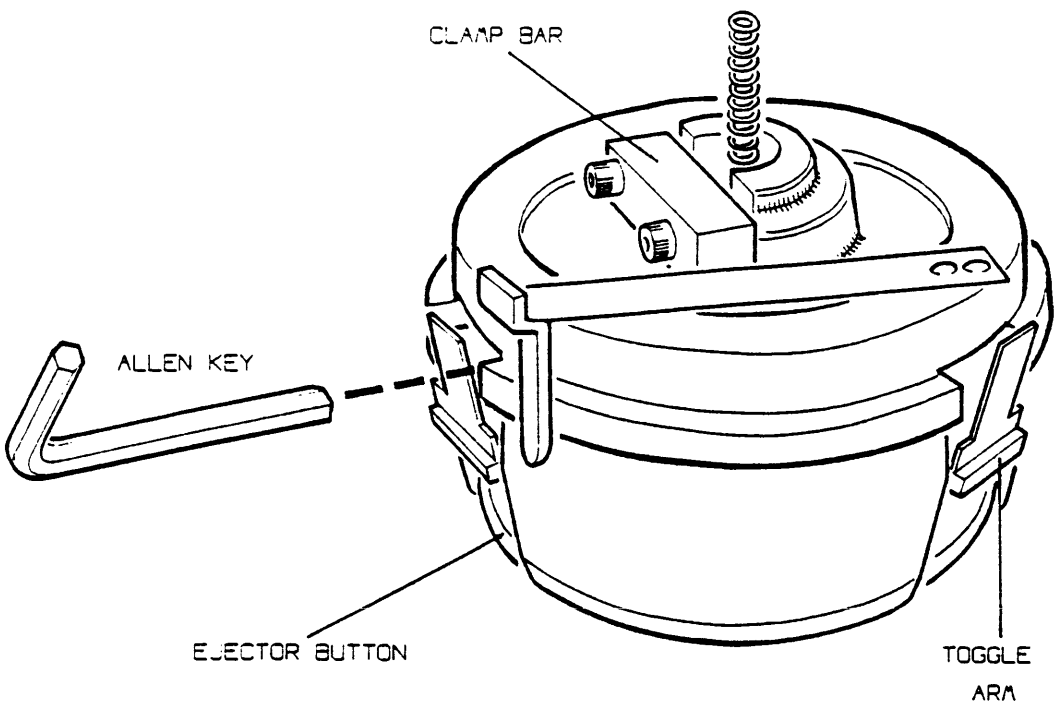

FIGURE 7.6.4 THE SUPPLY HUB

iv) Remove the ejector button.

v) Slacken the clamp bar screws and adjust the position of the hub on the motor spindle as required. If the tape pack had a smaller gap nearer the inside, move the hub nearer the SU motor.

vi) Tighten the clamp bar and replace the ejector button.
Note: if the hub and motor have been separated, ensure the flat on the shaft mates with the clamp bar.

vii) Refit the combined SU hub and motor assembly.

viii) Check the tape packing as described in Section 7.6.3.

ix) If the packing is biassed to one side, repeat the height adjustment procedure until the pack is evenly placed.

7.7 The Supply Reel Motor

7.7.1 Function

The SU reel motor is mounted on a plate which is then fixed to the deck casting. Motor current is supplied by the Servo Control board, to transport tape in the required direction or hold it steady in ' stop lock ' mode.

7.7.2 Location

The SU motor is the upper of the two motors (about 100 mm diameter by 150 mm long) behind the deck casting.

7.7.3 Checkout

There is no routine checkout of the SU reel motor, running diagnostic program 04 (auto servo checkout) successfully is an indication of acceptable performance. There is no facility to inspect the brushes on the Ametek motors.

7.7.4 Setting

There is no mechanical setting for the reel motors, any error in hub height is corrected by the procedures of Section 7.6.

7.7.5 Removal and Replacement

i) **Set power off** (depending on the supply type and connection method) either:

- with an ac supply, unplug the mains lead at the rear of the 9914V, *or*
- with a spade-connected dc supply, unplug the connectors at the rear of the 9914V, *or*
- with a plug-and-socket dc supply, unplug the 3-pin connector at the rear of the 9914V.

ii) Release the deck captive screw, lower the deck casting to its horizontal position, and monitor the test points, as stated.

iii) Unplug SU motor power lead at the Servo Control board.

iv) Unplug the Hub Sensor pcb at the In-Chute Sensor pcb end.

v) Remove the SU motor and hub as one assembly (see Section 7.6).

vi) Separate the motor from the hub.

After replacing the motor, reset the hub height as described in Section 7.6.

7.8 Tape Path Assembly

7.8.1 Function

The tape path casting is the reference component of the tape path, it locates against the reference face on the underside of the deck casting to carry:

- the read/write and erase head block;
- the tape cleaner;
- the two fixed guides (also called bollards);
- the BOT/EOT sensors board;
- the ' in-chute ' Tx/Rx blocks;
- the pre-amplifier assembly;
- the tension arm assembly;
- the tacho assembly.

The height of these items with respect to the tape is controlled to give an accurate tape path with no height adjustments.

7.8.2 Location

The tape path assembly is located behind the deck casting, as illustrated in Section 8.

7.8.3 Checkout

Only severe mechanical damage can be expected to alter the orientation of the tape path with respect to the three tape path mating faces.

The azimuth screw is set at the factory, to give the required skew performance. Diagnostic programs 82 and 83 have been provided to verify the skew performance.

7.8.4 Setting

The tape path mechanics are not field adjustable.

The BOT and EOT sensors can be set up as follows.

i) Select a reel of tape which has a highly reflective base (back-coated or dull-coated tapes are not suitable).

ii) With power on, load a tape by hand until the BOT marker is near the BOT/EOT block.

iii) Release the deck captive screw and, with the loading door closed, lower the deck casting to its horizontal position.

iv) Monitor IC34 pin 11 on the Servo Control board with a dc voltmeter.

v) Hold the reels so that the tension arm is centrally positioned and the BOT marker not opposite its detector.

vi) Check that the output is greater than (or equal to) 3.2 volts, adjusting R2 if necessary.

vii) Move the tape so the marker is opposite the detector block, check that the output is now less than 350 mV.

viii) Attach an EOT marker a few inches before the BOT marker.

ix) Repeat (iii) to (vii) for the EOT circuit, monitoring IC34 pin 13 and adjusting R1 if necessary.

x) Remove the EOT marker.

xi) Remove the voltmeter, raise the deck casting, and load a tape to BOT to confirm correct operation.

7.8.5 Removal and Replacement

Note: the Tape Path assembly contains electronic circuit boards, and is ESD sensitive, see Section 7.1.2 for handling precautions.

Set power off (depending on the supply type and connection method) either:

- with an ac supply, unplug the mains lead at the rear of the 9914V, *or*
- with a spade-connected dc supply, unplug the connectors at the rear of the 9914V, *or*
- with a plug-and-socket dc supply, unplug the 3-pin connector at the rear of the 9914V.

Open the tape loading door and remove the 4 caps on the fixed guides and rollers.

Release the deck captive screw and, with the loading door closed, lower the deck casting to its horizontal position.

Before removing the tape path assembly, release the attached cables:

i) the 40-way cable to the Servo Control board;
ii) the 40-way cable to the ADP board (read plug);
iii) the 28-way cable to the ADP board (write plug);
iv) the 14-way cable to the hub sensor pcb.

Attach some temporary covering (such as that supplied by the head manufacturer) to the recording surface of the head, for additional protection while removal is in progress. Suitable covering could be a piece of lint-free cloth secured in place by adhesive tape.

The tape path is fixed to the deck casting by three screws, one at each end and one at mid-point, near the 9914V's outer edge. While extracting the tape path assembly, **be extremely careful not to scrape the head face against the adjacent casting.**

Replacement is essentially the reverse of the removal procedure; again being extremely careful **not to scrape the head face against the adjacent casting**, and equally careful **not to impact the rollers.** Location pegs are provided to align the assembly.

7.9 Tape Cleaner

7.9.1 Function

The tape cleaner presents a very sharp edge to the tape at an acute angle during forward tape motion, any surface debris is thereby removed from the tape before it reaches the head.

7.9.2 Location

The tape cleaner is mounted on the head plate, near the head block.

7.9.3 Checkout

Warning: one edge of the tape cleaner is extremely sharp, observe great care.

The tape cleaner may be checked by visual examination, the edges should be straight and free from chips if damage to the tape is to be avoided. Observation with the tape loaded will show a small tape deflection of the tape by protrusion of the cleaner blade into the line of the tape.

The tape cleaner's angle of attack and intrusion into the tape path are fixed by two locating pins.

7.9.4 Setting

No re-setting is required.

7.9.5 Removal and Replacement

Warning: one edge of the tape cleaner is extremely sharp, observe great care.

Set power off (depending on the supply type and connection method) either:

- with an ac supply, unplug the mains lead at the rear of the 9914V, *or*
- with a spade-connected dc supply, unplug the connectors at the rear of the 9914V, *or*
- with a plug-and-socket dc supply, unplug the 3-pin connector at the rear of the 9914V.

The tape cleaner is removable by undoing its fixing screw under the head plate; take care not to undo screws belonging to other tape path components.

When replacing the tape cleaner, align it against its 2 dowels before tightening its fixing screw.

7.10 Tape Path Rollers

7.10.1 Function

The tape path rollers assist in transporting and guiding the tape along the tape path, they are precision made rotating parts.

7.10.2 Location

Three flanged rollers are used on the 9914V, one near the exit from the supply chamber, one mounted on the outer end of the tension arm and one at the entrance to the take-up chamber. The front and rear rollers are identical.

7.10.3 Checkout

Ensure that the rollers run freely and smoothly on their bearings, show no excessive end float, have no flange damage or roughness, and have clean smooth contact surfaces. If a bearing does not run smoothly this is usually apparent when it is rotated slowly by hand (compare with another); when rotated fast a rough bearing will cease to rotate immediately.

The height of each roller is designed to make a straight tape path. To examine how the tape is transported:

i) Locate a full reel of work tape which is free of edge damage, place it on the SU hub.

ii) Set power on, load the tape to BOT,

iii) Run diagnostic program 95 and enter the service key (this is necessary for the subsequent checkout with the tape loading door open or detached).

iv) Open the tape loading door.

Warnings, for the remainder of this checkout:

Keep fingers, hair, and clothing well clear of the hubs.

Do not open the deck casting while the tape loading door is open.

v) Examine the tape contact with the roller flanges while running diagnostic program 55, light edge contact is normal but curling against a flange causes tape damage.

7.10.4 Setting

There is no setting procedure. If a roller is replaced with its own shim, the straight tape path is retained.

7.10.5 Removal and Replacement

i) **Set power off** (depending on the supply type and connection method) either:

- with an ac supply, unplug the mains lead at the rear of the 9914V, *or*
- with a spade-connected dc supply, unplug the connectors at the rear of the 9914V, *or*
- with a plug-and-socket dc supply, unplug the 3-pin connector at the rear of the 9914V.

ii) Open the deck casting and release the hinge screws which secure the tape loading door (they are on the right hand side of the unit). Support the door until the next step has been completed.

iii) Detach the tape loading door (close the deck casting if necessary).

iv) Remove and or replace whichever roller is considered suspect.

Notes:

a) Any shims supplied with the replacement roller must be fitted as part of the replacement roller assembly.

b) The roller at the outer end of the tension arm appears to be an integral part of the tension arm assembly but may be replaced by moving the tension arm away from its rest position and using a bent tommy bar to engage with the hole in the roller base.

v) Check that all 3 rollers, and both fixed guides, are fitted with their caps. Missing caps may degrade the automatic tape threading process.

vi) Run the checkout procedure of Section 7.10.3 to confirm a straight tape path.

vii) Refit the tape loading door.

7.11 Tension Arm Assembly

7.11.1 Function

The tension arm assembly incorporates the arm itself together with a damping device and the position sensing circuits, including the ' limit ' flags and optical switch.

7.11.2 Location

The tension arm itself is visible at the front of the deck casting; the damping mechanism and position sensor circuits are at the back of the deck casting.

7.11.3 Checkout

a) Display check for arm position and limit

This procedure checks that the limit flag and position data is correctly interpreted by the Servo Control processor. It is important that the position sensor emits zero output at centre travel and that the limits are approximately equal.

i) Run diagnostic program 47, the ' LIMIT ' quantity in the indication may be ignored until step (ii). The other three characters indicate the position sensor output; with the arm at rest they should indicate about 80, at full travel they should indicate about 180. These are not rigid limits outside which re-setting must be carried out, but may be regarded as an indication of correct operation, the absolute limits are set out in (b) below.

ii) Check that when the arm is at either limit of travel, the indicated leading characters in the display are ' LIMIT ', and as the arm is moved away from either ' limit ' the 'LIMIT' disappears.

b) Voltage check for arm position and limit

i) Unload any tape.

ii) **Set power off** (depending on the supply type and connection method) either:

- with an ac supply, unplug the mains lead at the rear of the 9914V, *or*
- with a spade-connected dc supply, unplug the connectors at the rear of the 9914V, *or*
- with a plug-and-socket dc supply, unplug the 3-pin connector at the rear of the 9914V.

iii) Release the deck captive screw, lower the deck casting to its horizontal position, and monitor the test points, as stated.

iv) On the tension arm board, monitor IC1.7. Set power on and check that the position sensor generates approx +1.0 V (±0.2 V) relaxed, zero at mid-position and -1.0 V (±0.2 V) at full tension; the most important feature is zero volts at mid-travel. This level appears on the Servo Control board at the R64/C40 junction.

Note that mid-position is when the tension arm is pushed just clear of the 2 mm hole in the casting. Later castings have 3 holes, in which case mid-position is denoted by the middle hole.

v) On the Servo Control board, monitor IC34 pin 3 (or pin 4 - the gate output). Move the tension arm and check that it goes low (limit detected) just before the mechanical limit of travel, in both directions.

c) **Diagnostic test for arm response**

Run diagnostic program 48 (tension arm response), as described in Section 5.

7.11.4 Setting

The most important parameter of the position sensor is that at mid-travel its output is zero, this parameter is set during manufacture and does not vary during use. Should a circuit component be replaced, the following notes are provided.

Monitor IC1.7 to examine the output voltage. The offset control R3 is provided to set the output to 0.0 V when the tension arm is at mid-travel. The gain control R14 on later pcbs) is provided to set the output to +1.0 (±0.2) V at the travel extremes. Set the offset, set the gain, then check the offset.

7.11.5 Removal and Replacement

The tension arm roller removal/replacement is described in Section 7.10. The electronic components are not field-replaceable, because the position sensor is set up at the factory as part of the tape path assembly.

7.12 Data Control Board

7.12.1 Function

The Data Control board supervises the data-related parts of all logic activity, it is described in Section 2.

7.12.2 Location

The Control board is a plug-in printed circuit board which fits into the first slot in the card rack, as illustrated in Section 8, using three dual 32-way connectors.

7.12.3 Checkout

Specific Data Control board faults are highlighted by messages on the 8-character display at the front of the 9914V, Section 3 sets out these messages.

A general checkout of the Data Control board involves running one or more of diagnostic programs 05 to 09, depending on the fault symptom(s). This procedure assumes that the operator panel and Servo Control board are both fully functional.

A specific checkout and re-calibration, after replacement of the Data Control board, is described in Section 7.12.5.

7.12.4 Setting

The Data Control board does not incorporate any potentiometers, parameter-setting links, or switch options.

The link near the lower right corner determines whether the line termination resistors are powered from within the 9914V (as is usual) or from outside (as with daisy-chain systems). The links LK1 and LK2 (near upper edge of the board) should always be fitted when the board is in service.

The 9914V Data Control boards use EEPROM as non-volatile memory, no battery is therefore fitted. The earlier Data Control boards (which used battery-backed RAM) are not fitted to the 9914V.

7.12.5 Removal and Replacement

Note 1: the Data Control board is ESD sensitive, see Section 7.1.2 for handling precautions.

Note 2: the Data Control and DDP boards are paired. Data Control p/n 123638 goes with 123620. The earlier p/n 121600 goes with 121700, but are were not factory-fitted to 9914Vs. All drives will have been shipped with compatible pairs; which should not be mixed.

Removal

i) **Set power off** (depending on the supply type and connection method) either:

- with an ac supply, unplug the mains lead at the rear of the 9914V, *or*
- with a spade-connected dc supply, unplug the connectors at the rear of the 9914V, *or*
- with a plug-and-socket dc supply, unplug the 3-pin connector at the rear of the 9914V.

ii) Release the deck captive screw and, with the loading door closed, lower the deck casting to its horizontal position.

iii) Release the 2 captive screws which hold the card cage horizontal.

iv) Hinge the card cage up.

v) Identify the Data Control board.

vi) Disconnect any connectors which prevent the Data Control board being withdrawn.

v) Raise the two board extractors, simultaneously.

vi) Lift the board straight out.

Replacement

Replacement is essentially the reverse of the removal procedure.

When replacing the board, ensure it is placed in the third slot and the edge connectors are correctly aligned with the Mother board sockets before pushing the board fully home. No attempt should be made to insert the Data Control board in any but the third slot, because the all pcbs have designated positions, determined by the edge connectors.

