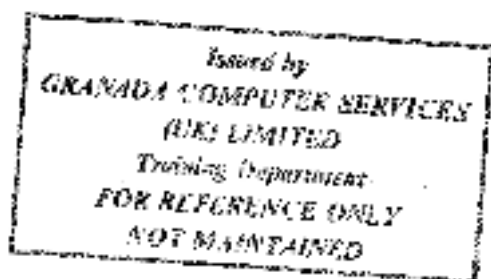


TU80 Magnetic Tape Subsystem

Pocket Service Guide



Prepared by Educational Services
of
Digital Equipment Corporation

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PREFACE

This document is designed to be used by someone trained to service a TC-80 subsystem. Procedures are brief, concise, and support the maintenance philosophy of module replacement.

The first two chapters provide product overview and installation information for quick review. Chapter 3 is troubleshooting information. By using diagrams and control panel features you can quickly locate malfunctions. Chapter 4 provides removal and replacement procedures. Appendix A provides electronic module layout. This document does not include programming information, but Appendix B does provide register summaries and definitions. There is a troubleshooting flowchart, which shows troubleshooting procedures, on the foldout in back of this document.



1 INTRODUCTION

1.1 GENERAL

The TU80 Magnetic Tape Subsystem is a dual-speed, nine-track streaming tape data storage system. The TU80 Tape Transport is a fully integrated tape transport, packaged with all its control and power electronics in a standard 11-6043 cabinet. The transport communicates with a host system via a shielded in-line cable assembly connected to a M7454 UNIBUS adapter, plugged into the SPC slot of the host CPU.

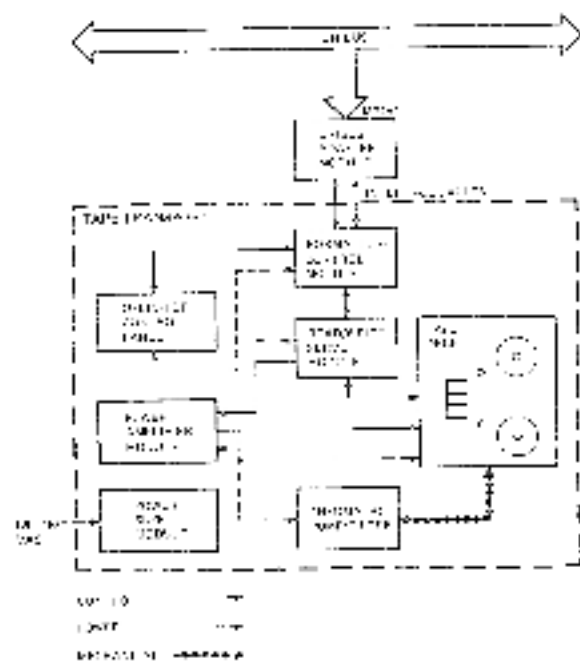
1.2 SUBSYSTEM OVERVIEW

Figure 1-1 shows the TU80 subsystem functional block diagram. Figure 1-2 shows the cabling diagram.

NOTE

You can connect up to four TU80 tape transports to a single host CPU (Figure 1-3). Each TU80 interfaces with the CPU through a dedicated UNIBUS adapter module (M7454) and interface cable assembly.

Refer to Paragraph 2.3 for M7454 installation and set-up.



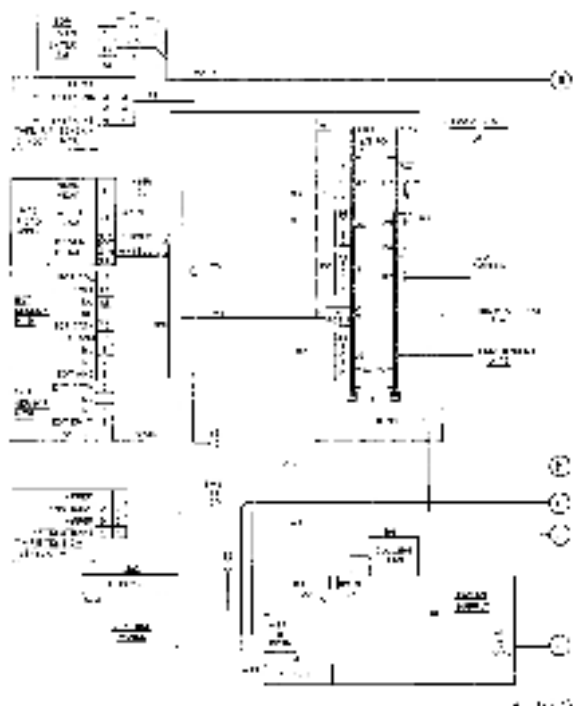
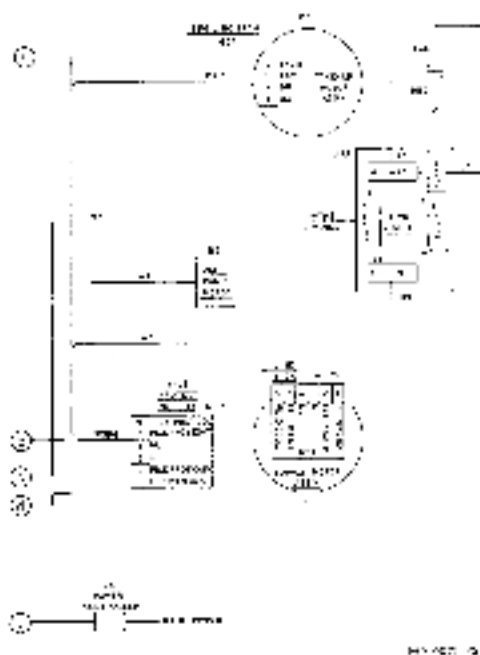
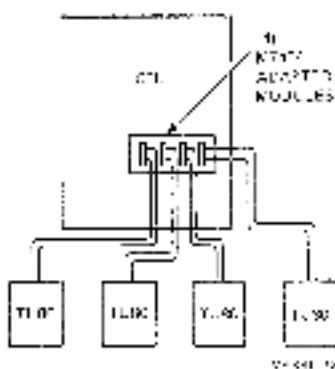


Figure 1-2 Typical Emergency Cooling Diagram
(Sheet 1 of 2)



HY-001-12

Figure 1-2 Type Transport Cabling Diagram
(Sheet 2 of 3)



HY-001-12

Figure 1-3 Maximum CPU Configuration

1.3 TUSO CONFIGURATION

Figure 1-5 shows the TUSO subsystem basic components. The transport is currently mounted in the upper portion of the H9643 cabinet. Figure 1-5 shows the tape deck.

NOTE

To ease TUSO transport maintenance, the transport deck is mounted on a pivot. The deck can be rotated from horizontal (operational) position to vertical (service) position. A special service lock (tape deck latch) on the left side of the cabinet under the tape deck, keeps the deck in one of those positions. (For more maintenance information, refer to Chapter 4).

The TUSO has the following variations.

TUSO-AA	120 V ac, 50 Hz
TUSO-AB	240 V ac, 50 Hz

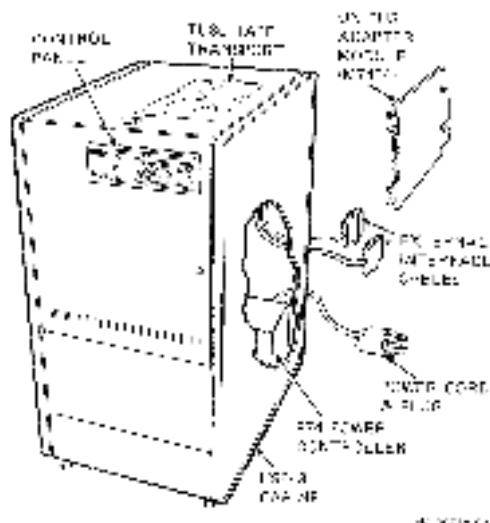


Figure 1-5. TUSO/Tape S subsystem

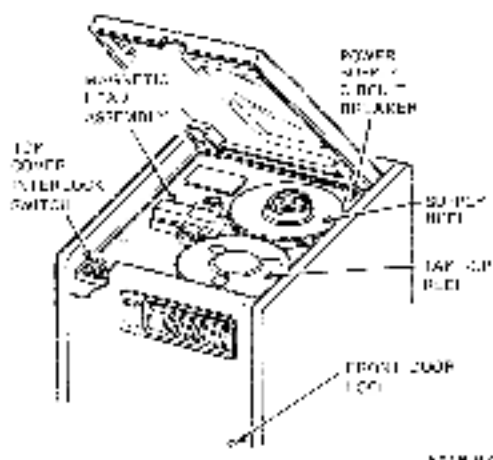


Figure 1-5 Tape Deck

1.4 SPARES KIT

The TU80 CD KIT (PN A2-W050) (8-10) contains the *TU80 Pathfinder* (TK 0TU80 SY), the cover interlock deflector, and all spares. Table 1-1 is a list of field replaceable units (FRUs) or spare parts on the Recommended Spares List (RSL). Refer to Figures in Chapter 4 (Removal/Replacement) and use the Illustrated Parts Breakdown (IPB) when you try to locate a part or part or assembly.

1.5 TOOLS

In addition to the Digital Tool Kit and the TU001 Tape Cleaning Kit, you should have 801/1001 (PN 90-0615-000) wrench. You need a special 3/8 inch socket set (PN 39-02445-00) to remove the reel motors.