Checkout and Re-Calibration after Replacement

i) Set power on and allow the power-on diagnostics to run,
the **NVR message may appear, if so press LD/ONL to by-pass this indication;
the **DN1 message may appear next, if so press LD/ONL to by-pass this indication.
If the 9914V loading door is open, ' Ready ' should be displayed,
if the 9914V loading door is closed, LOCATING should be displayed, press RESET once to halt the loading attempt and once again to display ' Ready '.

ii) Run program 95 and enter the service key.
Run program 80.

iii) Power cycle the 9914V.
Load a standard amplitude tape to BOT.
Leave the 9914V powered on for 15 minutes, to allow the small signal circuits to stabilise.

iv) Run program 95 and enter the service key.
Run diagnostic program 74 to re-calibrate the 9914V.

v) Set power off, wait a few seconds and set power on again. Allow the power-on diagnostics to run, there should be no error message.

vi) Load a scratch tape to BOT.
Run diagnostic program 01.

7.13 Analogue Data Paths Board

7.13.1 Function

The Analogue Data Paths (ADP) board handles the analogue tape data, it is described in Section 2.

7.13.2 Location

The Analogue Data Paths board is a plug-in printed circuit board which fits in the third (ie the back) slot in the card rack, using two dual 32-way connectors.

7.13.3 Checkout

A checkout of the ADP board involves running diagnostic program 07; this procedure assumes that other boards are fully functional.

7.13.4 Setting

The ADP board has no potentiometers, links, or switches. Any parameter setting is achieved electronically by signals from the Data Control board.

7.13.5 Removal and Replacement

Note: the ADP board is ESD sensitive, see Section 7.1.2 for handling precautions.

i) **Set power off** (depending on the supply type and connection method) either:

- with an ac supply, unplug the mains lead at the rear of the 9914V, *or*
- with a spade-connected dc supply, unplug the connectors at the rear of the 9914V, *or*
- with a plug-and-socket dc supply, unplug the 3-pin connector at the rear of the 9914V.

ii) Release the deck captive screw and, with the loading door closed, lower the deck casting to its horizontal position.

iii) Release the 2 captive screws which hold the card cage horizontal.

iv) Hinge the card cage up.

v) Identify the ADP board.

vi) Disconnect the IDC connectors to the pre-amplifier and Servo Control boards.

vii) Raise the two board extractors, simultaneously.

viii) Lift the board straight out.

When replacing the board, reverse the removal procedure, ensuring that the ADP board is inserted in the third slot and the edge connectors are correctly aligned with the Mother board sockets before pushing the board fully home.

No attempt should be made to insert the ADP board in any but the third slot, because its position is designated, determined by the edge connectors.

After ADP board replacement, the 9914V must be re-calibrated using diagnostic program 74 before being returned to on-line use.

7.14 Digital Data Paths Board

7.14.1 Function

The Digital Data Paths (DDP) board decodes the Pertec interface commands and executes the digital data processing associated with all recording densities.

A functional description appears in Section 2.

7.14.2 Location

The DDP board is a plug-in printed circuit board which fits into the second slot in the card rack, as illustrated in Section 8.

7.14.3 Checkout

A checkout of the DDP board involves running one or more of diagnostic programs 05 to 09; this procedure assumes that other boards are fully functional.

7.14.4 Setting

The DDP board contains the nine potentiometers which are set up at the factory to optimise the capture performance of the phase lock loop for each data channel. The re-setting of these pots is not required, if the PLL chips are replaced, re-setting of the pots requires base-station type facilities.

7.14.5 Removal and Replacement

Note 1: the DDP board is ESD sensitive, see Section 7.1.2 for handling precautions.

Note 2: the DDP and Data Control boards are paired. DDP p/n 123620 goes with 123638. Earlier p/n 121700 goes with 121600, but were not factory-fitted to 9914Vs. All drives will have been shipped with compatible pairs; the pairs should not be mixed.

i) **Set power off** (depending on the supply type and connection method) either:

- with an ac supply, unplug the mains lead at the rear of the 9914V, *or*
- with a spade-connected dc supply, unplug the connectors at the rear of the 9914V, *or*
- with a plug-and-socket dc supply, unplug the 3-pin connector at the rear of the 9914V.

ii) Release the deck captive screw and, with the loading door closed, lower the deck casting to its horizontal position.

iii) Release the 2 captive screws which hold the card cage horizontal.

iv) Hinge the card cage up.

v) Identify the DDP board.

vi) Disconnect any connectors which prevent free withdrawal of the DDP board.

vii) Raise the two board extractors, simultaneously.

viii) Lift the board straight out.

When replacing the board, reverse the removal procedure, ensuring that the edge connectors are correctly aligned with the Mother board socket before pushing the board fully home.

No attempt should be made to insert the DDP board in any but the second slot, because its position is designated, determined by the edge connectors.

7.15 SCSI Board

This section also applies to the Super SCSI board.

7.15.1 Function

The SCSI board handles the SCSI interface commands, it's circuit function is described in Section 2; it's command set is described a specific user manual.

7.15.2 Location

The SCSI board is a printed circuit assembly which fits under the card rack, and carries a connector for the SCSI signals to/from the system SCSI bus.

7.15.3 Checkout

A checkout of the SCSI board is automatically carried out when power is applied to the 9914V. At other times its recent command history and status can be interrogated by the SCSI Request Status command.

7.15.4 Setting

The SCSI board contains slide switches and links which can be set according to the customers' requirements. Alternatively the 9914V's NVR may be configured, as summarised in the 9914V User/Diagnostic Manual, to hold these options and override the switch settings. The various options are described in either the SCSI User Manual or the Super SCSI User Manual, as applicable.

7.15.5 Removal and Replacement

Note: the SCSI board is ESD sensitive, see Section 7.1.2 for handling precautions.

No attempt should be made to disconnect or reconnect the 9914V's SCSI interface connector while it is connected to its host computer. If the host is powered on, first get it re-configured so the 9914V is not available, then check that powering it off will not disturb the integrity of the SCSI bus. Failure to observe these precautions may adversely affect the host's communication with other SCSI devices.

i) **Set power off** (depending on the supply type and connection method) either:

- with an ac supply, unplug the mains lead at the rear of the 9914V, *or*
- with a spade-connected dc supply, unplug the connectors at the rear of the 9914V, *or*
- with a plug-and-socket dc supply, unplug the 3-pin connector at the rear of the 9914V.

ii) Release the deck captive screw and, with the loading door closed, lower the deck casting to its horizontal position.

iii) Release connectors as follows (rest the cables out of the way of the card cage):
2-way (P1 at the Servo Control board) to the TU motor;
2-way (P2 at the Servo Control board)) to the SU motor;
2-way twisted pair to the loading fan;
40-way read cable (at the ADP board);
28-way write cable (at the ADP board).

iv) Release the 2 captive screws which hold the card cage horizontal.

v) Hinge the card cage up.

vi) Disconnect the cable (P4/P5) from the card cage, at the SCSI board end.

vii) Release the 2 captive screws which secure the SCSI board tray to the base of the 9914V's enclosure.

viii) Withdraw the SCSI board tray.

ix) Disconnect the cable to the customer's SCSI bus.

Remove the 4 fixing screws, which attach the SCSI board to it's tray.

Remove the SCSI board from it's tray.

Replacing the SCSI board is essentially the reverse of the removal procedure.

7.16 Cooling Fan and Cooling Air Filter

7.16.1 Function

The cooling fan is powered by +24 volts dc (from the Power Supply board) and pulls air through a removable filter over the Power Supply and Servo Control boards.

7.16.2 Location

The cooling fan and filter are located on the right side of the 9914V, as illustrated in Section 8. The filter grille is visible from outside the 9914V's enclosure.

7.16.3 Checkout

The **cooling fan** is operative whenever power is on.

i) Set power off, release the deck captive screw, and lower the deck casting to its horizontal position.

ii) Keeping fingers, hair, and clothing clear of the fan, set power on and check that the fan starts to rotate.

iii) Check that an air current issues from the fan.

The **filter** may be released by the procedure of Section 7.16.5. If it is blocked with dust, shake off (or vacuum off) the dust and refit the filter.

7.16.4 Setting

There are no mechanical or electrical settings associated with the cooling fan. The only electrical check is to ensure that the +24V rail is correct, this is normally monitored by the Servo Control board.

7.16.5 Removal and Replacement

i) **Set power off** (depending on the supply type and connection method) either:

- with an ac supply, unplug the mains lead at the rear of the 9914V, *or*
- with a spade-connected dc supply, unplug the connectors at the rear of the 9914V, *or*
- with a plug-and-socket dc supply, unplug the 3-pin connector at the rear of the 9914V.

ii) Disconnect and free the cooling fan power lead at the Power Supply board, release the cable back to the fan.

iii) Release the 2 captive screws which hold the card cage horizontal.

iv) Hinge the card cage up.

v) Remove the 2 fixing screws which secure the fan/filter cover (early 9914Vs used 4 fixing screws).

vi) Lift out the cooling fan, or the filter.

Replacing the cooling fan (or filter) is essentially the reverse of the removal procedure.

7.17 Pertec Cache Interface Board

7.17.1 Function

The PCI board provides a buffer between a Pertec bus and the 9914V, so that data and commands can be queued within the buffer, relieving the host of the byte-synchronous mode which the unbuffered interface requires. The operating modes and capabilities of the PCI board are set out in the Pertec Cache Interface Product Description.

7.17.2 Location

The PCI board is a printed circuit assembly which fits under the card rack, and carries a connector for the Pertec signals to/from the system Pertec bus.

7.17.3 Checkout

A checkout of the PCI board is automatically carried out when power is applied to the 9914V. At other times its status can be interrogated by the PCI Read Controller Sense command.

7.17.4 Setting

The PCI board contains slide switches and links which can be set according to the customers' requirements. Alternatively the 9914V's NVR may be configured, as summarised in the 9914V User/Diagnostic Manual, to hold these options and override the switch settings. The various options are defined in Section 4 under Basic Configuration Options.

7.17.5 Removal and Replacement

Note: the PCI board is ESD sensitive, see Section 7.1.2 for handling precautions.

No attempt should be made to disconnect or reconnect the 9914V's Pertec interface connector while it is connected to its host computer. If the host is powered on, first check that the 9914V is not transferring data, then set it off-line. If the 9914V is part of a daisy-chain configuration, check that powering it off will not disturb the integrity of the Pertec bus.

i) **Set power off** (depending on the supply type and connection method) either:

- with an ac supply, unplug the mains lead at the rear of the 9914V, *or*
- with a spade-connected dc supply, unplug the connectors at the rear of the 9914V, *or*
- with a plug-and-socket dc supply, unplug the 3-pin connector at the rear of the 9914V.

ii) Release the deck captive screw and, with the loading door closed, lower the deck casting to its horizontal position.

iii) Release connectors as follows (rest the cables out of the way of the card cage):
2-way (P1 at the Servo Control board) to the TU motor;
2-way (P2 at the Servo Control board)) to the SU motor;
2-way twisted pair to the loading fan;
40-way read cable (at the ADP board);
28-way write cable (at the ADP board).

iv) Release the 2 captive screws which hold the card cage horizontal.

v) Hinge the card cage up.

vi) Disconnect the cable (P4/P5) from the card cage, at the PCI board end.

vii) Release the 2 captive screws which secure the PCI board tray to the base of the 9914V's enclosure.

viii) Withdraw the PCI board tray.

ix) Remove the Pertec cable clamp bar,
disconnect the cable to the customer's Pertec bus.

8. Illustrated Parts Lists

This section lists the 9914V spares and illustrates them. The spares are divided up into

- **major spares**, which are recommended at individual sites where the 9914V is in use,
- **option spares**, which are relevant when the customer uses an option. These spares may be at individual sites or at a base station, at the customer's discretion,
- **auxiliary spares**, which are recommended at base stations which service many 9914Vs.

8.1 Available Spares

8.1.1 Major Spares List

Spare description	Parts list number	Spares number	Fig. No.
Tape Path Assembly	125366 xx	95 125366 xx	8.2.1
Supply Hub Assembly	125147 xx	95 125147 xx	8.2.4
Cooling Fan	125153 xx	95 125153 xx	8.2.5
Loading Fan Motor	121723 02 #1	95 121723 02	8.2.6
Analogue Data Paths board	121710 14 #1	95 121710 14	8.2.7
Data Control board *(pairs with next item)*	123638 35 #1	95 123638 35	8.2.9
Digital Data Paths board (125 ips)	123620 12 #1	95 123620 12	8.2.8
Servo Control board	125370 xx	95 125370 xx	8.2.10
AC Power Supply board	123340 xx	95 123340 xx	8.2.11
Supply Reel Motor	125150 xx	95 125150 xx	8.2.4
Take-Up Reel Motor	121721 xx	95 121721 xx	8.2.12
Door Microswitch	QS240050	.....	8.2.14
Mains Switch	123056 xx	95 123056 xx	8.2.15

Note 1: assembly states earlier than these are not applicable to the 9914V.

8.1.2 Option Spares List

Spare description	Parts list number	Spares number	Fig. No.
If the SCSI interface is in use, either a standard SCSI:			
SCSI board (512K Single-Ended)	125420	95 125420 xx	8.3.1
SCSI board (512K Differential)	125421	95 125421 xx	8.3.1
or a Enhanced SCSI:			
Enhanced SCSI board (2 M)	125431 *(to be confirmed)*	95 125431 xx	8.3.1
PCI board (1 M)	125480 *(to be confirmed)*	95 125480 xx	8.3.2
DC Power Supply board	124920	95 124920 xx	8.3.3

8.1.3 Subsidiary Spares List

Spare description	Parts list number	Spares number	Fig. No.
Front/Rear Roller	123240	95 123240 xx	8.2.2
Tension Arm Roller	123910	95 123910 xx	8.2.2
BOT/EOT pcb	120910	95 120910 xx	8.2.2
Tape Cleaner	119287	95 119287 xx	8.2.2
Hub Sensor pcb	125151	95 125151 xx	8.4.2
In-Chute Sensor pcb	125293	95 125293 xx	8.2.3(b)
Tension Arm pcb	121010	95 121010 xx	8.2.3(a)
Pre-Amplifier pcb	125367	95 125367 xx	8.2.3(a)
EOT/BOT pcb	120910	95 120910 xx	8.2.2
Tension Arm Spring	125315	95 125315 xx	8.2.3(a)
Air Filter	125156	95 125156 xx	8.4.3
Motherboard	124960	95 124960 xx	8.4.6
Operator Panel	125240	95 125240 xx	8.2.13
Switch Fascia pcb	125010	95 125010 xx	8.2.13
Mains Transformer Assembly	125154	95 125154 xx	8.4.1
Take-Up Hub Assembly	121814	95 121814 xx	8.2.12
AC Fuse Kit 9914V	.....	.....	8.4.4
DC Fuse Kit 9914V	.....	.....	8.4.5

8.1.4 How to Use The Illustrated Parts Lists

Each illustration has numbered callouts; each number represents the associated FRU or attaching hardware. The text on the following (facing) page contains:

- Figure reference number;
  01 onwards for the replaceable part,
  10 onwards for any attaching hardware.
- Part number
- Description
- Quantity

8.1.5 Abbreviations Used

The following abbreviations are used, particularly when describing screws.

General format: SCR, Head type, Size, Thread pitch x length, Material and/or plating

SCR	Screw
SCR-LOC	Screw - self-locking type
ASH	Allen Socket Head, also called 'hex wrench'
CSK	Countersunk head
FHS	Flat Head Screw
PAN	Pan-head - ie a domed shape
POZ	Pozidriv-style screwdriver recess
THR-FM	Thread Forming Screw (self tapping)
UNC	Unified Coarse Thread
6-32x3/8	Size, thread pitch & length (in inches)
HTST	High tensile steel
MS	Mild Steel
ZP	Zinc Plated
HEX	Hexagonal
WAS	Washer
CRI	Crinkle
IT	Internal Teeth
M	Metric size
MTG	Mounting
SC	Single Coil
SHP	Shakeproof
SPR	Spring washer
UN	Unified (washer), to fit corresponding screw size

8.1.6 Spares Part Numbers

Spares numbers shown are standard part numbers. In special cases (eg the SCSI board) the customer may use a mechanically similar part with a different part number.