You do not need any other tools or instruments to service the TU80 tape transport.

However, to install the TU80 you need the following tools:

- 5/32 inch allen wrench
- 3/4 inch combination box and open-end wrench
- 7/16 inch open end wrench
- 9/16 inch open end wrench
- 5/16 inch flat blade screwdriver
- No. 3 philips screwdriver

Table 1.1 Recommended Spares List (RSL)

Digital PN	Description
29-24210	Tape cleaner assembly
29-24211	Sensor, file protect
29-24212	Club assembly, take-up reel
29-24213	Motor installation kit ^a
29-25016	Compressor (pump), universal 10/60 Hz
29-24114	Magnetic head installation kit
29-24116	Up/ater/pull assembly
29-24119	Power supply, 60 Hz
29-24121	Formatter/control module
29-24122	Read/write/servo module
29-24123	Power amplifier module
29-24224	Club assembly, supply reel
29-24225	Air filter
29-24226	Cooling fan
29-24234	Pressure regulator
29-25097	Switch, door interlock
29-24336	Sensor, F00/R00T
29-24337	Capacitor
29-24338	Technician's kit
29-24339	Accessories refurbishing kit
29-24344	Aray module
29-24372	Power supply, 50/60 Hz

^a Used when repairing take up reel and/or supply reel motor.

For more information on the T1080 subsystem, see the following:

- *Accessories Refurbishing Kit*

1.6 APPLICABLE DOCUMENTATION

If you need more information on the T1080 subsystem, Table 1.2 lists related documents.

Also, use manuals and hangpools appropriate for the PDP-11 and VAX computer systems and processors.

1.7 CONTROL PANEL

The following paragraphs discuss the control panel, diagnostic/troubleshooting panel operation, and on-line system diagnostics.

1.7.1 Control Panel Description

Figure 1-6 shows the T1080 control panel switches and status indicators.

The left part of the control panel contains operator switches/indicators. The two-digit display indicates a fault code related to an abnormal operating condition, or a test code when in diagnostic mode. The right part of the panel contains switches for running internal diagnostic tests.

Table 1-2 Related Documents

Document/PN	Description
TU80 Field Maintenance Print Set (MPC1-003)	Provides schematic diagrams for TU80.
TU80 Magnetic Tape System User Guide (MK 0 TU80 UC)	Contains functional overview, installation, operating, and programming information.
TU80 Technical Service Manual (PK 0 TU80 TMC)	Contains system functional description, introduction, and troubleshooting procedures, theory of operation, and maintenance information.
TU80 Pathfinder (EK 0 TU80-SV)	Contains detailed troubleshooting information, including how to establish power link, test, and correct order.
TU80 Illustrated Parts Breakdown (EK 0 TU80 IP)	Provides list and illustrations of replaceable parts.
S14 Power Controller Illustrated Parts Breakdown (EK-00-74-01)	Provides list and illustrations of replaceable parts.

Operator Controls

Switch/Indicator	Function
LOGIC OFF	Switch - When pressed, power is removed from transport logic circuitry and LOGIC OFF indicator turns on. Indicator - When on, indicates a standby power condition exists (power supply on, the cooling fan starts running, and transport logic is off). If indicator is off and no other indicators are on, then power switch (circuit breaker) is off (O) or there is a power supply problem. If indicator is off and LOGIC ON indicator is on, all transport circuitry is in power-on condition and ready for use.

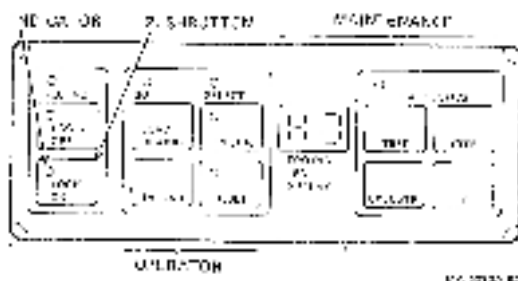


Figure 1-6 Control Panel

Operator Controls (Cont.)

Switch/Indicator	Function
LOGIC ON	Switch -- If pressed when power switch (circuit breaker) is on (.), the transport logic and control system is powered up and TUSC is ready for operation. Indicator -- When on, indicates transport circuitry is powered up and TUSC is ready for use.
BOT	Indicator -- When on, indicates tape is positioned at beginning of tape (BOT) marker.
LOAD/REWIND	Switch -- If transport is powered on and tape is threaded, pressing LOAD/REWIND causes load operation to be performed. If tape is loaded, pressing switch causes rewind operation to BOT.
UNLOAD	Switch -- If tape is ended at BOT, pressing UNLOAD causes tape to unload from take-up reel and tape path, onto supply reel. If tape is loaded beyond BOT, it rewinds to BOT. If tape is threaded, but not loaded, pressing switch causes transport to slowly unload tape onto supply reel.

Operator Controls (Cont)

Switch/Indicator	Function
ON LINE	Switch - If tape is loaded, pressing ON LINE causes TUSO to go on-line and become accessible by host system. Press RESET switch to take TUSO off-line. Indicator - When on, indicates that TUSO is in on-line mode. All switches except RESET and LOGIC OFF are inhibited.
FILE FRO	Indicator - When on, indicates absence of write buffering in supply reel and write operation is inhibited. Otherwise, write operation is allowed.
SELECT	Indicator - When on, indicates the following: • The address in TUSO and CPU are the same. • When the two I/O cards are connected, the address decoder in the transport is fault-free. • Both I/O cables and Pin 1 on the MT454 are assembled correctly. • TUSO is not in diagnostic mode.
RESET	Switch - When pressed, transport goes off-line, tape motion stops, and error status clears. Switch can stop LOAD or REWIND operation. Also turns off RESET indicator and clears diagnostic test conditions. Indicator - When on, indicates that TUSO is in fault or diagnostic test mode. Two-digit display may contain fault or termination code, or diagnostic code.

Diagnostic Controls

Switch/Indicator	Function
DIAGNOSTICS	Indicator – When on, indicates that TUSO is in diagnostic/test mode. Indicator stays on until you press RESET .
TEST	Switch – If TUSO has tape thrown in but not craned, pressing TEST places unit in diagnostic/test mode.
STEP	Switch – In diagnostic/test mode, pressing STEP increments diagnostic/test sequence numbers in two-digit display by one, or to the digit required.
EXECUTE	Switch – In diagnostic/test mode (with test number displayed), pressing EXECUTE initiates the internal diagnostic test.
CE (customer engineer)	Switch – If TUSO is in diagnostic/test mode, pressing CE (customer engineer) and TEST at the same time recalls an internal diagnostic routine (Field Service Tests) to aid a Field Service Representative.

1.7.2 Diagnostic/Maintenance Panel Operation

The TUSO has internal (resident) diagnostics which can be initiated through the transport's control panel. Internal diagnostics include operator diagnostic tests and Field Service diagnostic tests (customer engineer tests, described in Chapter 5).

To get into diagnostic mode and initiate Operator or Field Service diagnostic tests, use the diagnostic panel as follows:

1. To recall operator diagnostic tests (01, 02, 03), press **TEST**. 01 appears on the two-digit display. Each time you press **STEP**, the display number increments by one. Press **EXECUTE** to initiate the test you chose.

1.7 INTRODUCTION

2. To recall Field Service diagnostics, press and hold CE and press TEST.
 - a. The DIAGNOSTICS indicator illuminates.
 - b. 00 appears on the two-digit display.
3. Press STEP.
 - a. The display number increments by one each time you press STEP, or increments automatically if you press and hold STEP. The display can show 00 through 09.
 - b. To select a test number, use the STEP and TEST switches. When you press TEST after you press STEP, the number multiplies by 10.

Example: TEST 39 is required.

Step	Display
1. Press CE and TEST	00
2. Press STEP three times.	01
3. Press TEST	10
4. Press STEP until 9 displays.	39

- a. Press EXECUTE to initiate the test.

After the fault code appears on the display, you can recall the sub-fault code by pressing CL. The sub-fault code is displayed as long as you hold CL.

1.7.3 On-Line System Diagnostics

The TU80 is used with the PDP-11 and VAX systems. The TU80 subsystem status and performance can be verified by using PDP-11- and VAX-based on-line diagnostics. Paragraphs 1.7 and 1.4, respectively, describe these tests.

1.8 MAINTENANCE

NOTE

The TU80 does not need any mechanical and/or electrical adjustments or alignments for corrective or preventive maintenance.

Maintenance procedures include only regular cleaning of the tape path components.

1.8.1 Cover Interlock Switch Defeat

When servicing the TUBO, a Field Service Engineer may have to operate the unit and run diagnostics with the top cover open. To bypass the safety interlock switch, use the interlock defeat tool supplied in the TUBO CID Kit. You insert this tool into the interlock latch to *press* the interlock switch depressed, which simulates the top cover closed condition (Figure 1-7).

Use the interlock tool as follows:

1. Insert the tool into the slot of the cover interlock.
2. Turn the tool 90 degrees to keep it locked in the latch column.