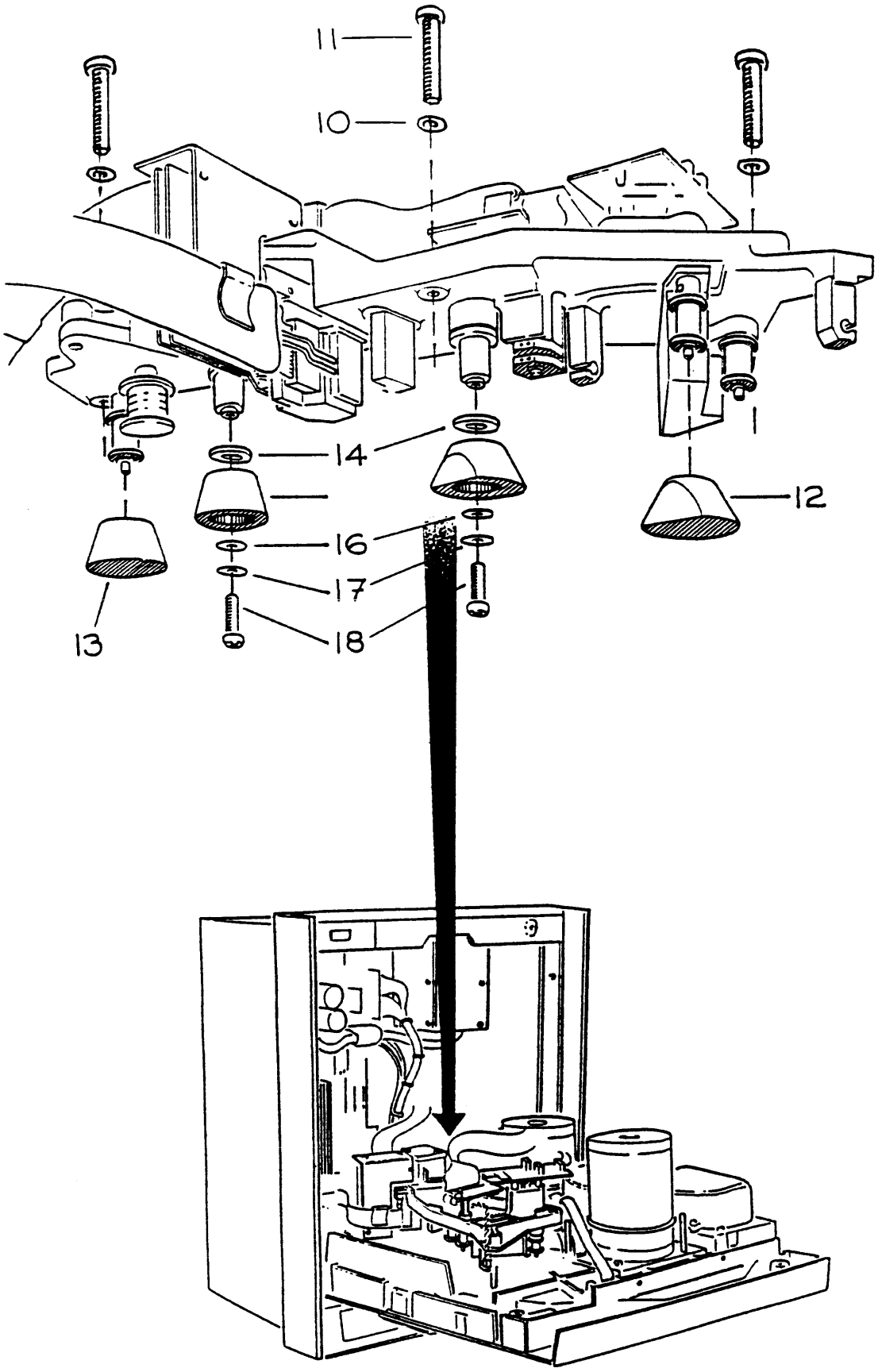

FIGURE 8.2.1 TAPE PATH ASSEMBLY

Figure ref.	Part Number	Description	Qty
01	95 125366 xx	Tape Path Assembly	1

Attaching Hardware:

Figure ref.		Description	Qty
10	95 041596	WAS, SHP, 8UN, IT	3
11	95 041067	SCR, POZ PAN, 8-32x1/2	3
12	95 125112 02	Tension arm roller cap, press-on	1
13	95 125113 02	Front or rear roller cap, press-on	1
14	95 076090 xx	Fixed Flange	2
15	95 125111 xx	Cap, first fixed guide	1
16	95 041351	WAS, PLAIN, 4UN	2
17	95 041679	WAS, SPR, 4UN, SC	2
18	95 041044	SCR, POZ PAN, 4-40x5/16 UNC	2
19	95 125110 xx	Cap, second fixed guide	1

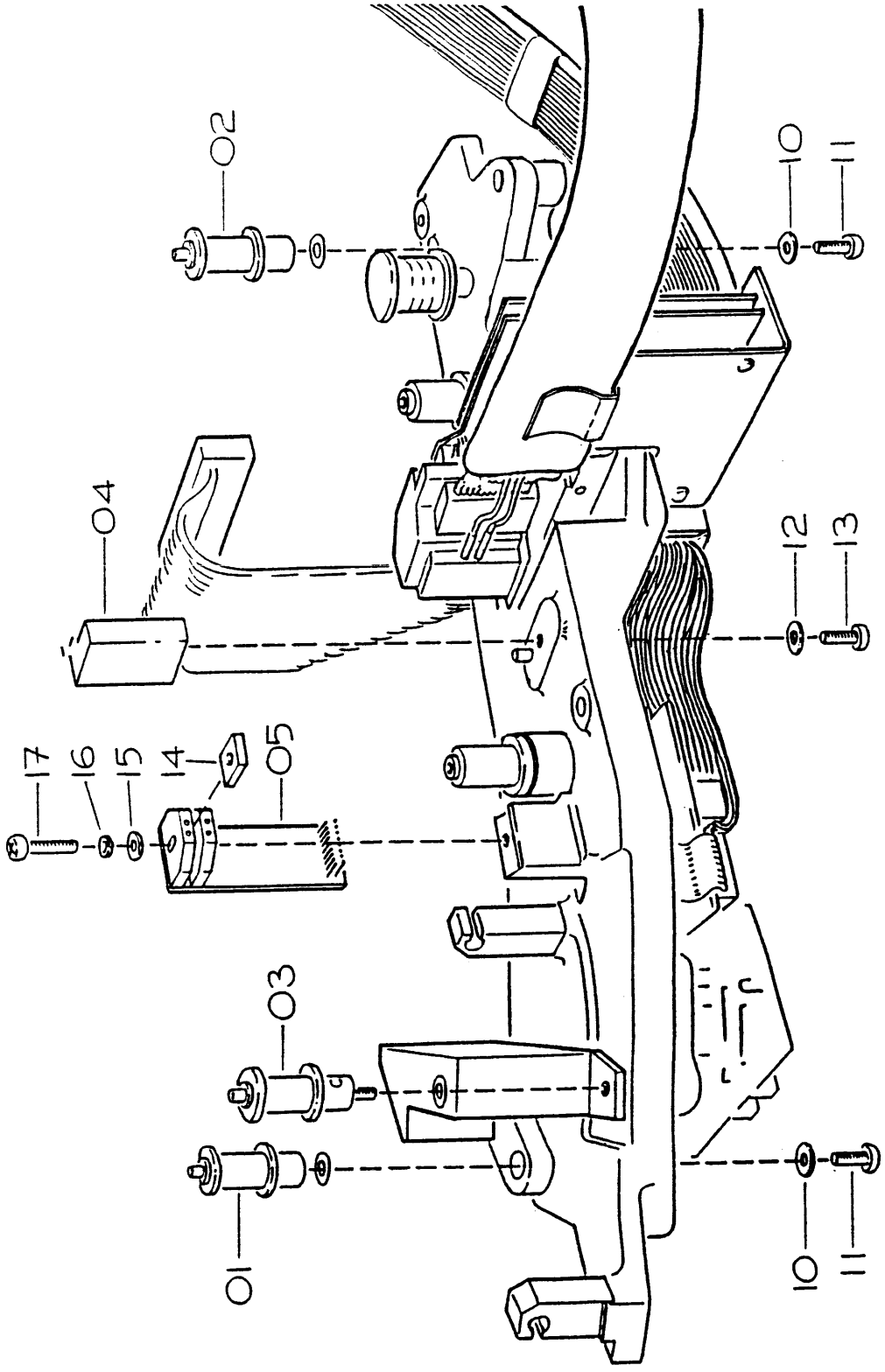

FIGURE 8.2.2 PARTS ABOVE THE TAPE PATH ASSEMBLY

Figure ref.	Part Number	Description	Qty
01	95 123240 xx	Front Roller	1
02	95 123240 xx	Rear Roller	1
03	95 123910 xx	Tension Arm Roller	1
04	95 119287 xx	Tape Cleaner	1
05	95 120910 xx	EOT/BOT pcb	1

Note: the Tape Path Assembly is illustrated in Figure 8.2.1

Attaching Hardware:

Figure ref.		Description	Qty
Front and rear rollers:			
10	95 041362	WAS, SPR, 6UN, SC	2
11	95 041591	SCR, ASH, 6-32UNx1/2 HTST	2
Tape cleaner:			
12	95 041662	WAS, SHP, 6UN, IT	1
13	95 041057	SCR, POZ PAN, 6-32x5/8	1
EOT/BOT pcb:			
14	95 119086 xx	EOT/BOT Spacer	1
15	95 041351	WAS, PLAIN, 4UN	1
16	95 041679	WAS, SPR, 4UN, SC	1
17	95 041711	SCR, POZ PAN, 4-40x3/4 UNC	1

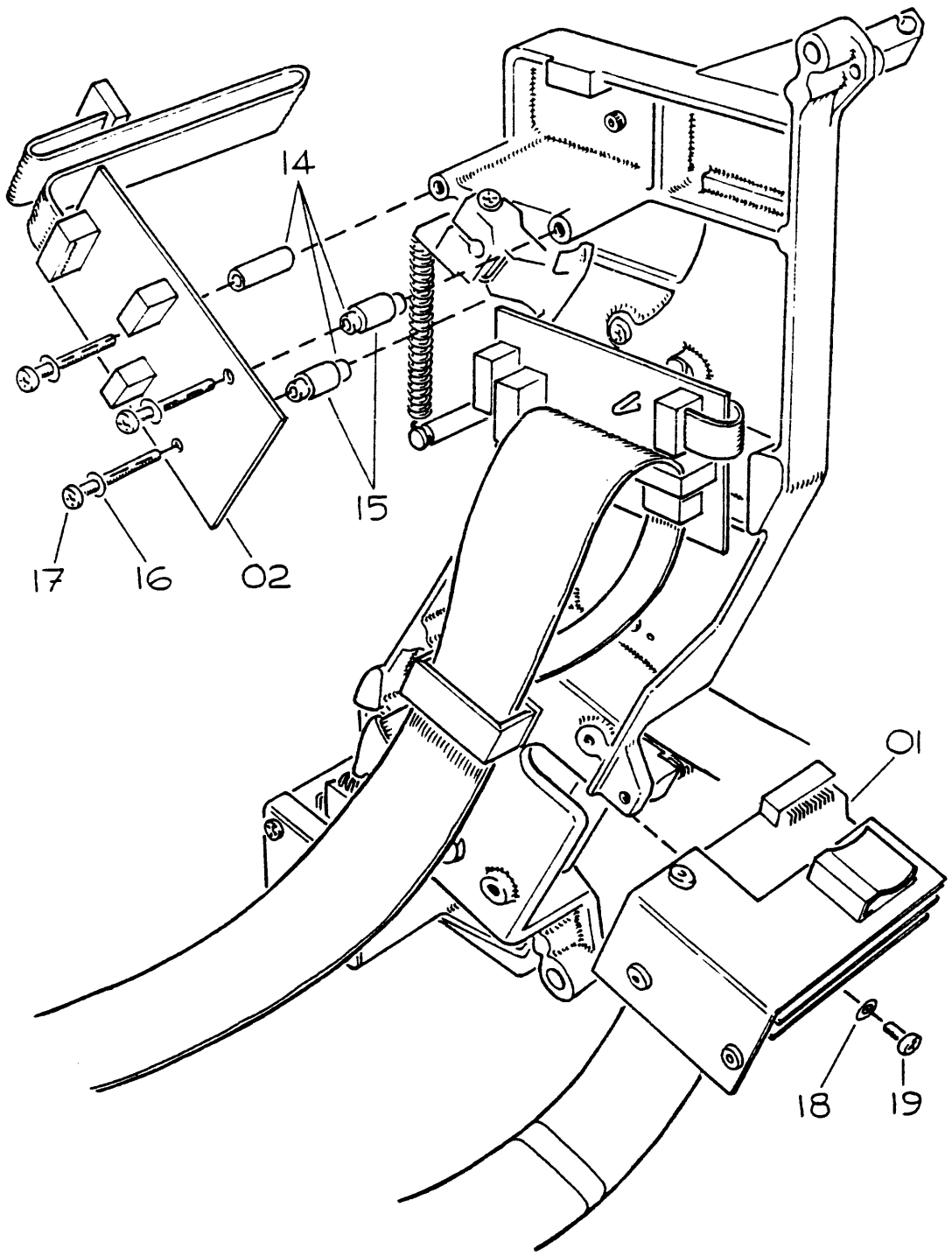

FIGURE 8.2.3(a) PARTS BELOW THE TAPE PATH ASSEMBLY

Figure ref.	Part Number	Description	Qty
01	95 124581 xx	Pre-Amplifier pcb	1
02	95 121010 xx	Tension Arm pcb	1

Note: the Tape Path Assembly is illustrated in Figure 8.2.1

Attaching Hardware:

Figure ref.		Description	Qty
Tension arm pcb:			
14	95 123038 xx	Spacer	3
15	95 020947 xx	Sleeve, 5 mm ID, 25 mm *(cut in half & fit over 2 spacers)*	1
16	95 041346	WAS, CRI, 6UN	3
17	95 040966	SCR, POZ PAN, 6-32x1 UNC	3
Pre-Amplifier pcb:			
18	95 041679	WAS, SPR, 4UN, SC	1
19	95 041044	SCR, POZ PAN, 4-40x5/16 UNC	1

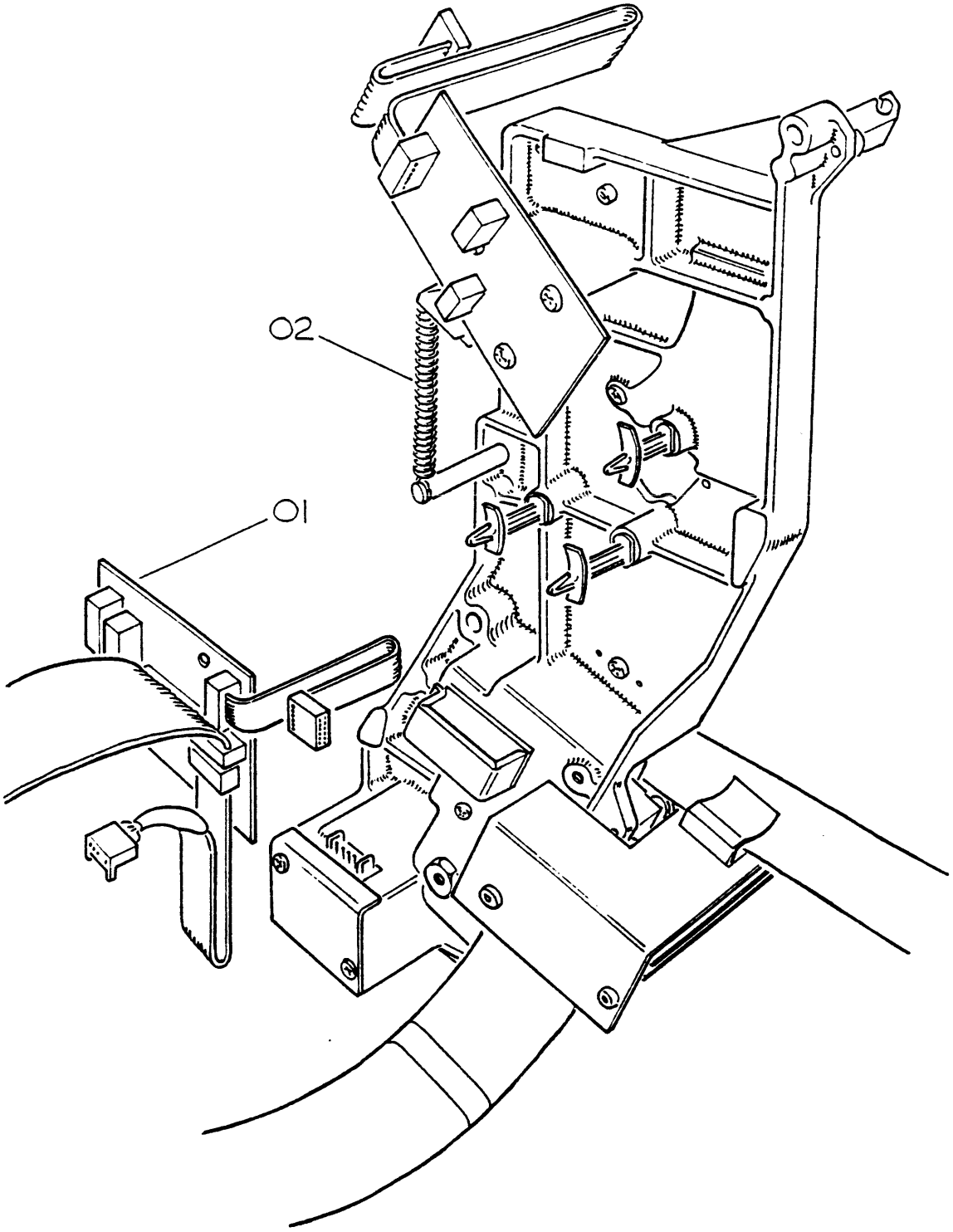

FIGURE 8.2.3(b) PARTS BELOW THE TAPE PATH ASSEMBLY

Figure ref.	Part Number	Description	Qty
01	95 125293 xx	In-Chute Sensor pcb	1
02	95 125315 xx	Tension Arm Spring	1