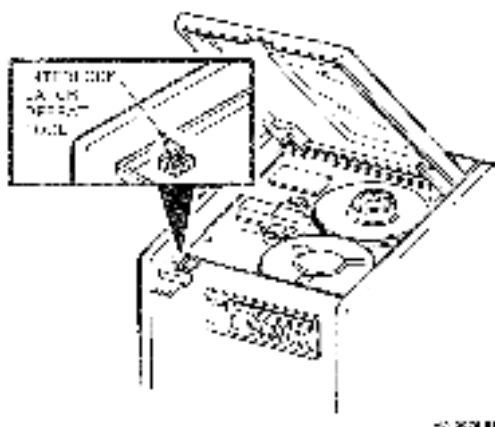


Fig. 1-7 Cover Interlock Defeat Tool

2 INSTALLATION

This chapter provides information on how to select and check the transport selectable addresses and options, and install or replace the M-104 UNIBUS adapter module.

2.1 TRANSPORT CONFIGURATION SELECTIONS

During TUSO installation and check out, check the formatter/control module for correct setting of the transport address and option selection components that specify the transport operating status and characteristics.

Table 2-1 and Figure 2-1 identify these features and the location of the labeled components on the formatter/control module.

NOTE

"Standard" means a standard component setting, good for normal operation in Digital computer systems.

Table 2-1 Tape Transport Configuration Selection

Option	Component/Location	Comments
<i>Cinched Parity Check</i>	W5 Location 18C Positions 1 and 2	As shipped (standard). Parity bit transmitted with data.
	Positions 3 and 4	Optional - Use in parity bit is not interfaced with data.
<i>Short Gap Variable short gap (0.6 to 1.9 in)</i>	W5 Location 18D Positions 1 and 2	As shipped (standard).
<i>Fixed short gap (0.6 in)</i>	Positions 3 and 4	Optional.
<i>Long Gap Variable long gap (0.6 to 1.2 in)</i>	W5 Location 18C Positions 1 and 2	As shipped (standard).
<i>Fixed long gap (1.2 in)</i>	Positions 3 and 4	Optional.
<i>Auto Speed (see Note)</i>	W5 Location 18F Positions 1 and 2	Optional - Disables auto speed select.
	Positions 3 and 4	As shipped (standard). Enable auto speed select.
<i>Automatic Anti-skip</i>	Location 21D 51 - 60	As shipped (standard).
<i>Transport Address 3</i>	Location 21D 87 - 90, 93 - 96	As shipped (standard).

NOTE

Jumper W5, Auto speed control When you invoke this standard feature, the transport will not automatically select 25 inch per second (ips) mode when low speed is commanded. Instead, the transport chooses the optimum speed to match system requirements. If 100 ips mode gives the best throughput, this mode is used; the same applies to 25 ips streaming and 25 ips start/stop modes. The transport chooses the operating mode automatically; system intervention is not required. This feature allows the 1000 to run under standard Digital 11/7 inch tape software, yet, offer the advantage of streaming. With this option enabled, the unit responds to a Set 100 IPS command in the normal manner.

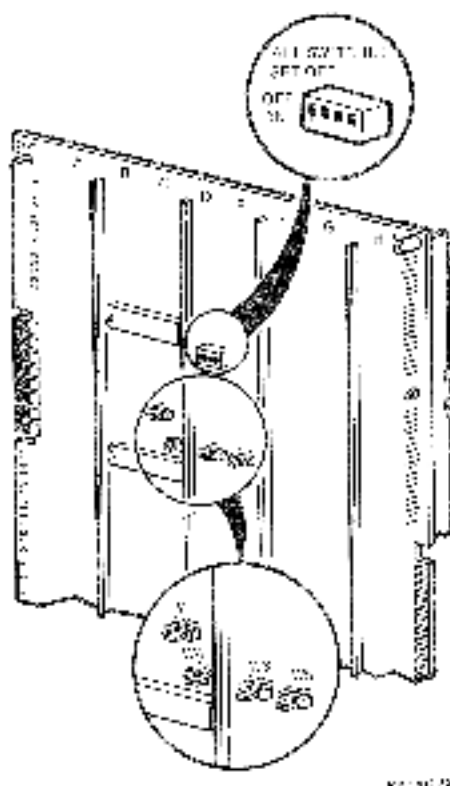


Figure 2-- Dynamic Selective Control unit of Transmitter Control Module

2.2.1 M7454 Preparation and Installation

NOTE:

You need to use the CPU Kit (1U80K-CP) to perform this procedure.

1. Remove M7454 module, cables, bulkhead connections, and mounting brackets from CPU Kit shipping container. Unwrap and examine them for any damage.
2. On the M7454 adapter module, make sure selections are correct for the UNIBUS address, interrupt vector, and word burst size using 10-position DIP switch in location 20C (Figures 2-3 and 2-4).

NOTE:

Table 2-2 shows the typical UNIBUS address and vector for a single 1U80 Subsystem configuration.

When more than one (up to four) 1U80 subsystems is installed with the host system, use Table 2-3 to select the UNIBUS addresses and vectors.

NOTE:

Switch positions 1 to 7 select vector bits 8 to 2. Switch position 8 selects two-word or four-word burst size. Two-word burst size is used for UNIBUS operation. Switch positions 9 and 10 determine a transport number and the corresponding UNIBUS address.

CAUTION:

Check jumpers in location 4X on the module. Jumpers JP11 (W4), JP12 (W3), JP13 (W2), and JP14 (W1) select the UNIBUS address range. The standard starting address is 772522, selected by JP11 (W4), which is etched on side two of 20N77354 (M7454).

If another address range is required, use JP11 and install JP12 (for address range starting at 772722), JP13 (777362), or JP14 (777422).

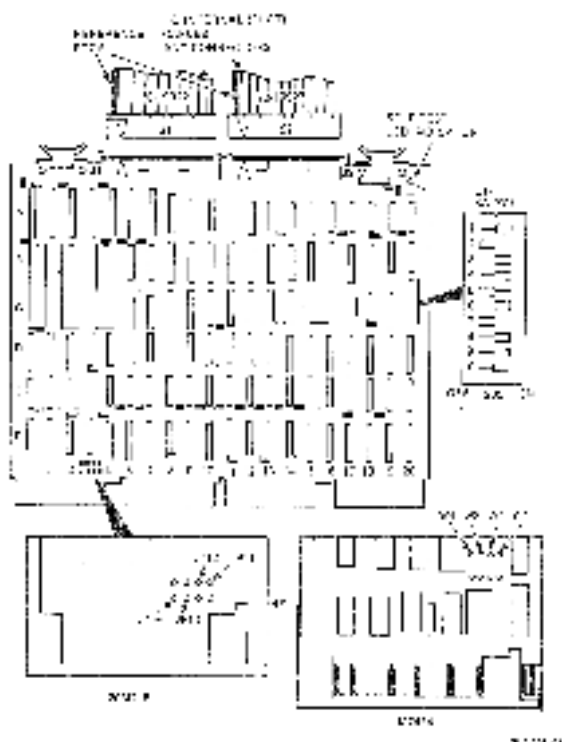


Figure 2-3 MD4541 INTEL 4-chip Module

SWAMP - LATCHED INTO 0 ON ALL LINES

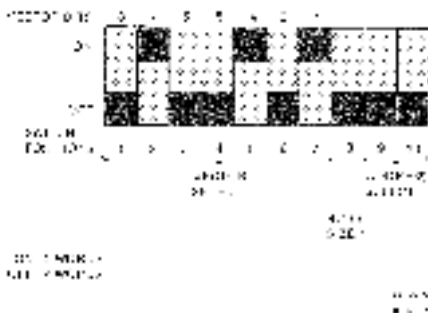


Figure 2-4 DIP Switch Settings for Single 7485 Configuration (Annex A172532, Version 224)

Table 2-2 Single TURB Address Selection

Unit	Address	Vector	Switch 9	Switch 10
0	172520 ₈ E221 ₈	224 ₈ 941 ₆	on	on

Table 2-3 Address Selection in Multi-TURB Configuration

Transport Unit	Address	Vector	Switches		Configuration
			9	10	
1	0 172520 ₈ E221 ₈	224 ₈ 941 ₆	on	on	1 (unit 0)
2	1 172526 ₈ E226 ₈	float ^a	on	on	2 (units 0,1)
3	2 172532 ₈ E22A ₈	float ^a	off	on	3 (units 0,1,2)
4	3 172536 ₈ E22E ₈	float ^a	off	on	4 (units 0,1,2,3)

^a float is vector 100 to 700₈.

- Remove G727 hot grant card from desired SPC slot. Remove (not CA1 to CB1) nonprocessor port (NPC) jumper from the backplane of the same SPC slot.
- Plug two internal ribbon cables *from beyond connectors* into the J1 and J2 edge connectors on M7454 module (Figure 2-2). Plug cable with male external connector into J1 on the board, and cable with female external connector into J2. To correctly connect all PDI cables plug, follow Figure 2-5.
- Carefully insert M7454 module into SPC slot.

NOTE:

If you are replacing the M7454, perform only the necessary steps from the following paragraphs.

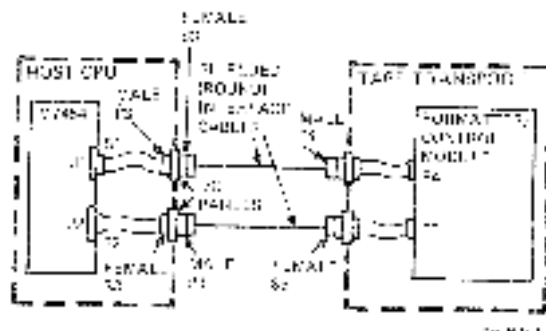


Figure 2-5 Plug-to-Plug I/O Cable Connections

2.2.2 CPU Internal Cabling

Examine the CPU for compliance with FCC installation specifications. According to FCC requirements, the CPU should have the I/O bulkhead connector frame at the bottom rear of its cabinet.

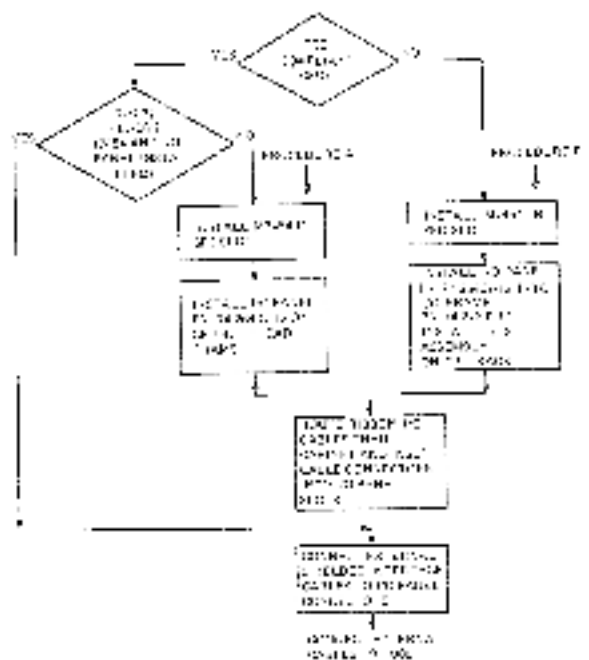
Then, follow the applicable procedures (A or B) shown in Figure 2-6.

Procedure A

1. Install I/O panel (PN 74-26907-12) on CPU's I/O bulkhead frame at bottom of CPU cabinet (Figure 2-6, Procedure A). Secure I/O panel with two screws.
2. Route internal I/O ribbon cables from M7454 module through CPU cabinet to CPU frame. Then, insert cable connectors into slots on I/O panel.
3. Go to Paragraph 2.3.3 and perform external interface cabling.

NOTE

Do not chafe the internal cables against other modules and chassis parts.



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Pressione: 0

1. Mount I/O panel (PN 74-26427-12) on I/O frame (PN 74-27392-0-1). Secure with two screws (Figure 2-6, Procedure B).
2. Install I/O frame (with I/O panel) on CPU rack. Find location on CPU rack that will best accommodate internal and external interface cabling.

46716

Digital recommends locating the I/O frame at the bottom rear of the CPU cabinet.

4. Repeat steps 2 and 3 above.

2.2.3 TURBO External Cabling

NOTE

You need to use the Accessory Kit TURBO-ACC to perform this procedure.

1. Use allen wrench to open rear door.

NOTE

To check the I/O cables in the TURBO, refer to Figure 2-7.

2. Route signal shielded interface cables (PN BCU7N-12) from TURBO to CPU (Figure 2-21).

NOTE

In configurations with three or four TURBOs on one CPU, you can use 24 ft cables (PN BCU7N-24).

3. On CPU's do not external interface cables are keyed bulkhead connectors on the CPU I/O frame (or bracket). This step connects the cables with the internal UNIBUS cables. Secure each plug with two screws (Figure 2-8).
4. Close rear door.

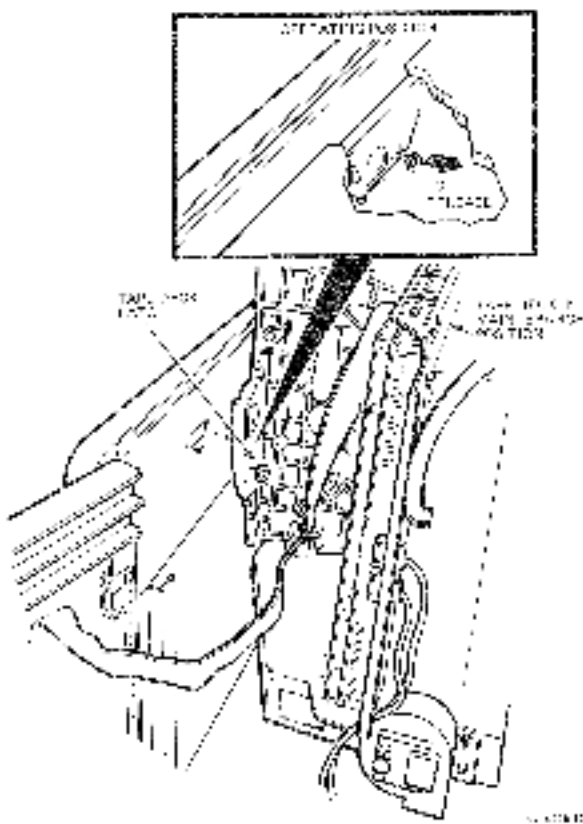


Figure 2.7 Tape Deck - 2" Stereo-Are Position

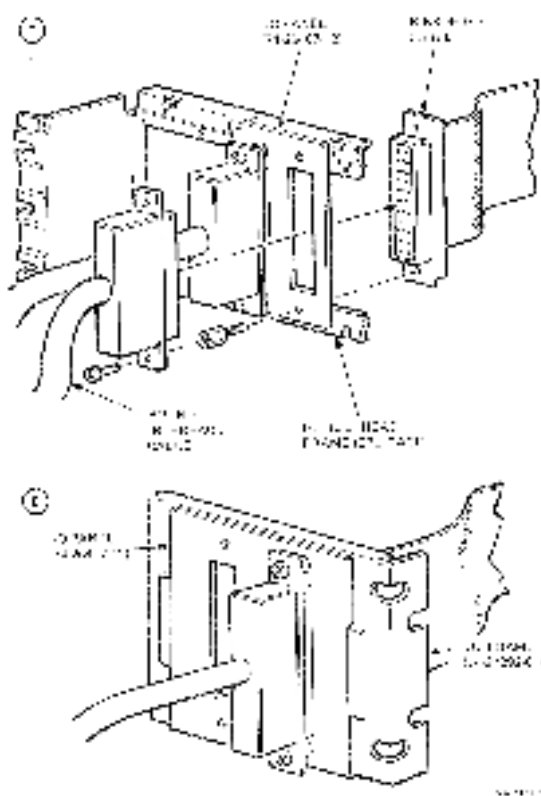


Figure 2-8 1/2" Gase Connections

3 TROUBLESHOOTING

3.1 GENERAL

Paragraph 3.2 describes internal (resident) diagnostics; Paragraphs 3.3 and 3.4 respectively, describe the PDP-11 and VAX on-line diagnostics.

When you report to the site, get all the available information from the operator and operating system. You should consider fault codes, the frequency at which they occur and, if possible, the operation in progress at the time before executing diagnostics. If the fault is intermittent, information from the operator and operating system may be instrumental in directing you to the appropriate test to duplicate the fault condition.

3.2 RESIDENT DIAGNOSTICS

TU80 resident diagnostics consist of operator diagnostics and Field Service diagnostics.

NOTE

Make sure that the TU80 power cord is plugged in, and the transport is energized (power switch ON) before you start any diagnostic routine.

The diagnostic tests designed into the TU80 are off-line tests initiated through the control panel. There are no built-in on-line diagnostics. However, the host CPT can monitor TU80 status through the Get Status command. A Channel Loopback command is also provided to exercise the TU80's formatter logic.

Although on-line diagnostics are not part of the TU80, its control logic processor tests for many operational fault conditions while it runs on-line. These conditions are indicated on the control panel display as fault codes. The RESET indicator lights to indicate the fault condition and the control panel displays the appropriate fault code.

3.2.1 Corrective Fault Code Matrix

When a trouble call is received from the site, Field Service personnel should consult the fault code matrix (Table 3-1) and corresponding corrective action taken in the *TI-60 Pathfinder I-K-STU-50-SV* (included in the CD kit). These tables help Field Service personnel determine if operator action (A, B, or C) is required. If the fault persists after appropriate operator action, consult the tables for a list of FRUs to take to the site.

The fault code matrix lists all malfunctions or fault codes, and assemblies which may cause the fault condition. This table is designed to provide a list of related assemblies before you report to the customer site. Assemblies listed under individual malfunction or fault codes are arranged in a "most probable fault" order. In addition to listing assemblies, the table may direct the Field Service Representative to ask the operator to perform Operator Diagnostic Test 02 or Test 03.

When onsite, consult and use the *TI-60 Pathfinder* troubleshooting procedures and diagnostic tests to isolate and correct the malfunction.

3.2.2 Operator Troubleshooting

Before you run any tests, do the following steps to isolate an easily correctable external malfunction.

1. Make sure the tape has a BOT marker.
2. If a write operation is to be performed, make sure the tape reel has the write-enable ring installed.
3. Make sure the tape path is clear.
4. Make sure the power switch is on (1).
5. In case of power failure, make sure the power controller circuit breaker is on.
6. Make sure the top cover door is closed and latched.

NOTE

If the host computer reports data (read/write) errors, "first-aid" action is to clean the tape path.

3.2.3 Power-Up Health Check

This self-test diagnostic checks ac power, and the control plane's and major logic modules' functionality.

To start the health check, press the LOGIC ON push-button (assume the power switch is on).