Note: the Tape Path Assembly is illustrated in Figure 8.2.1

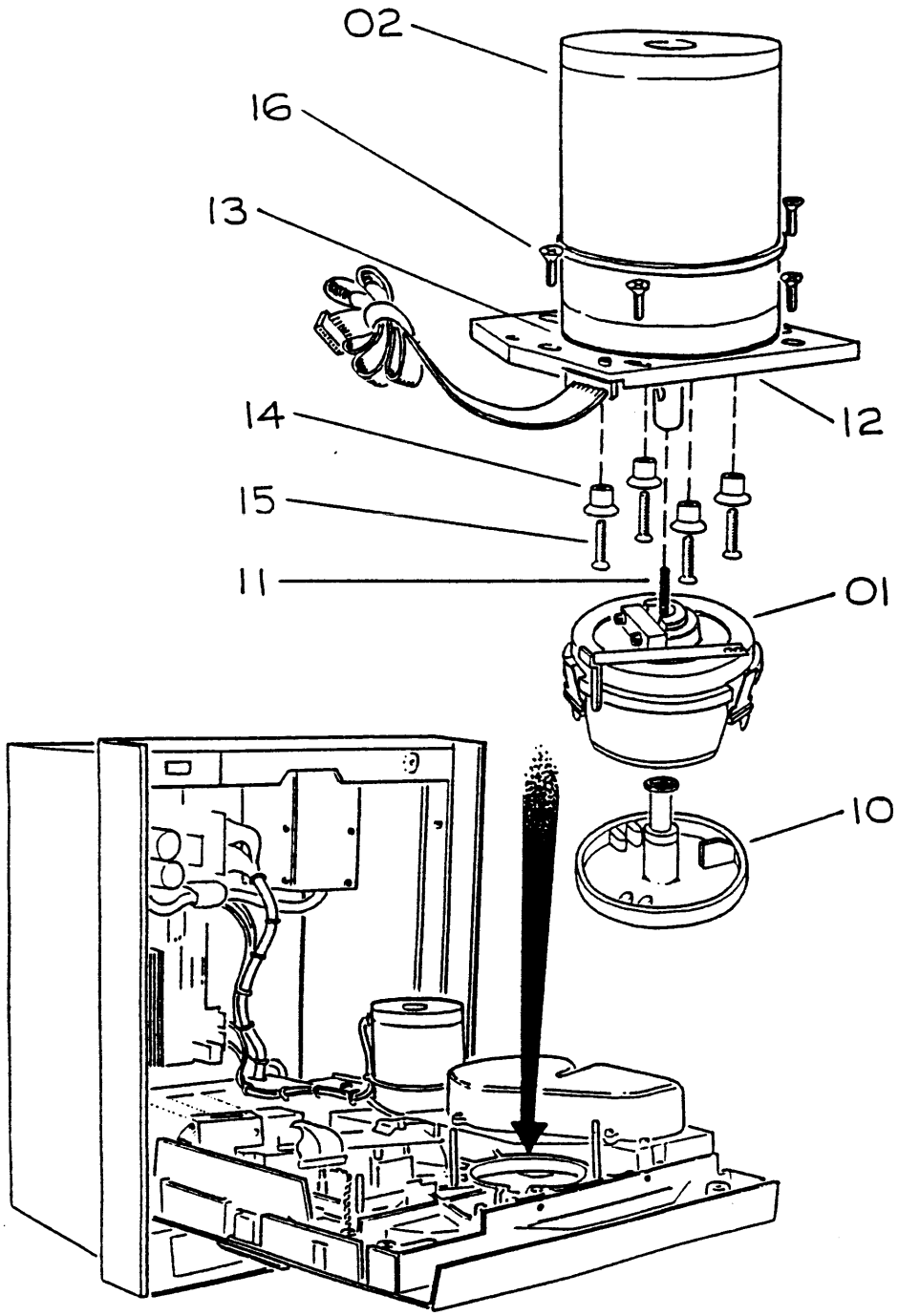

FIGURE 8.2.4 SUPPLY HUB AND MOTOR

Figure ref.	Part Number	Description	Qty
01	95 125147 xx	Supply Hub Assembly *(excl items 10 & 11)*	1
02	95 125150 xx	Supply Reel Motor	1

Attaching Hardware:

Figure ref.		Description	Qty
Supply hub:			
10	95 079169 xx	Ejector Button	1
11	95 111536 xx	Spring, ejector button	1
Supply Hub Motor:			
12	95 125087 xx	Supply Motor Mounting Plate	4
13	95 121393 xx	Insulator	1
14	95 103948 xx	Bush, Motor	4
15	95 041623	SCR, POZ CSK, 8-32x3/4, UNC	4
16	95 041682	SCR, POZ CSK, 8-32x1/2 UNC	6

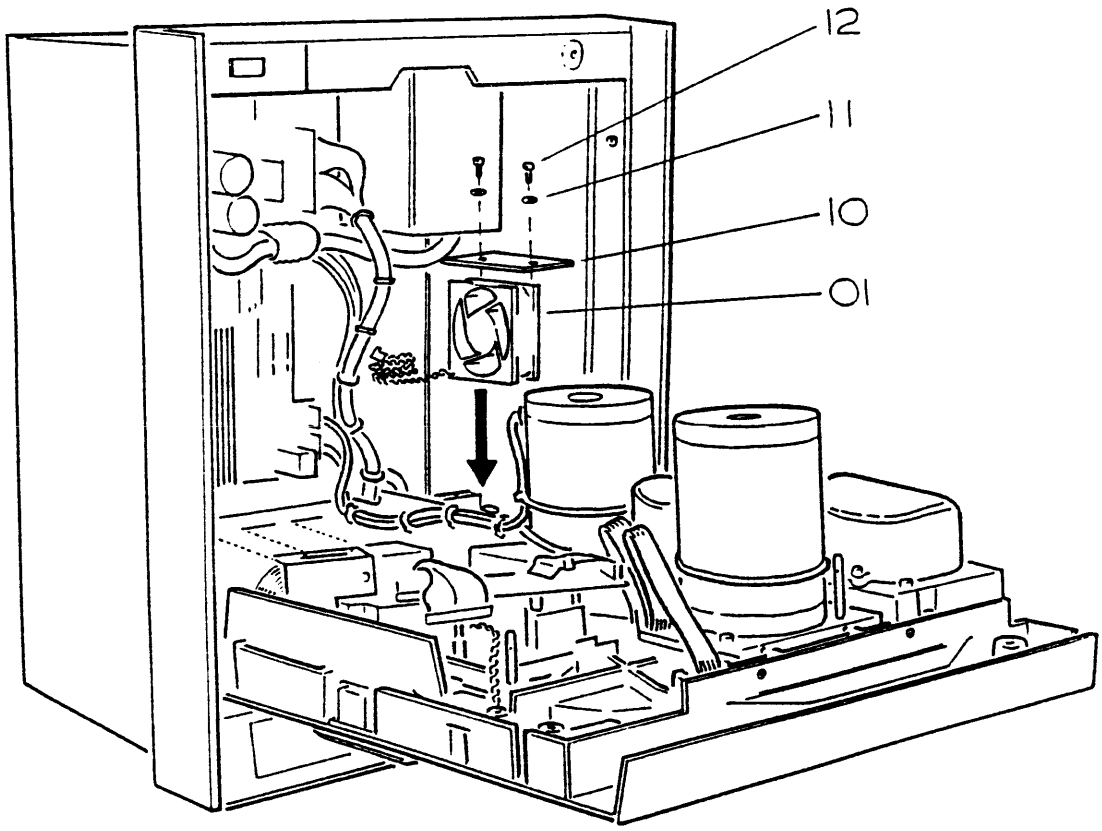

FIGURE 8.2.5 COOLING FAN ASSEMBLY

Figure ref.	Part Number	Description	Qty
01	95 125153 xx	Cooling Fan Assembly	1

Attaching Hardware:

Figure ref.		Description	Qty
10	95 041065	SCR, POZ PAN, 8-32x3/8	2
11	95 041596	WAS, SHP, 8UN, IT	2
12	95 125093 xx	Fan/Filter Cover	1

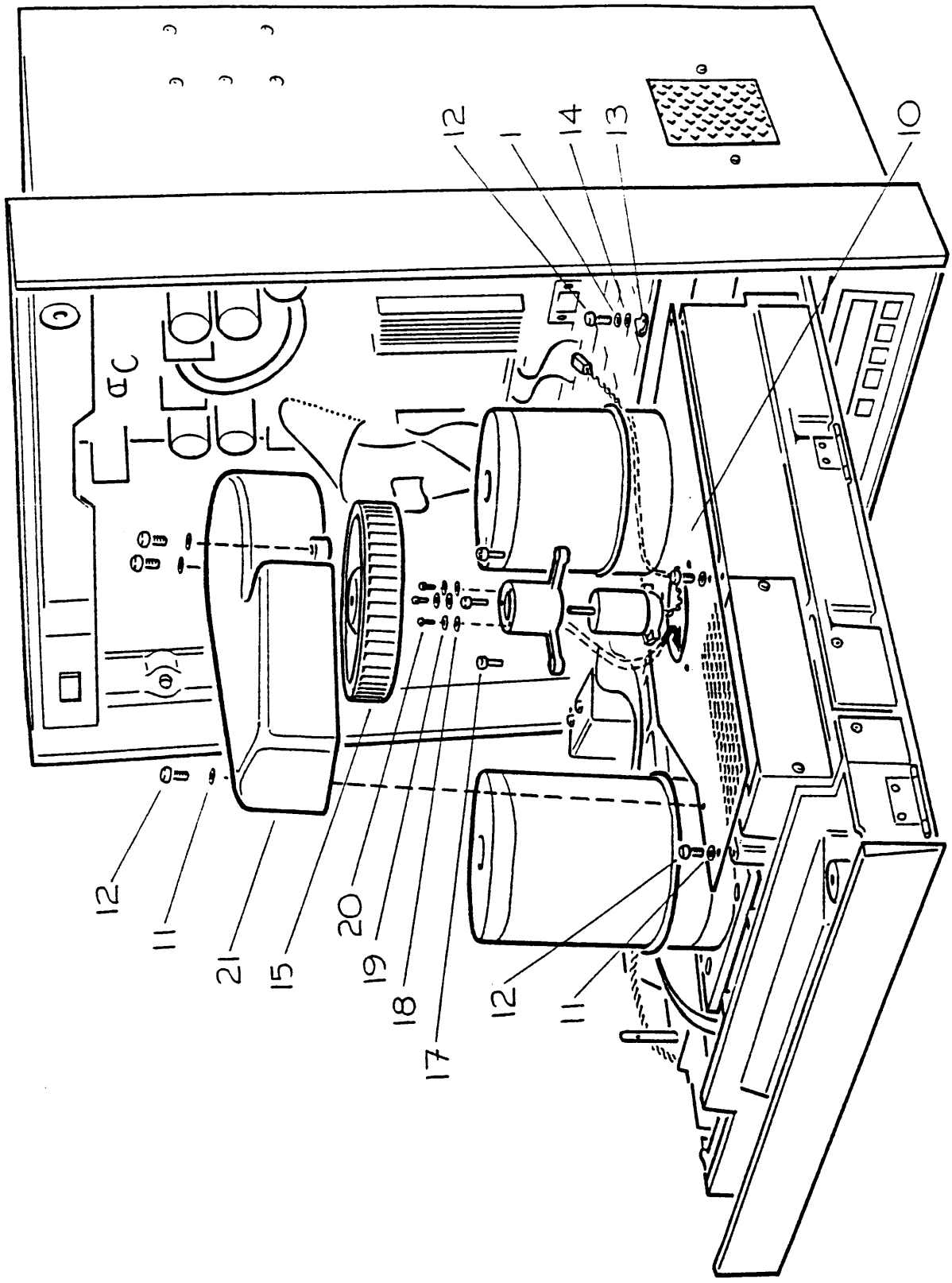

FIGURE 8.2.6 LOADING FAN ASSEMBLY

Figure ref.	Part Number	Description	Qty
01	95 121723 02 or later	Loading Fan Motor	1

Attaching Hardware:

Figure ref.		Description	Qty
10	95 121267 xx	Fan Plate	1
11	95 041596	WAS, 8UN, SHP, IT	7
12	95 041065	SCR, POZ PAN, 6-32x3/8	7
13	95 019052 xx	P Clip	1
14	95 041597	WAS, 8UN PLAIN	1
15	95 062027 xx	Fan Wheel, Aluminium	1
16	95 121852 xx	Motor Mount Moulding	1
17	95 041710	SCR, THR-FM, No.4x1/2	3
18	95 040441	WAS, M3, PLAIN	3
19	95 040449	WAS, SPR, M3, SC	3
20	95 040086	SCR, POZ PAN, M3x6	3
21	95 121811 xx	Fan Casing Moulding	1

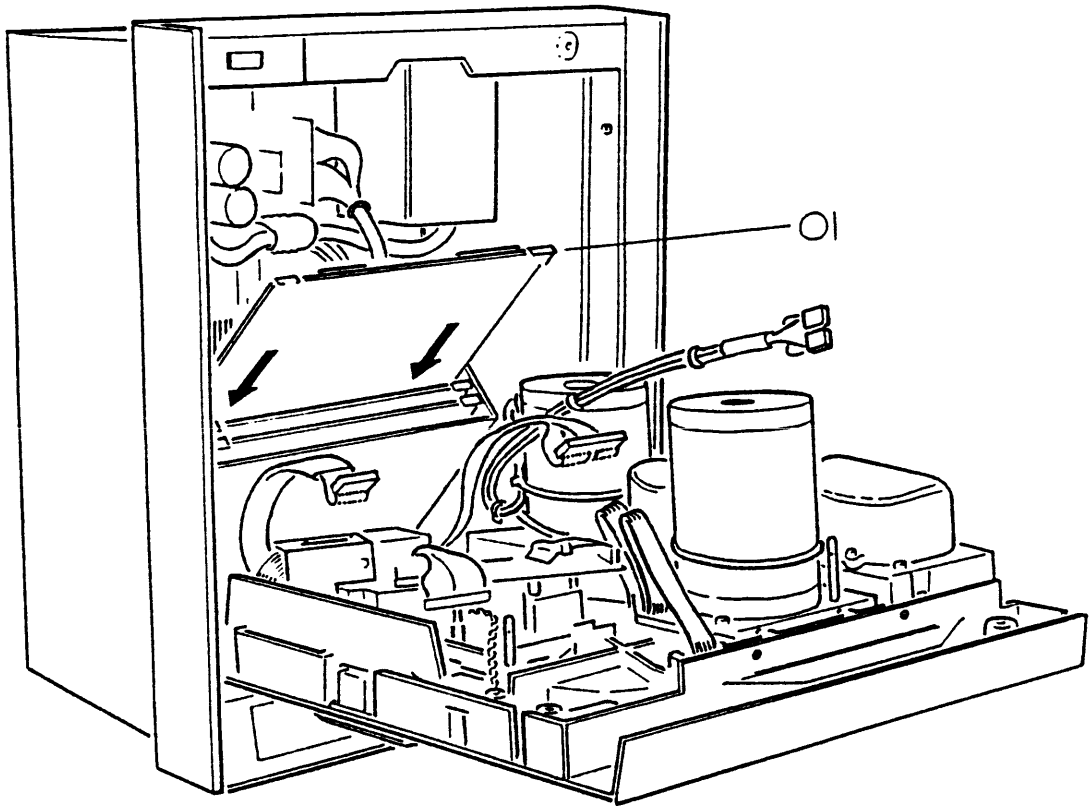

FIGURE 8.2.7 ANALOGUE DATA PATHS BOARD

Figure ref.	Part Number	Description	Qty
01	95 121710 14 or later	Analogue Data Paths board	1

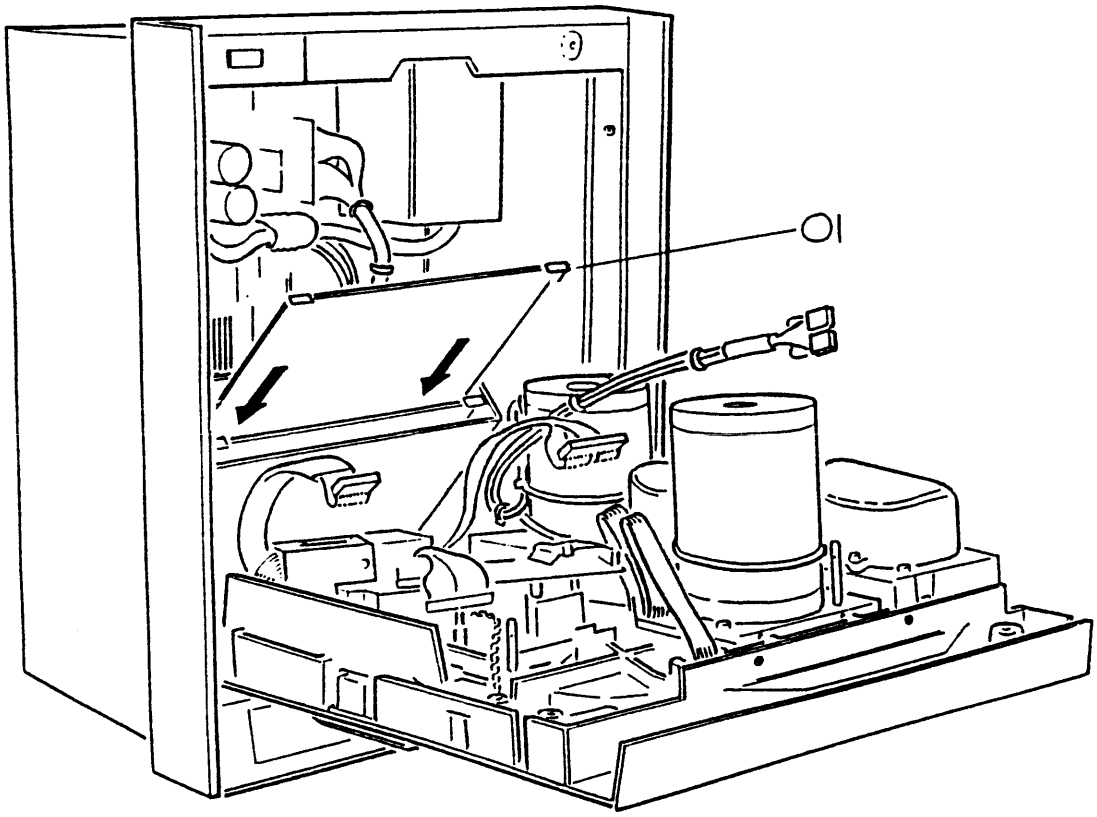

FIGURE 8.2.8 DIGITAL DATA PATHS BOARD

Figure ref.	Part Number	Description	Qty
01	95 123620 12	Digital Data Paths board (42/125 ips machines)	1