The two-digit display should momentarily show 00, the LOGIC OFF indicator should go off, and the following indicators should go on momentarily: BOT, RESET, ONLINE, DIAGNOSTICS and SELECT. The LOGIC ON and FIVE PRG indicators should go on and stay on.

NOTE:

If a fault code appears on the display, press RESET and LOGIC OFF to clear the display. Then press LOGIC ON again to repeat the Health Check.

If the fault code reappears, refer to the TUSO Pathfinder for on-site troubleshooting procedures and Field Service diagnostic tests to isolate the failure.

3.2.4 Basic Operator Test #1

This test checks basic transport functions and tape motions including BOT/EOY tape motion, read data, and write data. Use a write-enabled, known good quality tape for this test. The test takes about 10 minutes to complete (with 2400 fast tape).

Pre-Test Conditions

1. Power switch and LOGIC ON are on (power-up health check is successful); digital display is blank.
2. Tape is threaded through tape path and onto take up reel.
3. Tape is not under.
4. Top cover is closed and latched.

Test Procedure

1. Press RESET.
2. Press TEST on control panel's diagnostic portion.
 - a. DIAGNOSTICS indicator lights.
 - b. Digital display indicates 01.
3. Press EXECUTE.
 - a. Test starts with display panel incrementing from 20, 11, 22, through 99. Make sure all numerical display segments are functioning.
 - b. Make sure all indicators except LOGIC OFF, BCT and SUBJECT are lit.

Test Successful

If the test completes, the TUBO performs a REWIND/UNLOAD operation and the digital display indicates 00; the RESET indicator is lit.

Test Unsuccessful

If the test is unsuccessful, the diagnostic program halts and the display shows a numerical code; the RESET indicator is lit. Record this number and refer to the *TUBO Pathfinder* for further instructions.

3.2.5 Optional Operator Tests

The optional tests are 02 and 03. The user may perform them on your request.

Test 02 checks tape tension characteristics. Test 03 checks operation of the velocity servo loop and the take-up motor/tack assembly.

When Test 01 calls for Test 02 or Test 03 to be executed, refer to the *TUBO Pathfinder* for more information.

3.2.6 M7454 Resident Diagnostic

The M7454 UNIBUS Adapter Module performs its own resident diagnostic routine at system power-up. To run this diagnostic, turn the CPU circuit breaker off and on.

The M7454 diagnostic resides in the on-board programmable ROM and checks the M7454 module only, without tape motion or antecedent testing. The diagnostic checks the M7454's microprocessor, sequencer, data paths, and buffer area. The lit LED on the module indicates a successful test.

3.2.7 M7454 Status Checking

3.2.7.1 TU80 Turnkey Configuration — When the M7454 (and TU80) fails during new system configuration (PDP-11 or VAX), the host configures around the TU80, not recognizing it. The computer console terminal displays the appropriate error message.

3.2.7.2 TU80 Add-On Configuration

1. If a TU80 is added to a PDP-11 system, an operator error reconfigures the host system by using an applicable SYSGEN command. If the M7454 fails during SYSGEN, the host cannot access the TU80 and the console terminal displays the appropriate error message.
2. If a TU80 is added to a VAX system, the host automatically configures the unit into the system. If the M7454 fails at that time, the host cannot access the TU80, and the terminal displays the appropriate message.

3.2.7.3 On-Line Failure — If the M7454 fails during normal on-line operation, the host loses communication link with the TU80. The error message is entered in the system error log. When the operator tries to recall the TU80, the terminal displays the appropriate error message to indicate the "not found" status of the device.

To check TU80 operating status and localize the failed module, reset the TU80 unit and perform the host system power-up. Then, place the TU80 on-line and try to access the transport through the host. If the fault condition persists, replace the M7454 module.

3.3 PDP-11-BASED DIAGNOSTICS

3.3.1 PDP-11 Front-End Diagnostic (CZTUW, CZTUX, CZTUY, CZTUZ)

This diagnostic is a four-part complex test that checks the subsystems in all basic operating modes, and tests the interface bus, I/O silo and TU80 transport logic.

CZTUW

TST:001 Initialize
TST:002 RAM test
TST:003 Command reject test
TST:004 Write characteristics test
TST:005 Volume check
TST:006 Correlation interrupt test
TST:007 Basic packet protocol test
TST:008 Non-tape motion command test
TST:009 DMA memory addressing test
TST:010 Initialization after write characteristic test
TST:011 Basic write subsystem memory test

CZTUX

TST:001 FIFO exerciser test
TST:002 Initialize 4 test
TST:003 Off-line request and rewind test
TST:004 Basic write data test
TST:005 Basic read data (forward and reverse) test
TST:006 Manual Intervention test
TST:007 Configuration type-out test
TST:008 Scope loops test

CZTUY

TST:001 Speed records test
TST:002 Rewinds test
TST:003 Write data retry test
TST:004 Write tape mark test

CZTUZ

TST:001 Write tape mark's retry test
TST:002 Skip tape marks test
TST:003 No op and initialize test
TST:004 Pause and operation interrupt test
TST:005 Test of operation 21.001 test
TST:006 Function tuning test

3.3.2 PDP-11 Data Reliability Diagnostic (CZTUV)

This test simulates a typical maintenance operating environment and checks data integrity in both start/stop and operating modes. It is mainly a data confidence test.

Data Reliability Program Tests

- Test 1: Basic functions
- Test 2: Data reliability
- Test 3: Streaming test
- Test 4: Write compatibility/write utility
- Test 5: Read compatibility/read utility
- Test 6: Operator selected sequence

NOTE

Refer to the diagnostic listing for program control flags.

3.3.3 Operating Instructions for PDP-11-Based Diagnostics

1. Load XXDP monitor.
 - a. Enter date.
2. Answer hard core questions.
 - a. 50 Hz? Type Y or N.
 - b. LSI? Type Y or N.

This is XXDP+. Type H or H/L for details (help file).

[Receive XXDP+ prompt (dot)]

3. Enter R (space) program name (CZTUV or CZTUPW, CZTUX, CZTUY, or CZTUZ).

The operator entry should look like:

[^R CZTUV]

4. Receive DR> prompt.
5. Enter the appropriate command. For example, to start the test type:

DR>STA

6. Change HW(1)? Type Y to run the diagnostic.
7. Change SW(1)? Type Y or N.

NOTE

Refer to the diagnostic listing for specific program problems and instructions.

No hard errors are allowed.

Hardware Parameters

The following are TUSO base address and vector assignments.

TNR ADDRESS (72822)?

VECTOR (04)?

Command example: STN/VES.2/PLA : IDC : LGE

Command example: Start test 2, inhibit dropping unit
meaning: and trap on error

Software Parameters

Refer to diagnostic listings.

3.4 VAX-BASED DIAGNOSTIC**3.4.1 VAX Front End Diagnostic (EYMBF), (EYMBF)**

These tests check the subsystem in all basic operating modes and test the TUSO transport logic, interface bus, and I/O slice.

3.4.2 VAX Data Reliability Diagnostic (EYMAA)

This check is designed to thoroughly check out the tape subsystem. It allows the operator to test the TUSO on line without bringing the system down.

The data reliability test consists of the following:

- Test 1: Qualification test
- Test 2: Qualification test
- Test 3: Data reliability test
- Test 4: Multi-drive test
- Test 5: Conversion mode test
- Test 6: Streaming test

3.4.3 Operating Instructions for VAX-Based Diagnostics

1. Load the Diagnostic Supervisor (ECSAA, ENSAA, or ESSAA)

NOTE

Use ECSAA on VAX 11/750s.

Use ESSAA on VAX 11/780s.

Use ENSAA on VAX 11/720s.

2. Attach and select a device to be loaded in one of two ways:

- a. Prompt mode

```
DS> ATT DW7XX HUB DWO
```

```
DS> ATT
```

```
Device Type? 1511
```

```
Device File? DWO
```

```
Device Name? MSAO
```

```
CSR? 772520*
```

```
Vector? 224
```

```
BR? 5
```

```
DS> STT MSAO
```

- b. Explicit mode

```
DS> ATT DW7XX HUB DWO
```

```
DS> ATT 1511 DWO MSAO 772520 254 5
```

```
DS> STT MSAO
```

3. Load and start the diagnostic in one of two ways:

- a. Example 1

```
DS> Load EYMAA (or EYMBD), EYMBE!
```

```
DS> Stop/Switches
```

- b. Example 2

```
DS> Run EYMAA (or EYMBD, EYMBE)  
Switches
```

No hard errors are allowed.

NOTE

Refer to the diagnostic listing for control flags.

* CSR address (V000 starting address is 772522)

4 REMOVAL AND REPLACEMENT

This chapter describes removal and replacement procedures for TU80 components listed in the Table of replaceable unit (PRU) table (Table 1-1). Each procedure also names a test to perform which checks the replaced module.

Paragraph 4.1 describes the PRUs located on top of the tape deck. Paragraph 4.2 describes PRUs inside the cabinet and accessed only in the maintenance position.

4.1 TAPE DECK COMPONENTS

While you replace the tape deck components, refer to Figure 4-1 as well as applicable figures. All these components can be accessed easily when the TU80 top cover is open.

4.1.1 BOT/BOT Assembly

Removal

1. Remove magnetic head cover covers by pulling them straight out.
2. Disconnect WEP plug from BOT/BOT sensor. Monitor arrow is under cable (Figure 4-2).
3. Remove mounting screw from assembly and lift off face coils.