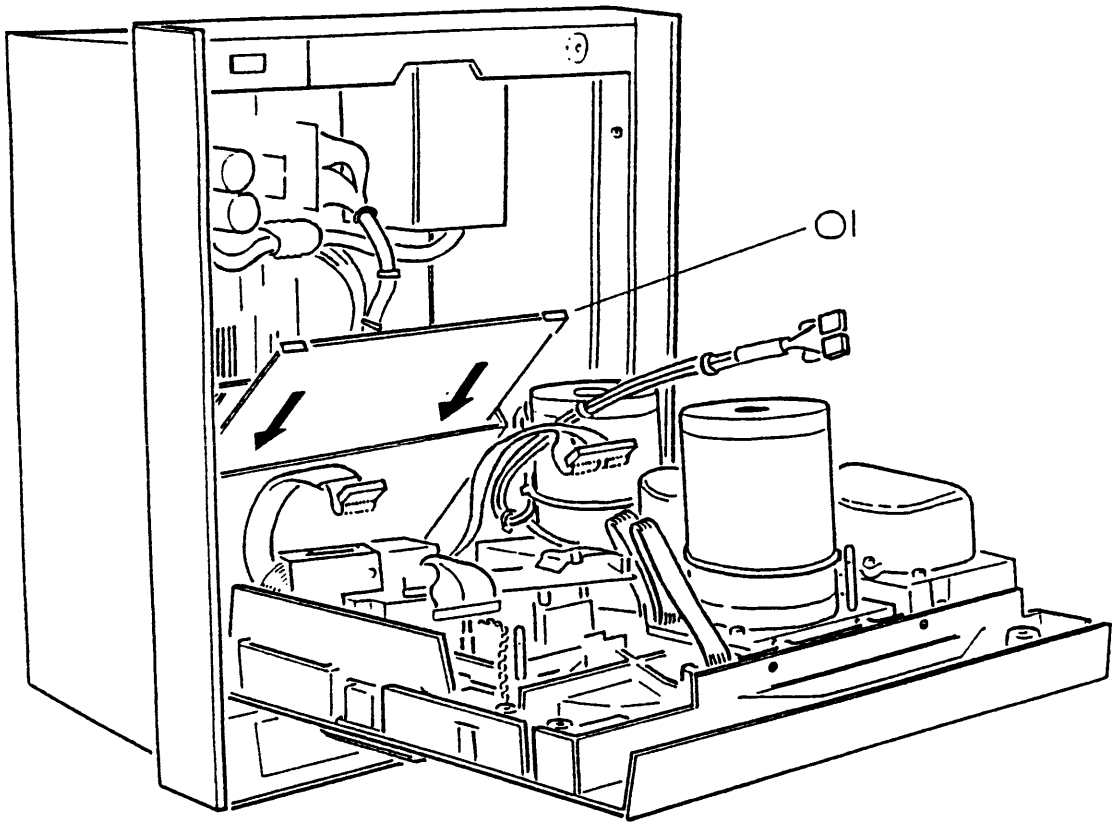

FIGURE 8.2.9 DATA CONTROL BOARD

Figure ref.	Part Number	Description	Qty
01	95 123638 35	Data Control board (42/125 ips machines)	1

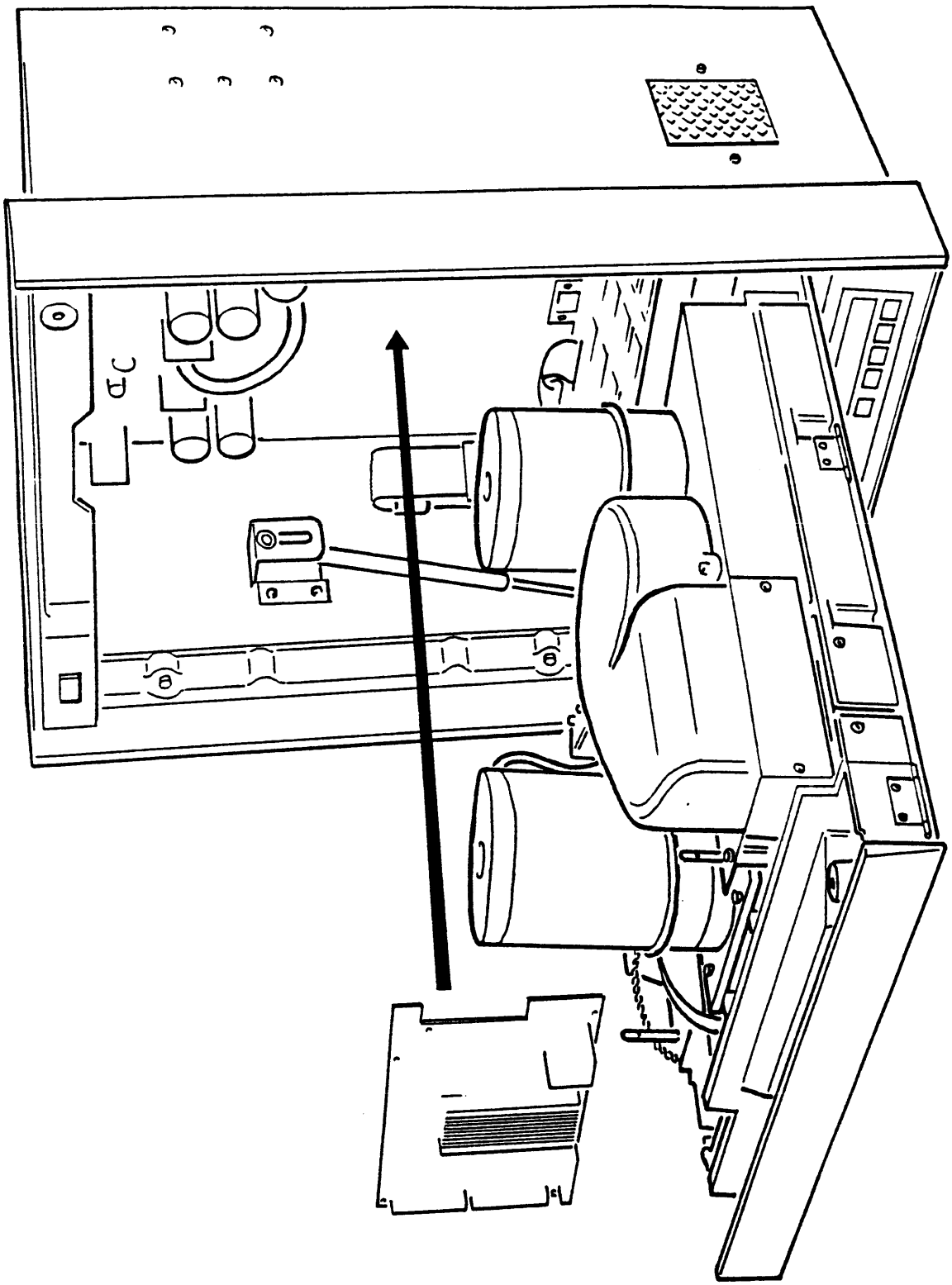

FIGURE 8.2.10 SERVO CONTROL BOARD

Figure ref.	Part Number	Description	Qty
01	95 125370 xx	Servo Control board	1

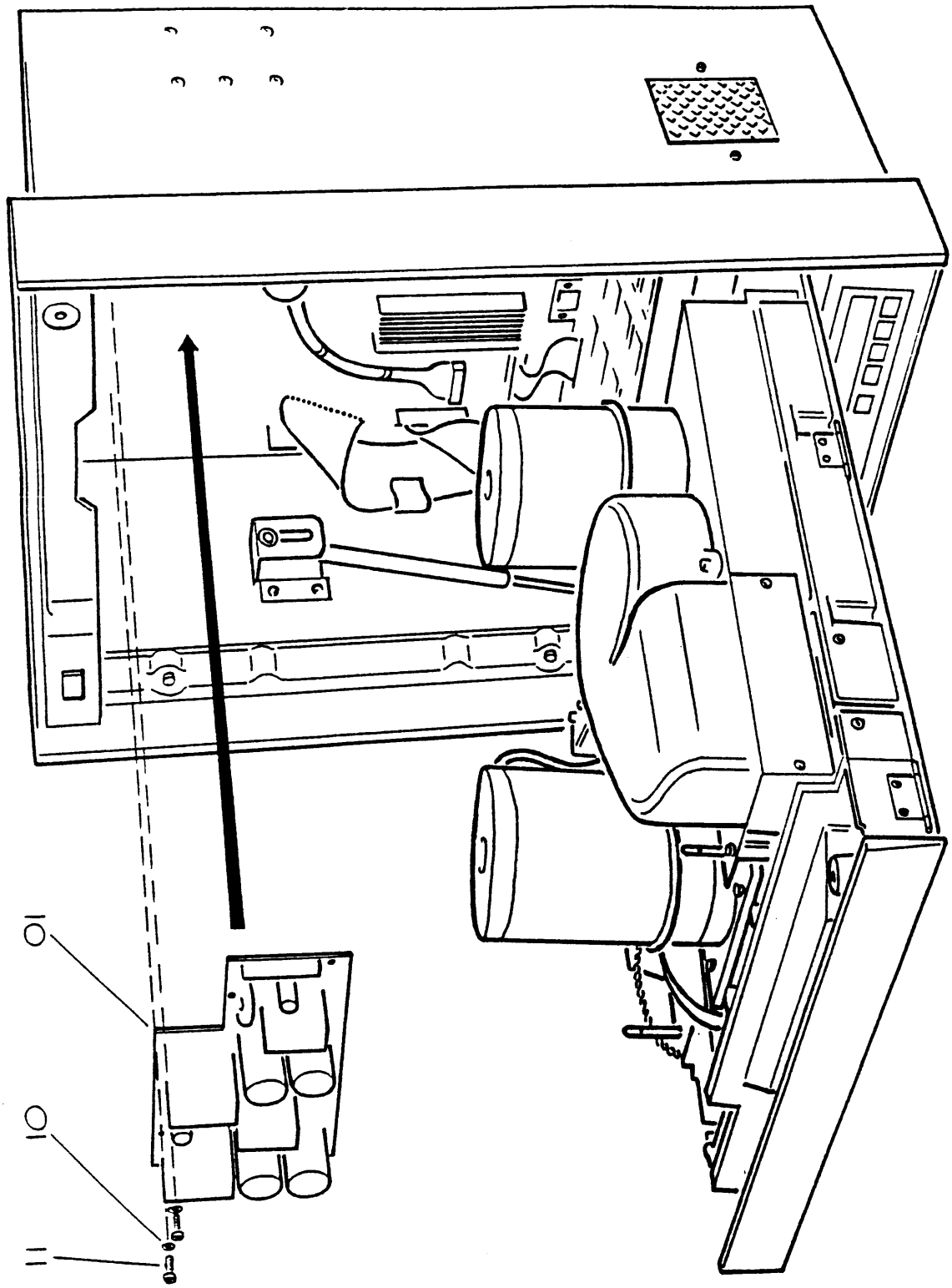

FIGURE 8.2.11 AC POWER SUPPLY BOARD

Figure ref.	Part Number	Description	Qty
01	95 123340 xx	AC Power Supply board	1

Attaching Hardware:

Figure ref.		Description	Qty
10	95 041662	WAS, SHP, 6UN, IT	2
11	95 041056	SCR, POZ PAN, 6-32x1/2 UNC	2

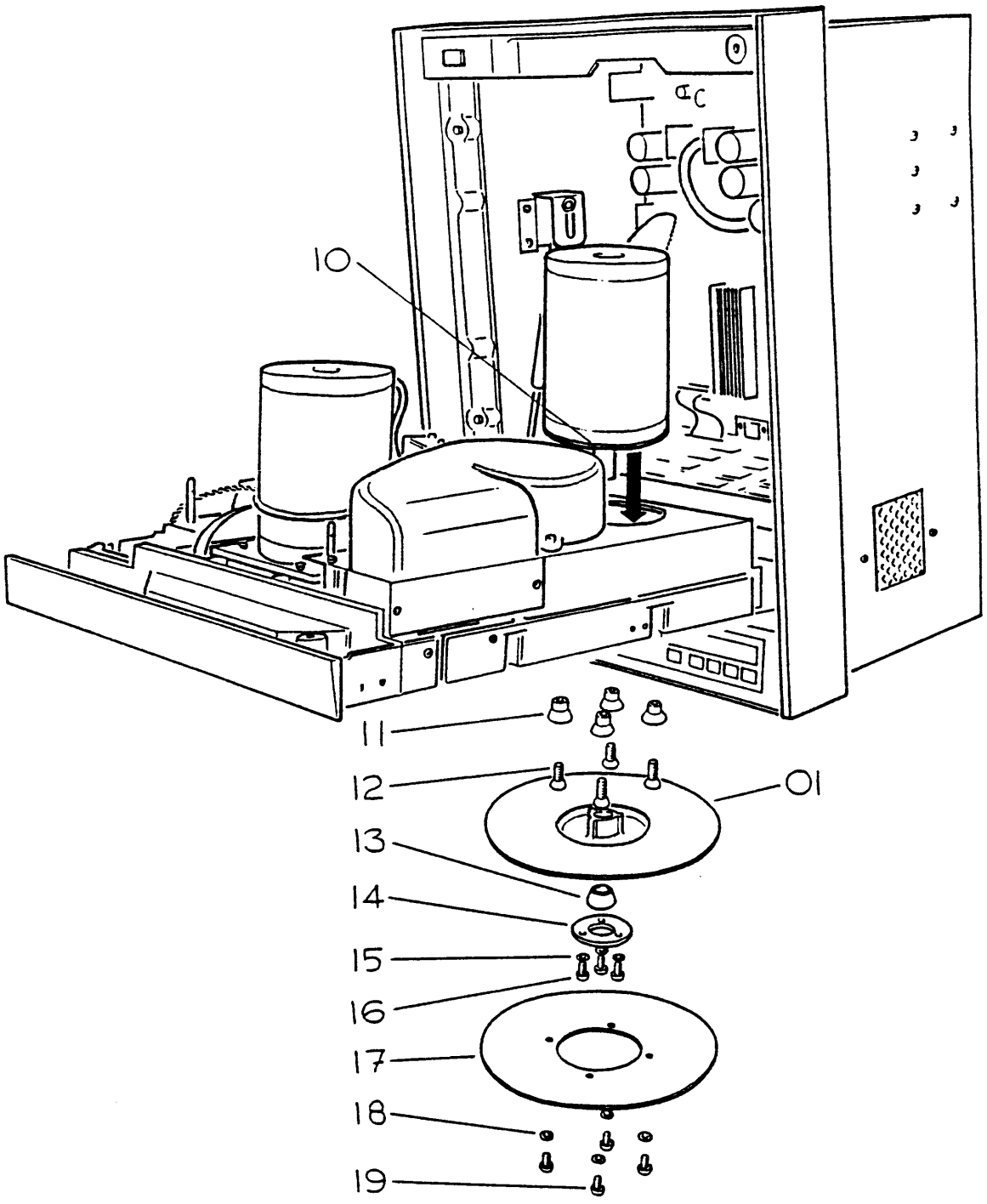

FIGURE 8.2.12 TAKE-UP HUB AND MOTOR

Figure ref.	Part Number	Description	Qty
01	95 121814 xx	Take-Up Hub Assembly *(incl item 17)*	1
02	95 121721 xx	Take-Up Reel Motor Assembly	1

Attaching Hardware:

Figure ref.		Description	Qty
10	95 121393 xx	Insulator	1
11	95 103948 xx	Bush	4
12	95 041623	SCR, CSK, 8-32x3/4	4
13	95 105616 xx	Split Olive	1
14	95 105614 xx	Clamp Ring	1
15	95 041662	WAS, SELF-LOCKING, 6UN	3
16	95 041056	SCR, POZ PAN, 6-32x1/2 UNC	3
17	*95 125439 xx*	*TU Hub Top Flange (metal)*	*1*
18	95 041348	WAS, CRI, 4UN	4
19	95 041044	SCR, POZ PAN, 4-40x5/16 UNC	4