CAUTION

Do not loosen or remove phillips screw on top of assembly. This may cause misalignment.

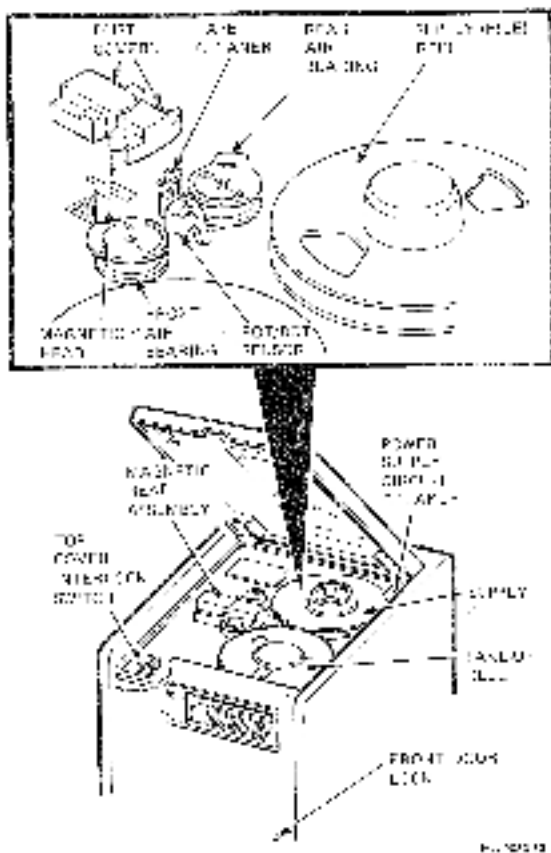


Figure 1- Tape Deck Components

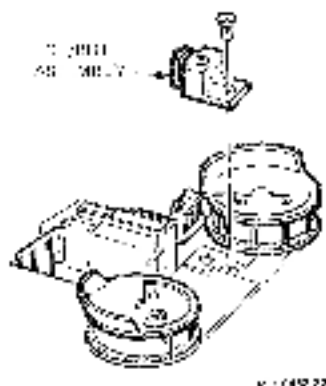


Fig. 4-2 ROT/ROT Assembly

Replacement

NOTE

You must replace any defective sensor as a complete assembly.

1. Position assembly in its place on tape deck and install and slightly tighten flat-head mounting screw.
2. Thread a tape onto take-up reel and adjust ROT/ROT assembly so it is parallel to tape path. Sensor positioning is not critical.
3. Tighten mounting screw.
4. Reattach W3P1 plug to assembly connector as shown in Figure 4-2. If excess cable exists, pull excess under tape deck.

CAUTION

Make sure plug is positioned in correct pins.

2. Install dust cover.

Verification Check**NOTE**

If available, use a 600-foot reel of tape (such as PN 29-22020) with properly installed BOT/EOT markers to reduce test time.

1. Install reel of tape onto supply Lab and thread tape so BOT marker is located before BO (EOT) assembly.
2. Perform LOAD operation and observe that tape loads and positions itself at BOT marker (BOT indicator lights) to check BOT sensor operation.
3. Execute Field Service Test 44 to verify EOT sensor operation.
4. Unload rail tape.

4.1.2 Tape Cleaner**Removal**

1. Remove dust covers from magnetic head assembly.
2. Loosen two pan-head mounting screws and remove tape cleaner assembly from tape deck (Figure 4-3).
3. Remove screws, lockwashers, and cover plate from blade housing.
4. Slide platform mount out from tape cleaner.

NOTE

You must replace defective tape cleaner as a complete assembly.

Replacement

1. Inspect cleaner blades for damage. If blades are chipped or damaged, replace entire assembly.
2. If blades are not damaged, clean platform and install. When you install platform, make sure flanges are positioned so platform fits firmly inside tape cleaner.
3. Install cover plate, two washers and mounting screws.
4. Position assembly onto guide pins on tape deck, and tighten screws.
5. Reinstall dust covers.

Verification Check

No functional checks are necessary.

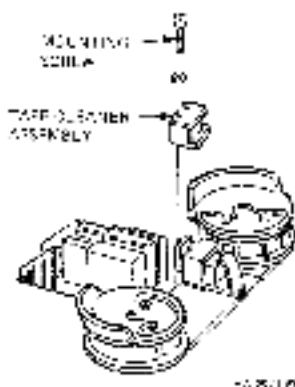


Figure 4-3 Tape Cleaner

4.1.3 File Protect Sensor

Removal

1. Remove tape reel from supply hub.
2. Remove top cover (Paragraph 4.1.5).
3. Remove four mounting screws and file protect sensor cover plate from tape deck (Figure 4-4).
4. Remove the Phillips mounting screw and washer securing the file protect sensor to the tape deck (Figure 4-4).
5. Detach connector W3P6 from sensor and discard sensor.

Replacement

NOTE

File protect sensor positioning is not critical.

1. Place sensor on tape deck as shown on Figure 4-4, and secure it with mounting screw and washer.
2. Attach W3P6 cable plug to sensor pins.
3. Reinstall sensor cover plate and secure to tape deck with four mounting screws.

Verification Check

Perform power-up troubleshooting procedure 1003.

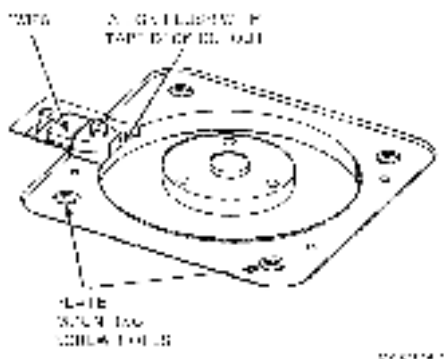


Figure 4-4 File Processor Sensor

4.1.4 Take-Up Reel and Hub Assembly

Removal

1. Remove four matching screws from take-up reel hub cover and remove cover from hub assembly (Figure 4-5).
2. Remove three allen screws, lockwashers, and plain washers which secure reel to motor shaft assembly.

NOTE

Do not remove phillips screws.

3. Remove take up reel from transport.

Replacement

CAUTION

If you are installing new reel, inspect reel edges for burrs or cracks that could cause tape damage.

1. Perform above removal procedure in reverse (position take-up reel on transport; use three allen screws, lockwashers, and plain washers to secure reel to shaft assembly, etc.)

1. Place hub assembly in latched position by depressing cam carrier.

CAUTION

Make sure hub is latched before you proceed with further removal steps. Otherwise, parts could be lost due to unnecessary disassembly.

1. Remove three large shoulder mounting screws from cam carrier. You can then remove hub assembly from tape deck (Figure 4-5).

Replacement

1. Position hub assembly into motor shaft assembly and secure with three large shoulder screws.
2. Install reel cover on face of hub assembly and snap securely.

Verification Check

1. Mount tape reel onto hub assembly. Reel should mount easily onto hub and against bottom flange.
2. Latch reel onto hub. Make sure reel is secure.
3. Load known good quality tape and observe reel during tape motion. Tape should not contact top reel flange.
4. With tape threaded, set car loaded, execute Operator Diagnostic Test 01.

4.1.6 Air Bearing Spring Guides

NOTE:

Replacement parts for air bearing assembly are contained in a kit (PN 29-21359) which includes two spring guides, a transducer (sensor), and small and large O-rings. If a spring guide has to be changed, replace both guides at same time.

Removal

1. Remove head dust covers from tape deck.
2. Remove two philips head screws that secure spring guide and a guard to bearing housing (Figure 4-6).
3. Remove spring guard and a guide from housing.
4. Repeat steps 2 and 3 to remove other spring guide.

Replacement

1. Place new spring guide (refer to Table 1-1 for guide's part number) and a guard into bearing housing. Holes for mounting screws provide positive alignment for both parts in housing.
2. Secure assembly with two philips head screws.
3. Repeat steps 1 and 2 to replace second spring guide.
4. Reinstall head covers on tape deck.

Verification Check

1. With tape threaded, but not loaded, execute Operator Diagnostic Test 21.
2. Examine tape for any torn edge damage.

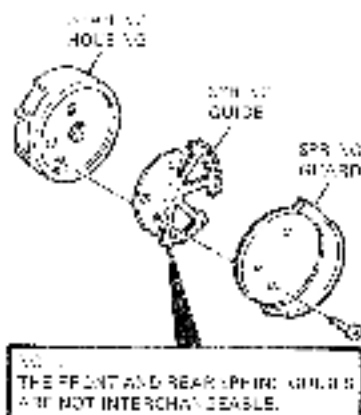


Figure 4-6

Figure 4-6 A. Housing

4.2 INTERNAL (INSIDE CABINET) REPLACEMENTS

Refer to Figures 4-7 and 4-8 as well as applicable figures when you access and replace tape transport components in the cabinet and/or mounted on the bottom of the tape deck. Appendix A contains layouts of the formatter/control/read/write/serve and power amplifier modules, with all cable connectors called out.

Perform all replacements described hereafter with the tape deck in its service (vertical) position.

With the tape deck in the vertical position it is easy to service and repair any transport part or module.

The transport has a service release lock (tape deck latch) (Figure 4-7) which secures the tape deck in either horizontal (operational) or vertical (maintenance) position.

4.2.1 Rotating the Tape Deck

1. Use a 5/16 inch Allen wrench to open front and rear doors. Release tape deck post fastener.
2. From front, reach under tape deck (Figure 4-7) and locate tape deck latch under tape deck on left side panel of cabinet.
3. Release latch as follows:
 - a. Gently lift or press tape deck to remove pressure from latch ring.
 - b. Pull latch ring and keep released.
4. Keep latch ring released with one hand and tilt tape deck up with other hand until deck is in full vertical (maintenance) position.

NOTE

Listen for a click which indicates tape deck is snapped in service position.

CAUTION

Be sure not to snag control panel cable or any other cable in cabinet.

2. To return tape deck to operating position, pull on latch ring, release tape deck latch, and then tilt deck down to horizontal position until latch is engaged again.

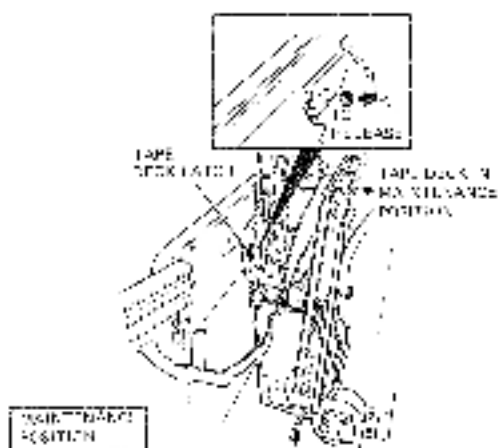
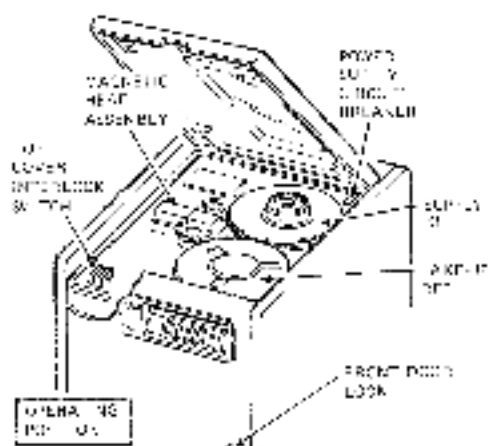


Figure 4-1 Tape Deck Functional Positions

4.2.2 Supply Reel Motor

Removal

NOTE

Supply reel motor assembly is not supplied as a part of ERU kit. Instead, you must remove 1000-line inch on take-up reel motor assembly spare unit and use take-up motor as replacement for supply reel motor.

1. Remove supply reel and hub assembly as described in Paragraph 4.1.5.
2. Turn off power switch and unplug power cord.
3. With tone disk in maintenance position (Paragraph 4.2.1), remove protective acoustic cover (Paragraph 4.3.2).
4. Detach 14-P connector from J2 plug on power amplifier module (Figure A-2).
5. Remove four mounting screws and tach cover from motor (Figure 4-9).
6. Detach WPP connector from tach sensor on motor.

NOTE

This connector is not keyed. Mark it for proper replacement.

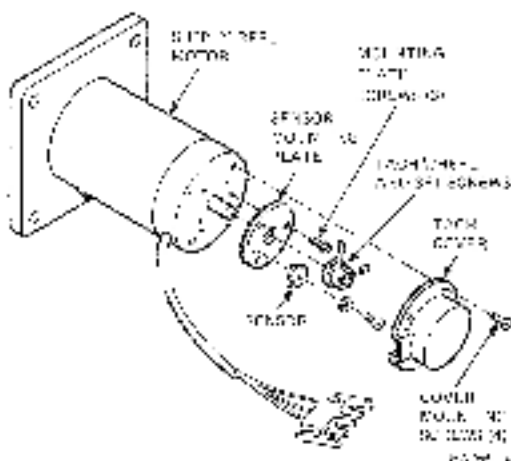


Figure 4-9 Supply Reel Motor Assembly

7. Remove four mounting screws that secure motor to rear of tape deck. Carefully remove motor from transport. Use 9/16" inch extension tool if necessary.

N4317

You must replace motor, rack and sensor on a new motor assembly. You must replace entire assembly as a unit.

Continue with motor disassembly and removal of on-line tachometer (Figure 4-9).

8. Remove mounting screw and on-line sensor from mounting plate on motor. Retain for re-use.
9. Loosen two set screws and remove tach wheel from motor shaft. Retain for re-use.
10. Remove four screws on mounting plate and remove plate. Retain for re-use.
11. Disassemble spare take-up reel motor assembly (Figure 4-10) as follows:
 - a. Remove two mounting screws and tach cover from washer assembly.
 - b. Loosen two screws and remove 1000-Line tach sensor from motor (tach shaft and tach wheel).
 - c. Loosen set screw and remove tach wheel from motor shaft.

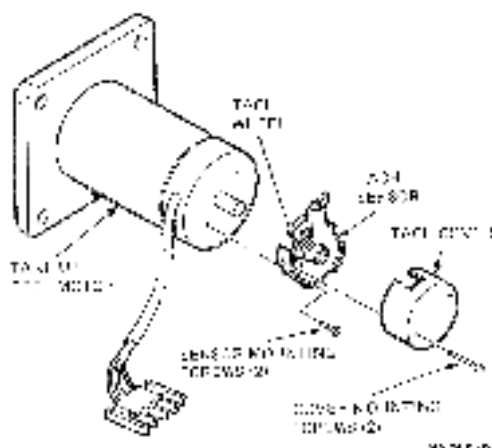


Figure 4.16 Take-L n Rec Mean Assembly

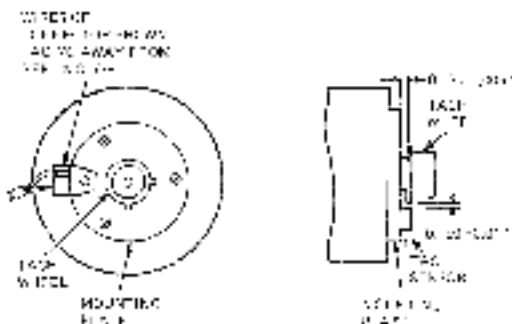
Replacement

1. Install end-line tachometer on new motor as follows:
 - a. Place mounting plate (from supply reel motor – removal step 10) onto new motor and secure with four mounting screws.
 - b. Install old end-line sensor and tach wheel (removal steps 8 and 9) onto new motor mounting plate and shaft, and adjust according to tolerance requirements listed in Paragraph 4.2.3.1 (Figure 4-13).

CAUTION

When you install a motor, make sure no loose wires are between motor mounting plate and tape deck.

2. Position replacement motor on rear of tape deck so BIPF cable extends to right of motor assembly. Secure motor to deck with four mounting screws.
3. Connect BIPF cable to J3 on power amplifier module (Figure A-31).
4. Connect W3P5 cable to tach assembly on motor.
5. Position tach cover on motor and secure with four mounting screws.
6. Replace protective cover (Paragraph 4.2.2). Return tape deck to operating position.
7. Perform supply reel and hub assembly replacement procedure (Paragraph 4.1.5).



(22-1086-01)

Figure 4-13. Tach Wheel/Sensor Installation

Verification Check

1. Check hub assembly (Paragraph 4.1.5).
2. With tape threaded, but not loaded, execute Operator Diagnostic Test 01.

4.2.3.1 Tach Wheel/Sensor**Installation**

1. Insert tach wheel on motor shaft. Position tape for 0.030 ± 0.002 inch clearance between tach and sensor mounting plate (Figure 4-11).
2. Install sensor on mounting plate and position for 0.150 ± 0.01 inch clearance between sensor and tach. Tighten sensor mounting screw.

Verification Check

1. Verify that connector W4P5 is attached to the supply motor tach sensor pins.
2. Turn the drive power on before installing the tachometer cover.
3. Using a voltmeter, probe the top pin of connector W4P5 and verify that -5 volts (logical high) is present when the reflective strip on the tachometer wheel is not aligned with the sensor. Now align the reflective strip with the sensor by running the tachometer wheel by hand and verify that -2 volts (logical low) is present at the top pin of connector W4P5.

4.2.4 Take-Up Reel Motor**Removal**

1. Remove take-up hub assembly (Paragraph 4.1.4).
2. With tape dock in maintenance position (Paragraph 4.2.1), remove access cover (Paragraph 4.2.2).
3. Detach connector W4P2 from tach assembly on take-up motor (Figure 4-10).

NOTE:

Check W4P2 position by using strip on connector.

4. Detach B3P1 connector from power amplifier module (connector fit on power amplifier).

5. Remove four mounting screws that secure motor to rear of tape deck. Carefully remove motor from transport.

Replacement

CAUTION

When you install a motor, make sure no loose wires are between motor mounting plate and tape deck.

1. Position motor on rear of tape deck so B5P1 cable extends from right of motor assembly.
2. Connect B5P1 cable to power amplifier module.
3. Connect W4P2 cable to tach assembly on motor.
4. Replace protective acoustic cover (Paragraph 4.2.2).
5. Replace take-up tool and hub assembly (Paragraph 4.1.4).
6. If required, return tape deck to operating position.

Verification Check

1. With tape not threaded, execute Operator Diagnostic Test 02.
2. Thread tape (but do not load) and execute Operator Diagnostic Test 01.