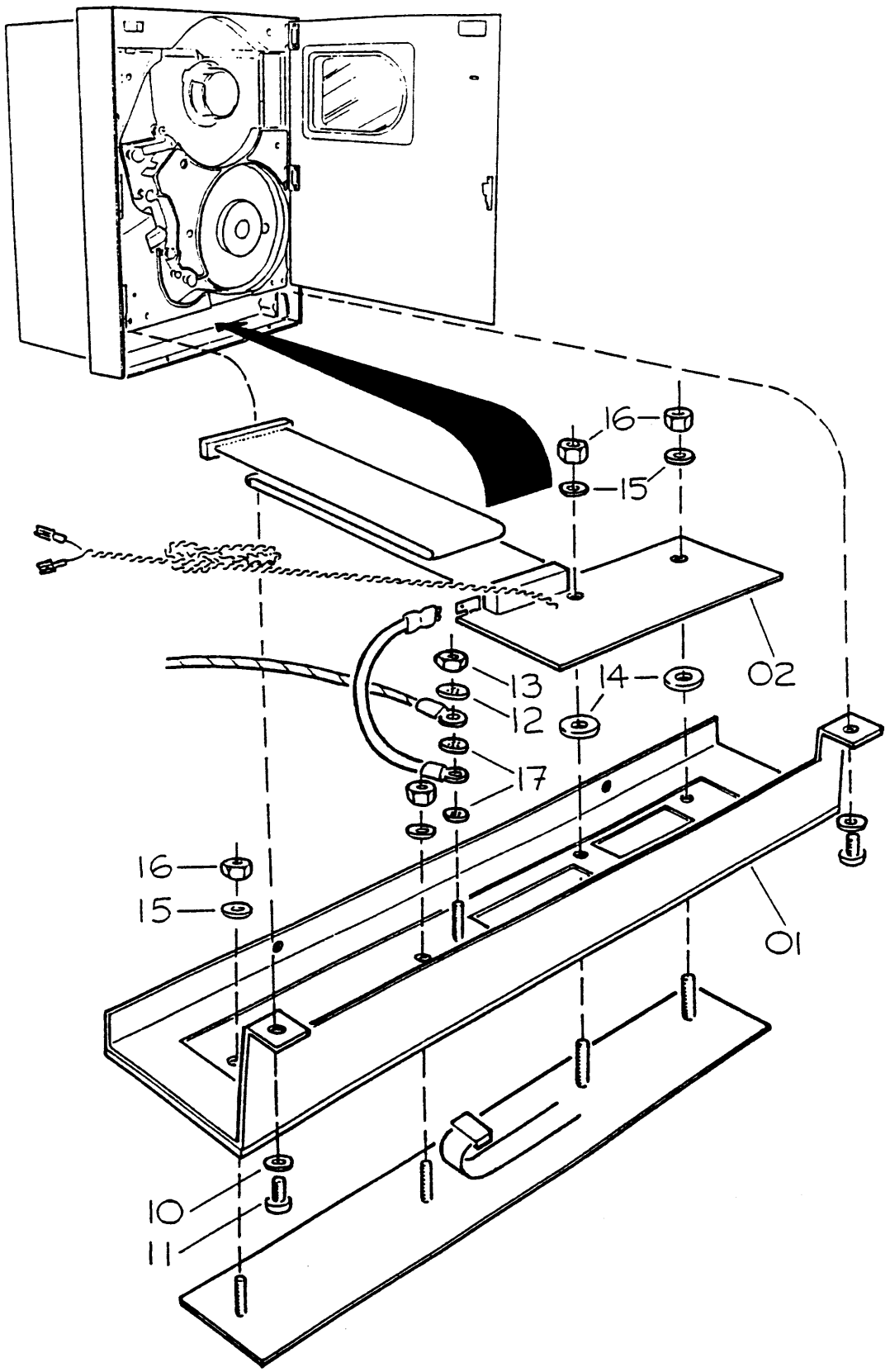

FIGURE 8.2.13 OPERATOR PANEL AND SWITCH FASCIA PCB

Figure ref.	Part Number	Description	Qty
01	95 125240 xx	Operator Panel Assembly	1
02	95 125010 xx	Switch Fascia pcb	1

Attaching Hardware

Figure ref.		Description	Qty
Operator panel:			
10	95 041596	WAS, 8UN, SHP, IT	2
11	95 041065	NUT, FULL HEX, 8UN	2
12	95 041596	WAS, 8UN, SHP, IT	1
13	95 041367	NUT, FULL HEX, 8-32	1
Switch fascia pcb:			
14	95 125115 xx	Spacer	2
15	95 041662	WAS, SHP, 6UN, IT	2
16	95 041413	NUT, HEX, 6UN, FULL	2
17	95 041596	WAS, 8UN, SHP, IT	2

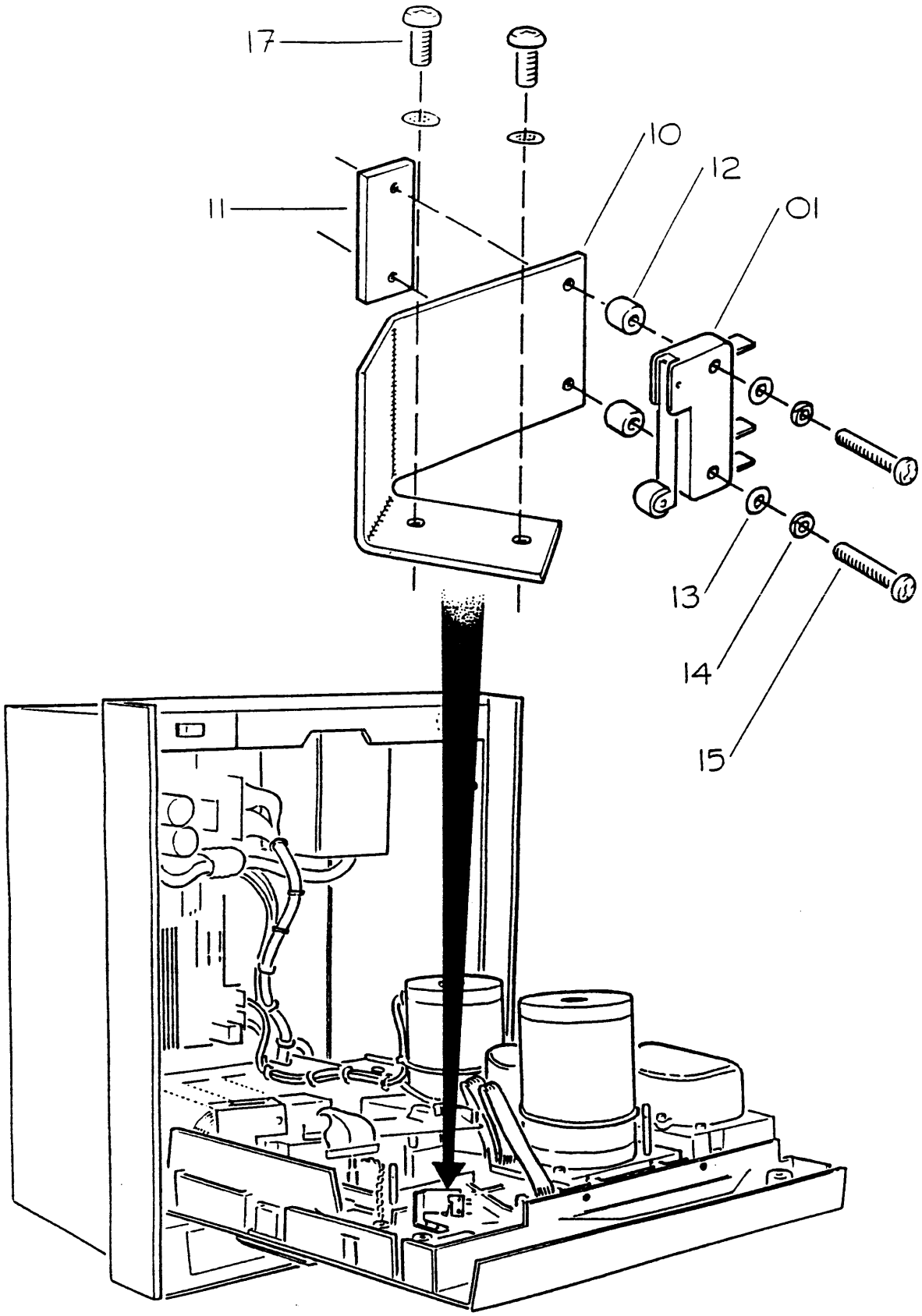

FIGURE 8.2.14 DOOR MICROSWITCH

Figure ref.	Part Number	Description	Qty
01	QS 22835	Door Microswitch	1

Attaching Hardware:

Figure ref.		Description	Qty
10	95 125101 xx	Microswitch Bracket	1
11	95 111376 xx	Nut Plate	1
12	95 109552 xx	Spacer	2
13	95 041353	WAS, PLAIN, 2UN	2
14	95 040844	WAS, SPR, SC, 2UN	2
15	95 041605	SCR, POZ PAN, 2-56x5/8 UNC	2
16	*95 024751*	*Loctite 222 (use on item 17)*	*a/r*
17	95 041051	SCR, POZ PAN, 6-32x5/16	2

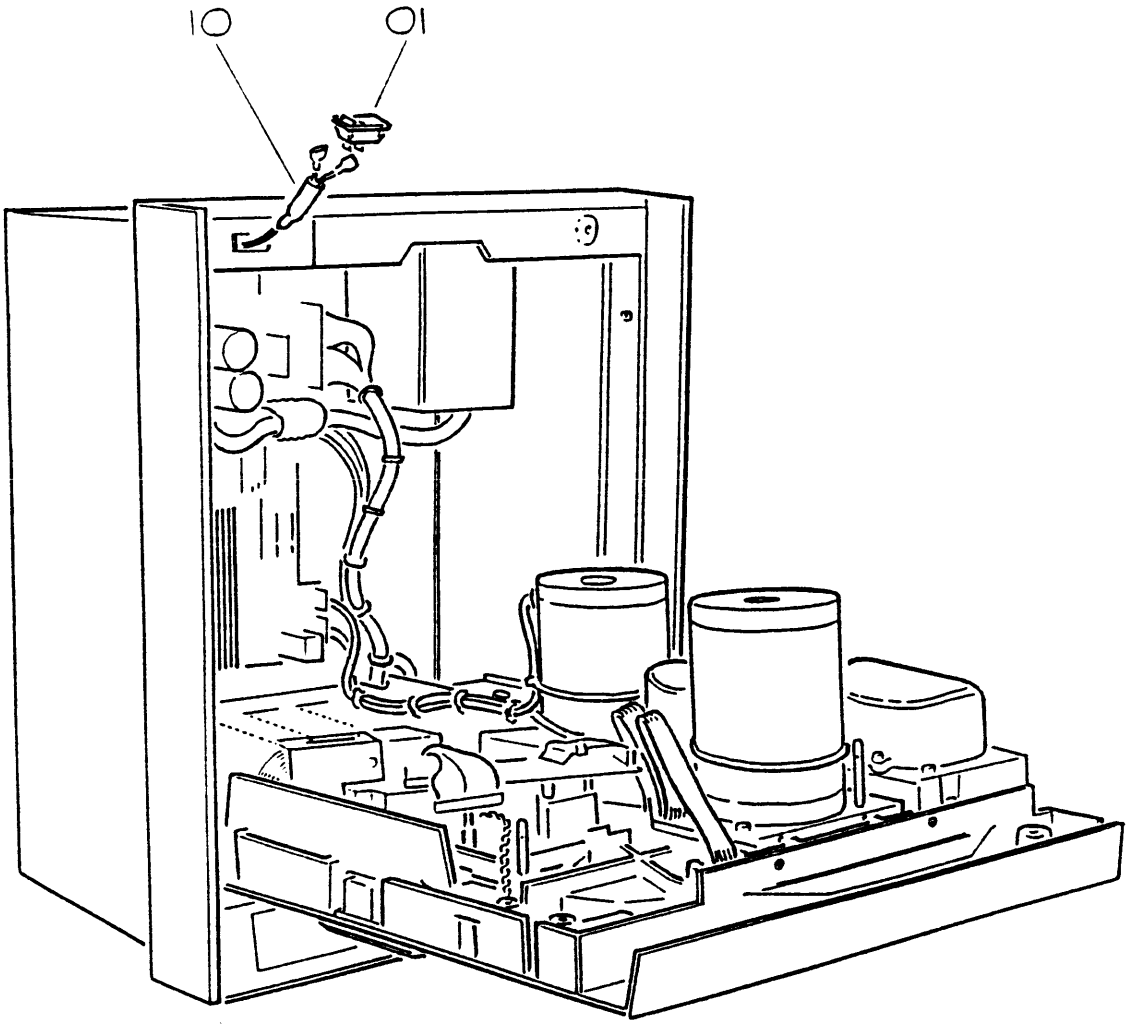

FIGURE 8.2.15 MAINS SWITCH

Figure ref.	Part Number	Description	Qty
01	95 123056 xx	Mains Switch	1

Attaching Hardware:

Figure ref.		Description	Qty
10	95 016316 xx	Insulation Boot	1

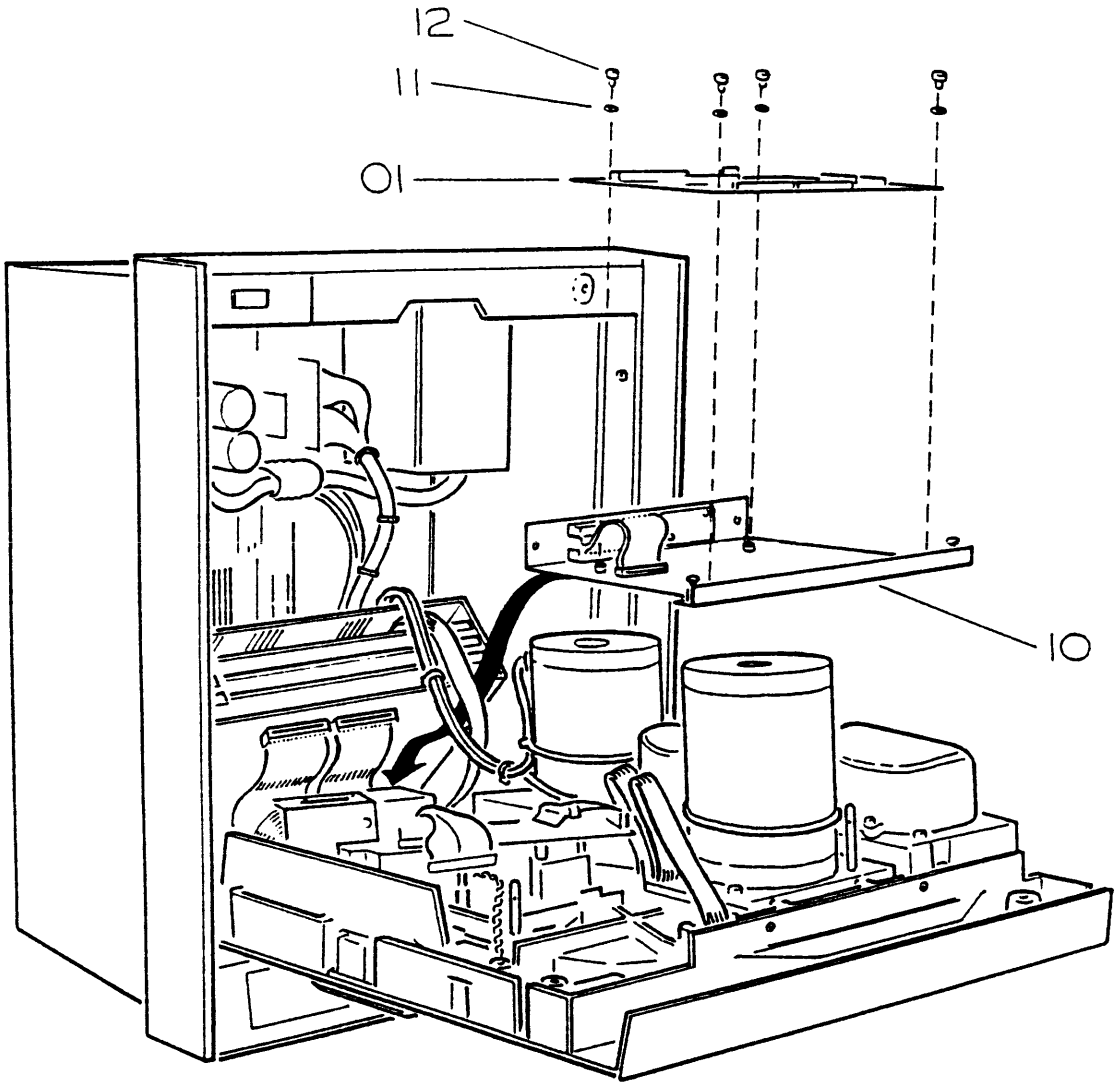

FIGURE 8.3.1 SCSI BOARDS

Figure ref.	Part Number	Description	Qty
01	95 125420 xx	SCSI board (512K, single-ended)	1
01	95 125421 xx	SCSI board (512K, differential)	1
01	95 125431 xx *(to be confirmed)*	Enhanced SCSI board	1

Attaching Hardware:

Figure ref.		Description	Qty
10	95 124907 xx	SCSI Tray	1
11	95 041617	WAS, SHP, 4 UN, IT	4
12	95 041043	SCR, POZ PAN, 4-40x1/4	4

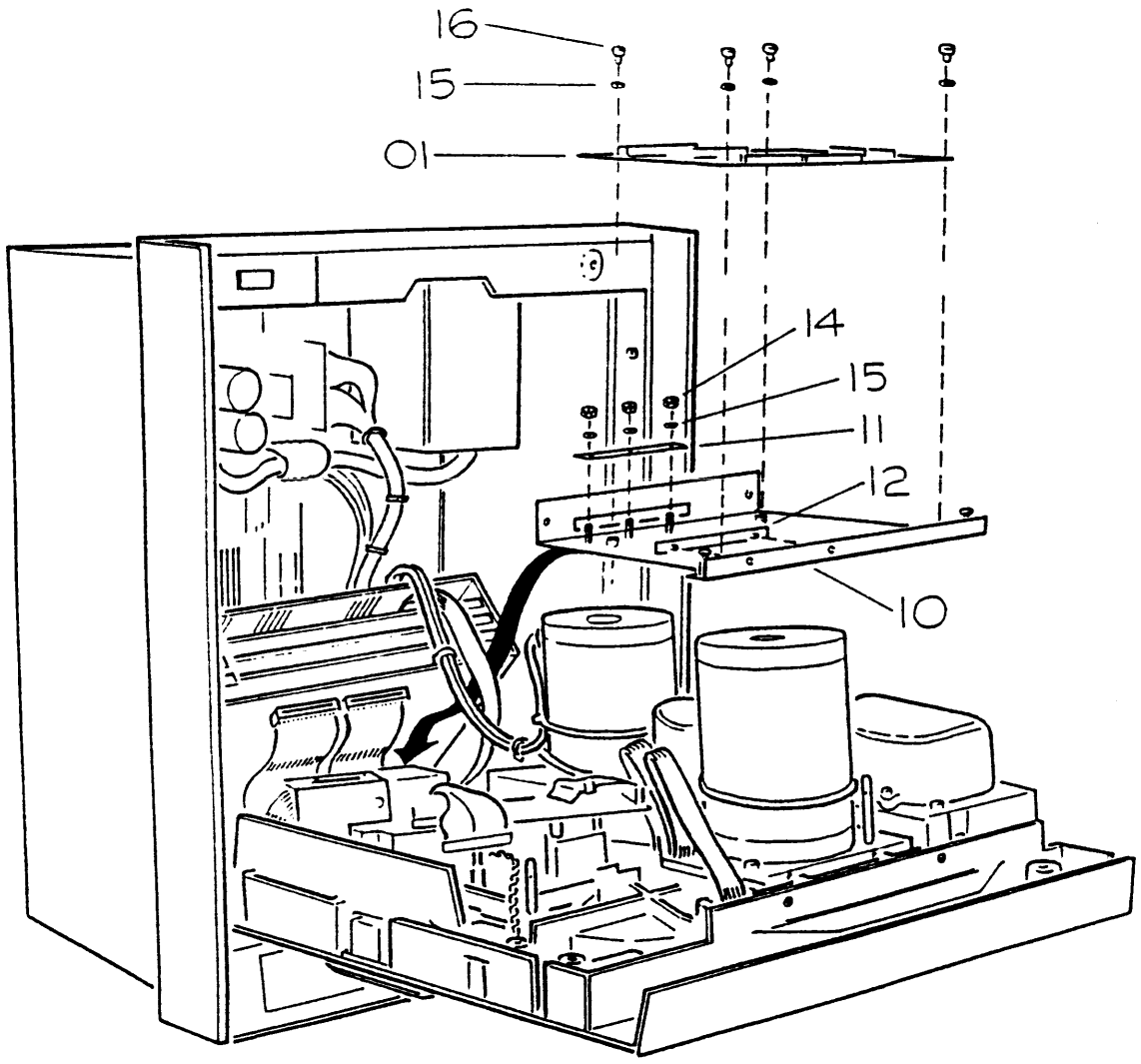

FIGURE 8.3.2 PERTEC CACHE BOARDS

Figure ref.	Part Number	Description	Qty
01	95 125480 xx *(pending confirmation)*	Pertec Cache Interface board (1 MB memory)	1

Attaching Hardware:

Figure ref.		Description	Qty
10	95 124908 xx	Pertec Cache Tray	1
11	95 123933 xx	Clamp Bar	1
12	95 060938	Guide, pcb	1
13	95 041596	WAS, SHP, 8 UN, IT	3
14	95 041367	NUT, FULL HEX, 8UN	3
15	95 041617	WAS, SHP, 4 UN, IT	8
16	95 041043	SCR, POZ PAN, 4-40x1/4	8

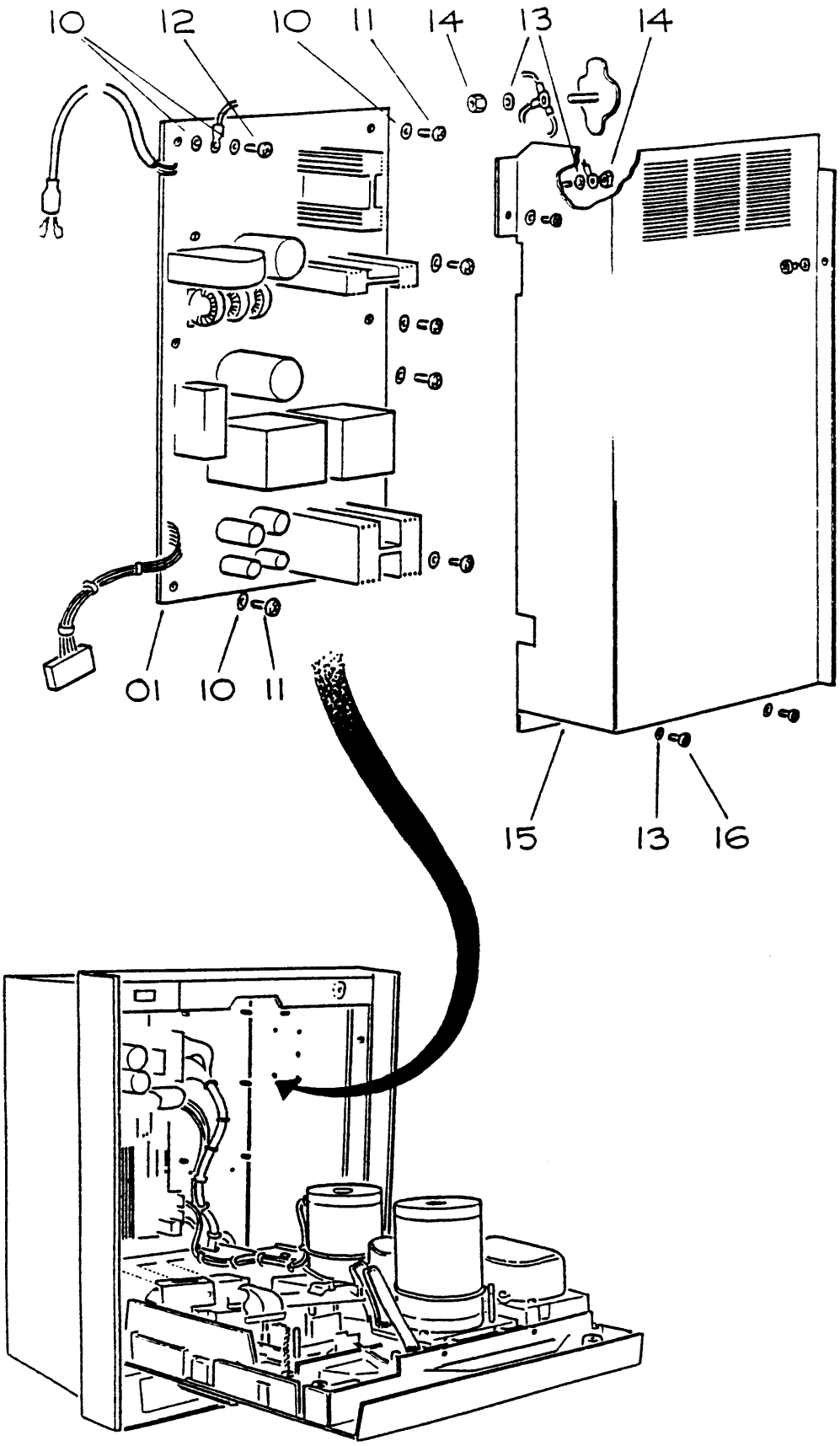

FIGURE 8.3.3 DC POWER SUPPLY PCB

Figure ref.	Part Number	Description	Qty
01	95 124920 xx	DC Power board *(standard)*	1
01	95 125543 xx	DC Power board *(3-pin power input)*	1

Attaching Hardware:

Figure ref.		Description	Qty
Power Supply Board:			
10	95 041662	WAS, SHP, 6UN	8
11	95 041054	SCR, POZ PAN, 6-32x3/8	6
12	95 041056	SCR, POZ PAN, 6-32x1/2	1
Power Supply Cover:			
13	95 041596	WAS, SHP, 8UN, IT	6
14	95 041367	NUT, FULL HEX, 8UN	2
15	95 125089 xx	Cover for DC PSU	1
16	95 040955	SCR, POZ PAN, 8-32x1/4	4

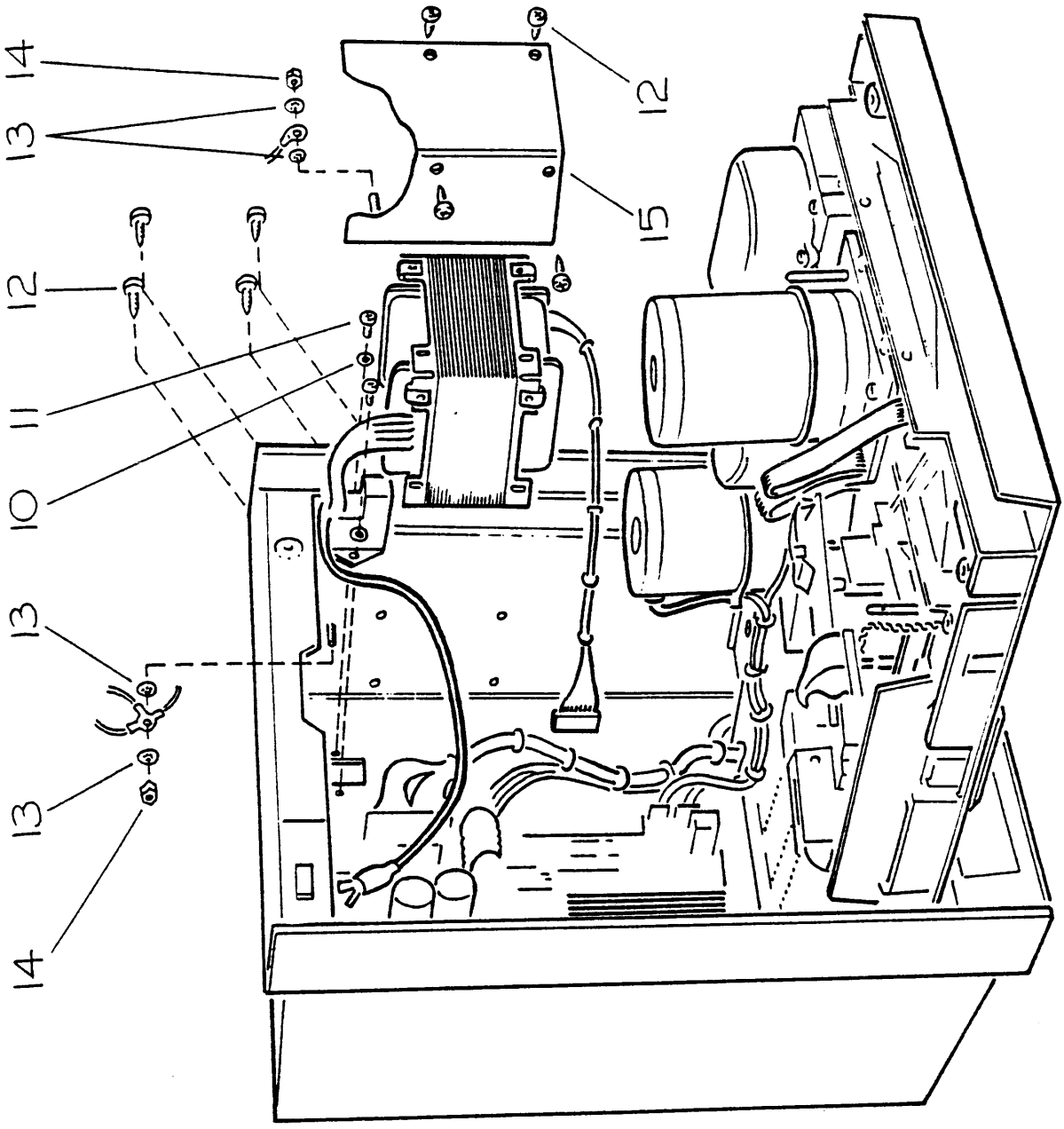

FIGURE 8.4.1 MAINS TRANSFORMER ASSEMBLY

Figure ref.	Part Number	Description	Qty
01	95 125154 xx	Mains Transformer	1

Attaching Hardware:

Figure ref.		Description	Qty
10	95 041351	WAS, PLAIN, 4UN	2
11	95 041044	SCR, POZ PAN, 4-40 UN, IT	2
12	95 041612	SCR, POZ PAN, THR-FM (type B), No.10x1/2	8
13	95 041596	WAS, SHK, 8UN, IT	4
14	95 041367	NUT, FULL HEX, 8UN	2
15	95 125005	Transformer cover	1

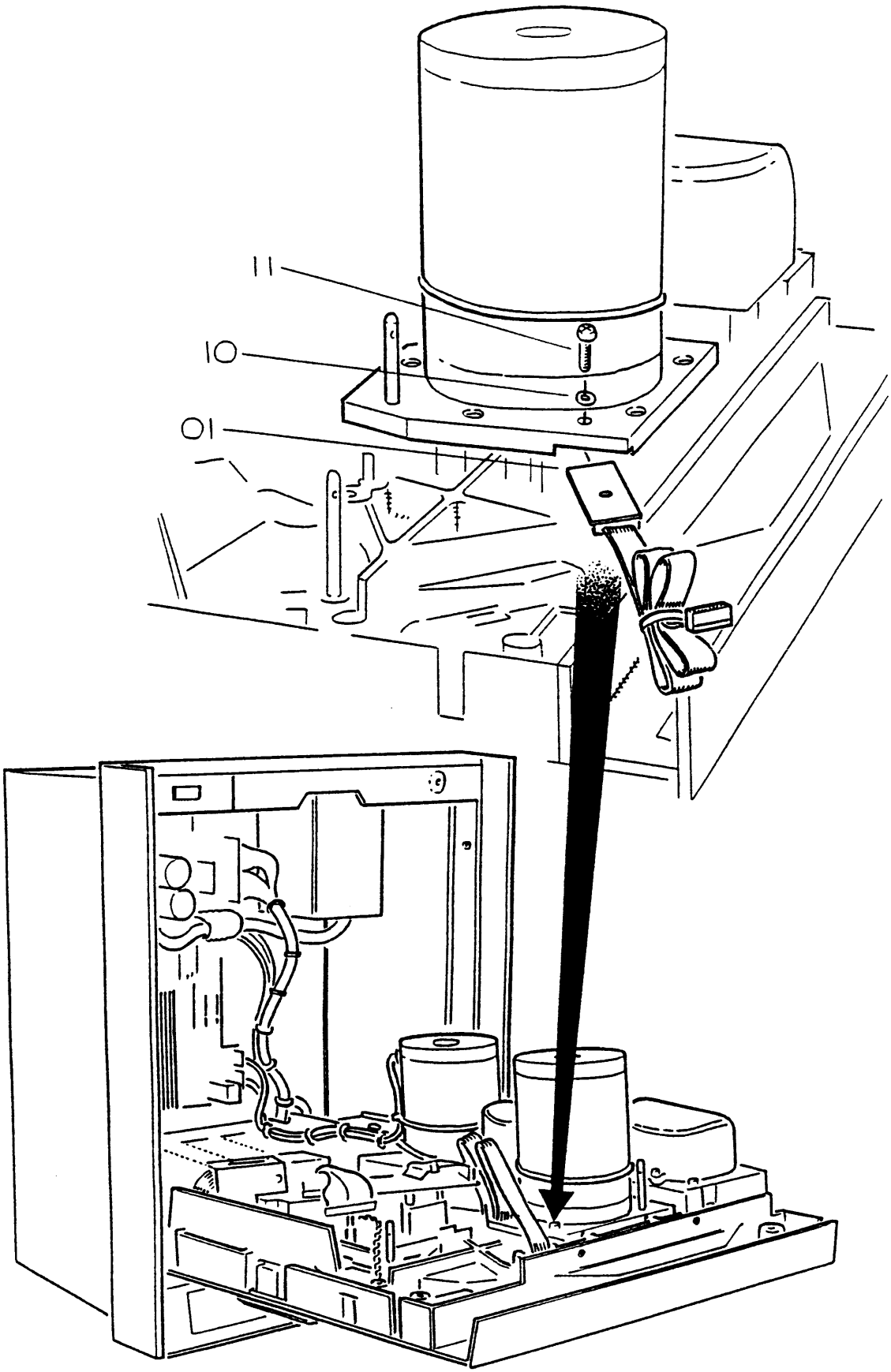

FIGURE 8.4.2 HUB SENSOR PCB

Figure ref.	Part Number	Description	Qty
01	95 125151 xx	Hub Sensor pcb	1

Attaching Hardware

Figure ref.		Description	Qty
10	95 041346	WAS, CRI, 6UN	1
11	95 041057	SCR, POZ PAN 6-32x5/8 UNC	1

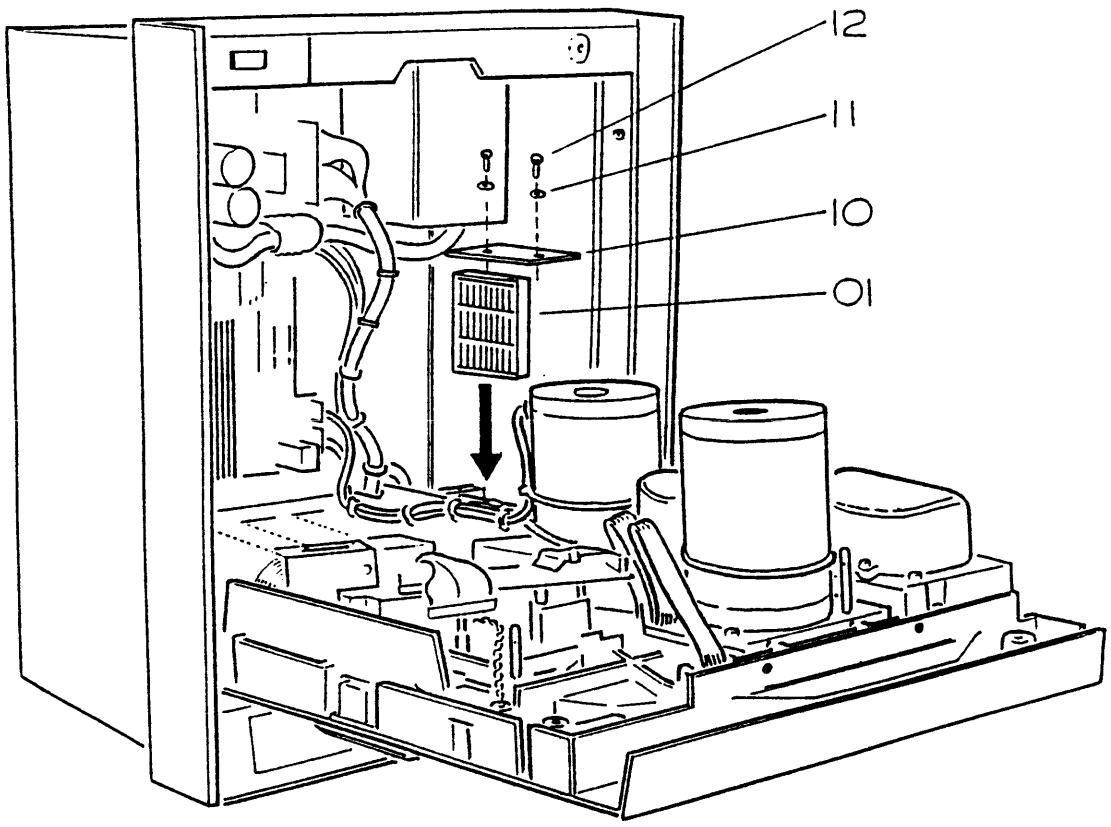

FIGURE 8.4.3 AIR FILTER

Figure ref.	Part Number	Description	Qty
01	95 125156 xx	Air Filter	1

Attaching Hardware:

Figure ref.		Description	Qty
10	95 125093 xx	Fan/Filter Cover	1
11	95 041596	WAS, SHK, 8UN, IT	2
12	95 041065	SCR, POZ PAN, 8-32x3/8	2

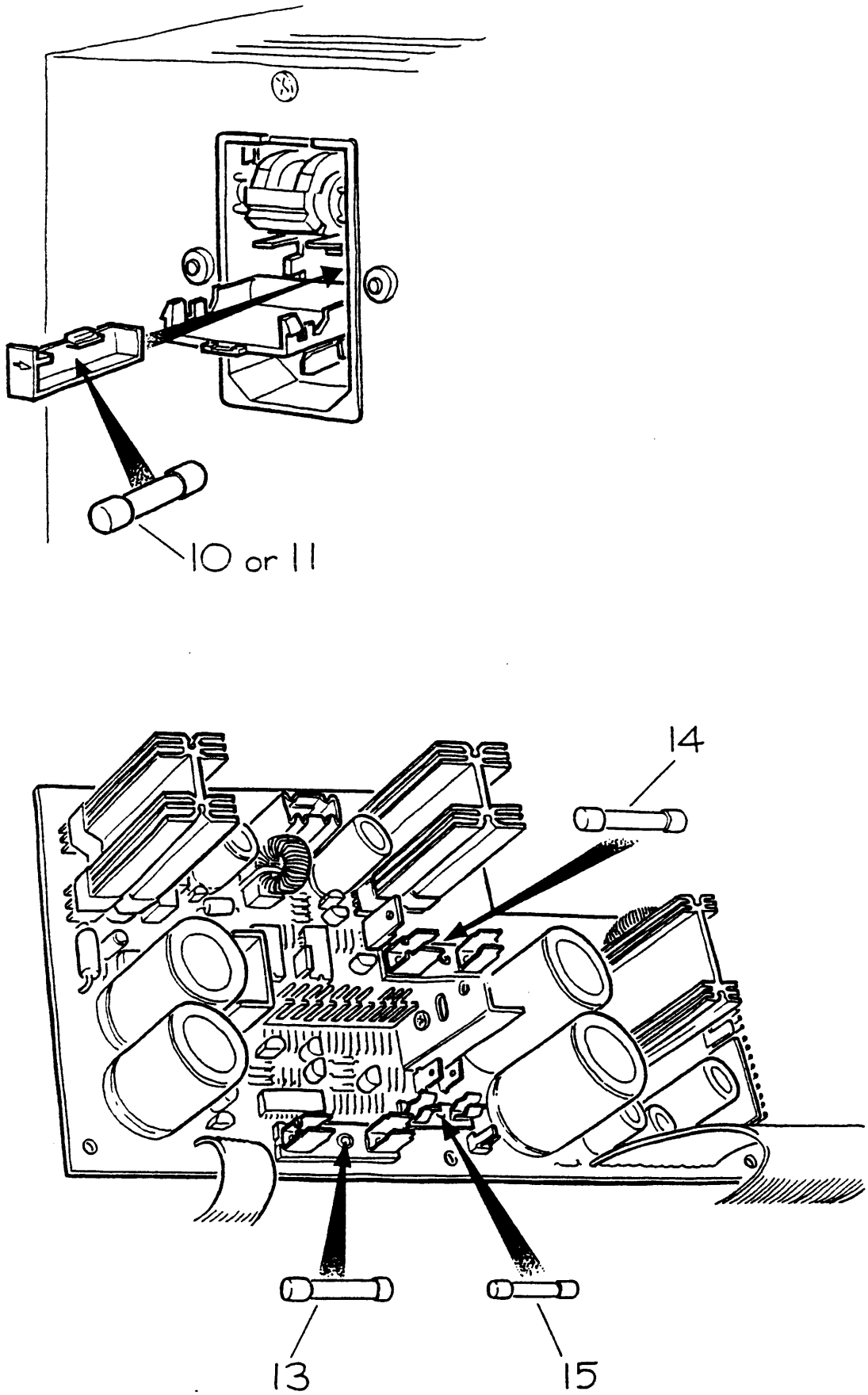

FIGURE 8.4.4 AC FUSE KIT

Figure ref.	Part Number	Description	Qty
01	95 XXXXXX xx *(to be allocated)*	AC Fuse Kit	1

Kits consists of:

Figure ref.		Description	Qty
10	95 023248	1.25" x 0.25" 2.0 A Slo-Blo Anti-Surge Fuse *(for 110V systems)*	1
11	95 023381	1.25" x 0.25" 4.0 A Slo-Blo Anti-Surge Fuse *(for 240V systems)*	1
13	95 023397	1.25" 4.0 A Fast-Blo Fuse	1
14	95 023404	1.25" 6.0 A Fast-Blo Fuse	1
15	95 023398	2.0 A Fast-Blo Fuse	1

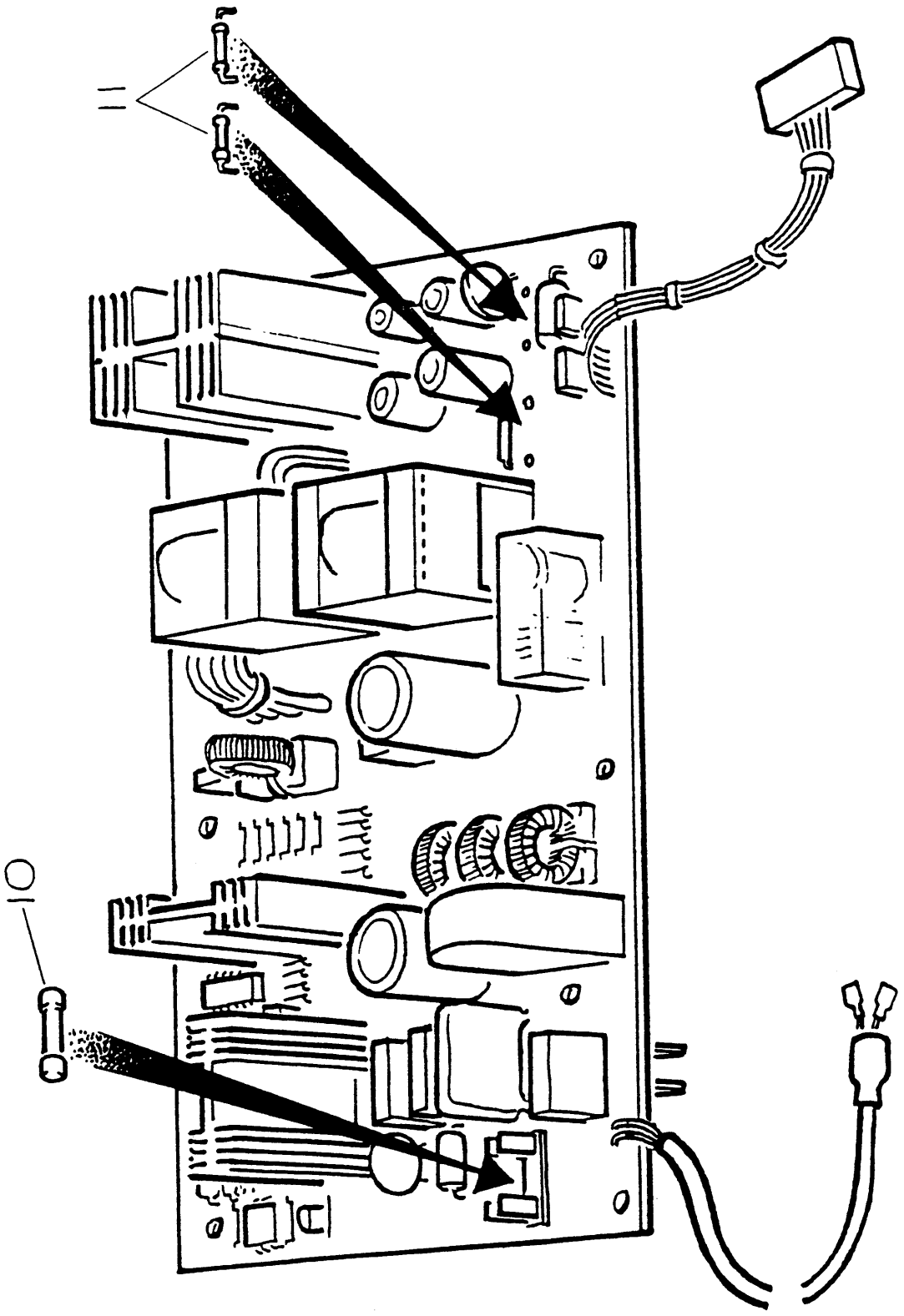

FIGURE 8.4.5 DC FUSE KIT

Figure ref.	Part Number	Description	Qty
01	95 XXXXXX xx *(to be allocated)*	DC Fuse Kit	1

Kits consists of:

Figure ref.		Description	Qty
10	95 023414	20 mm x 0.05 M 5.0 A Fast-Blo Fuse	1
11	95 023386	Wire-in 7.0 A Fast-Blo Anti-Surge Fuse	2

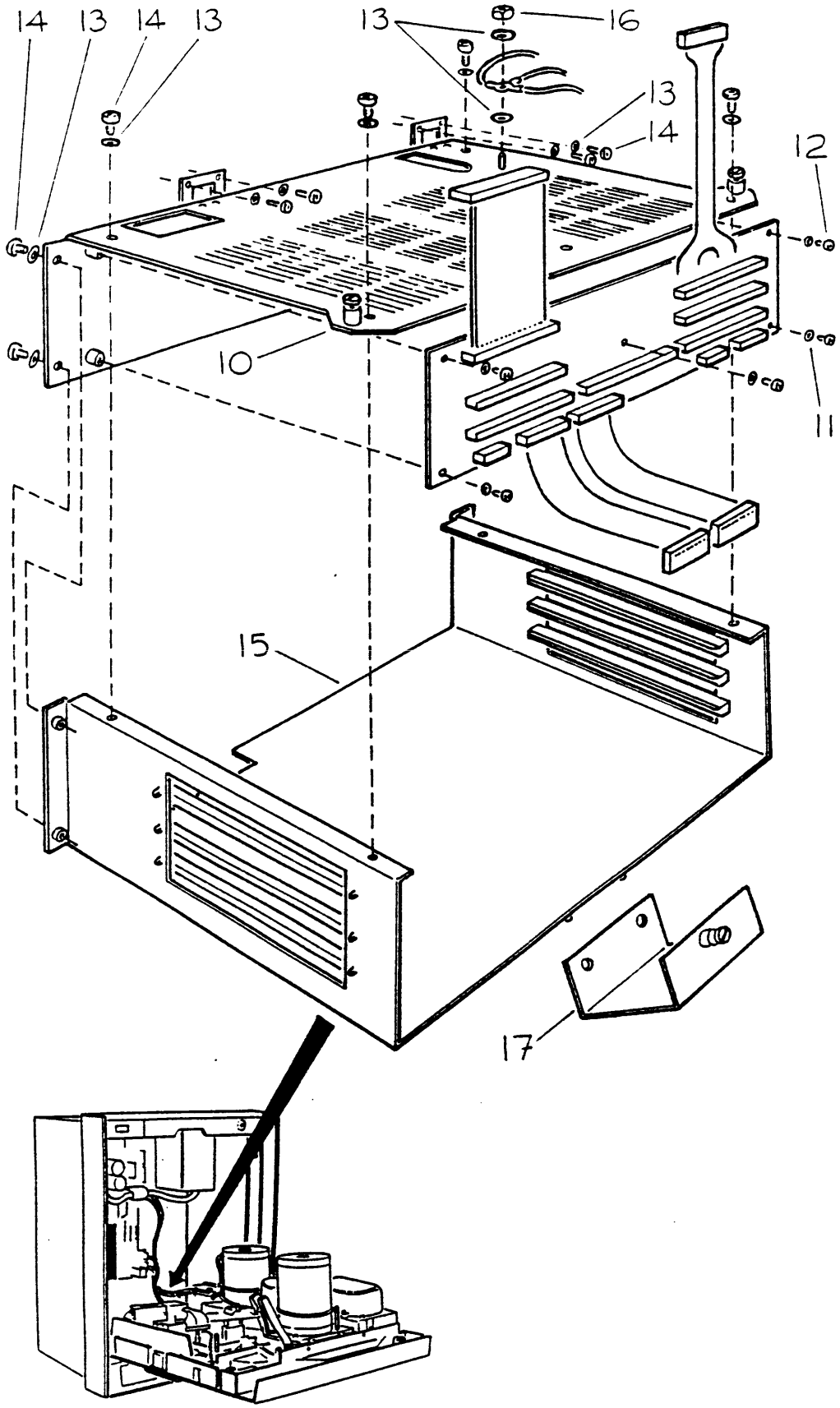

FIGURE 8.4.6 MOTHERBOARD

Figure ref.	Part Number	Description	Qty
01	95 124960 xx	Motherboard	1

Attaching Hardware:

Figure ref.		Description	Qty
10	95 125004 xx	Motherboard Mounting Plate	1
11	95 041662	WAS, SELF-LOCK, 6UN, IT	5
12	95 041053	SCR, POZ PAN, 6-32x5/16	5
13	95 041596	WAS, SELF-LOCK, 8UN, IT	14
14	95 040955	SCR, POZ PAN, 8-32x1/4	12
15	95 125003 xx	Card Cage	1
16	95 041367	NUT, FULL HEX, 8UN	1
17	95 125090 xx	PCB Retainer	1

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