4.2.5 Air Bearing Sensor

Removal

NOTE

Replacement parts for air bearing assembly are contained in spares under kit PN 26-24359. This kit contains two spring guides (one front and one rear), a sensor, and small and large O-rings. If you are replacing sensor Digital recommends that you also replace two spring guides and large and small O-rings.

CAUTION

Use tape to secure air bearings to tape deck.

1. Remove magnetic head dust covers.
2. Tilt tape deck into maintenance position (Paragraph 4.2.1).

3. Locate supply or take-up air pressure sensors and their respective connectors on bottom of tape deck. Detach cable connector (check W1 cable for supply sensor, and W9 cable for take-up sensor) from sensor pins (Figure 4-12).

NOTE:

Check (and mark if necessary) pins on sensor and cable plug for proper reconnection.

CAUTION:

Make sure not to bend sensor pins when you detach cable. Pins can easily bend and break.

NOTE:

Replace spring guide(s) as necessary.

4. Remove two mounting screws that secure air bearing assembly to bottom of tape deck. Peel off tape and remove complete air bearing assembly from top of tape deck.

CAUTION:

Do not remove assembly screws. Make sure large O-ring does not fall out of air bearing.

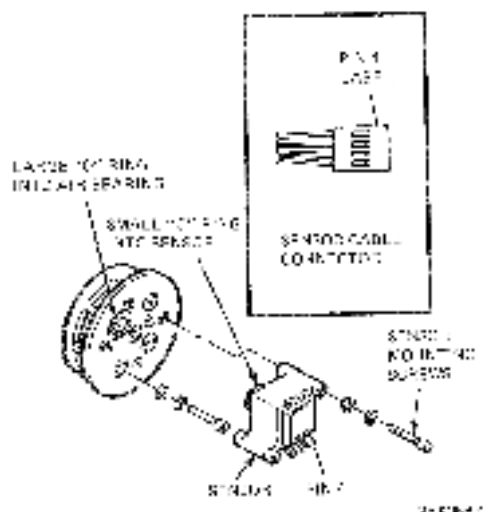


Figure 4-12 Air Bearing Sensor Assembly

5. Place assembly on flat surface and remove two screws that secure sensor to rear of air bearing.

CAUTION

Small O-ring is underneath sensor. Do not lose it.

NOTE

If necessary, you can now remove spring guide.

Replacement

1. Insert small O-ring in aperture at rear of air bearing housing.
2. Position new sensor on air bearing and secure with two mounting screws.
3. With large O-ring properly seated in aperture on air bearing, position air bearing assembly onto tape deck and tape it. Then, use two mounting screws to secure air bearing to bottom of tape deck.
4. Reattach connector to sensor pins (Figure 4-12).

Verification Check

1. With tape threaded, but not loaded, execute Operator Diagnostic Tests 02 and 03.

4.2.6 Pneumatic Pump Assembly (Compressor)

Removal

1. Turn off power switch and unplug power cord.
2. With tape deck in maintenance position (Paragraph 4.2.1), remove acoustic cover (Paragraph 4.2.2).
3. On pneumatic pump (Figure 4-13), remove vacuum and pressure tubes from nipples on bottom of tape deck behind pump.

NOTE

Mark nipples for proper tube reattachment.

4. Detach B2P1 connector (W4 cable) which connects pump to power supply connector W4P4.

NOTE

Detach any wiring that may interfere with remaining pneumatic pump assembly.

5. Remove four mounting screws that secure pneumatic pump assembly to bottom of tape deck. Carefully withdraw assembly from transport.

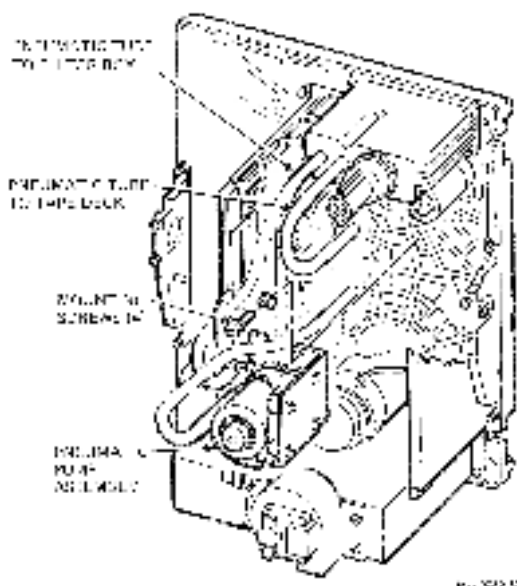


Figure 4-3. Pneumatic Pump Assembly

Replacement

1. Position new pneumatic pump assembly in place on tape deck and secure with mounting hardware.
2. Attach pneumatic tubing to corresponding nipples on tape deck pneumatic loaded pump.
3. Attach B2P1 connector (W4 cable) to pump.

NOTE

Reattach any wiring disconnected during removal.

4. Replace acoustic cover (Paragraph 4.2.2).
5. If required at that time, return tape deck to operating position. Power on transport.

Verification Check

1. With tape threaded, but not loaded, execute Operator Diagnostic Test 02.
2. With tape threaded, but not loaded, execute Operator Diagnostic Test 01.

4.2.7 Pressure Regulator and Air Filter Assembly

Removal

1. Tip tape deck into maintenance position (Paragraph 4.2.1).

NOTE

If you are replacing pressure regulator only, unscrew (counterclockwise) it from plenum box assembly, replace with new regulator, then perform verification check.

2. Remove two pressure tubes (Figure 4-14) from plenum box.

NOTE

You cannot pick up these tubes. Make sure they are marked for easy replacement.

3. Unscrew pressure regulator by turning counterclockwise (Figure 4-14).
4. Remove plenum box by removing four mounting screws.

NOTE

Make sure screws do not fall into cabinet. Screw in lower left corner is especially difficult.

5. Remove air filter by pulling straight out from plenum box interior.

Replacement

1. Position filter over shaft and press onto filter base.

NOTE

Make sure O ring is in place on filter base so that seal is maintained between base and filter can.

2. Replace plenum box and secure to tape deck with four mounting screws.
3. Screw pressure regulator clockwise onto filter shaft.
4. Install two pressure tubes. Make sure they are in proper nipples.

10. REMOVAL AND REPLACEMENT

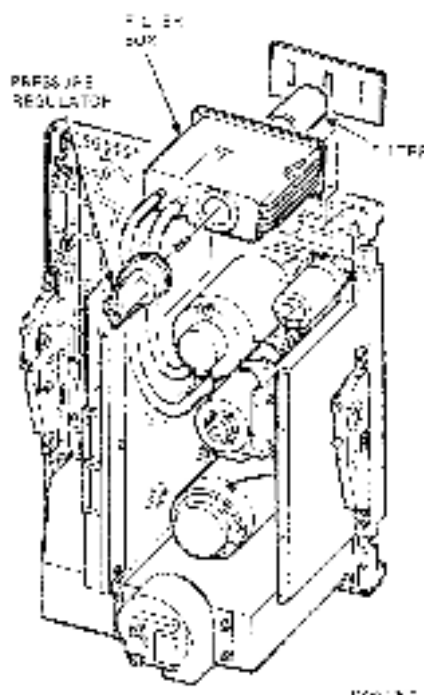


Figure 4-14 Pressure Regulator/Air Filter Assembly

Verification Check

1. With tape threaded, but not loaded, execute Operator Diagnostic Test 02.
2. With tape threaded, but not loaded, execute Operator Diagnostic Test 01.

4.2.8 Magnetic Head Assembly

CAUTION

Magnetic head and two write resistors on read/write/servo module (R224/R225) are matched components. If you are replacing head, you must also replace write resistors. Resistors are supplied with new head and labeled with head serial number, resistor number (R224 or R225), resistor value, and equivalent write current and dc voltage.

- Turn off power switch, and unplug power cord. Fill tape deck into maintenance position (Paragraph 4-2-1).

CAUTION

Refer to Figure 4-15 for location of head mounting screws. Do not loosen factory alignment screws on head; otherwise, you must replace entire head with a new assembly. Head is factory positioned on base and must never be moved.

- Loosen four head mounting screws. Hold in tape head against tape deck while you remove mounting hardware.
- Carefully withdraw complete head assembly from tape deck (Figure 4-15).
- Open logic cage and gain access to read/write/servo module (Paragraph 4-2-12).

Remove write resistors R224 and R225 from read/write/servo module at location 131 (refer to Figure A-1). These resistors are plugged in and can be removed without removing board from logic cage.

NOTE

Keep magnetic head and write resistors together as package. If head is being returned to factory.

Replacement

- Plug new write resistors R224 and R225 into read/write/servo module, location 131.

NOTE

Before you install a magnetic head, make sure recording surface is protected with soft material.

- Insert magnetic head up through tape deck, and position head onto guide pins.
- While you hold head in place, insert mounting hardware and tighten four mounting screws.
- Guide read and write erase cables through tape deck.
- From top of tape deck, attach read, write and erase connectors to magnetic head (Figure 4-15). Remove recording surface protective covering.

Verification Check**NOTE**

To run tests, power on transport and secure tape deck in operating position.

1. Clean magnetic head recording surface with soft lint-free cloth moistened with tape transport cleaner (supplied). Wipe recording surface in same direction as tape motion, and at 90° to tape motion.
2. Load known good quality write-enabled scratch tape and execute Field Service Diagnostic Test 18 to move tape away from BDT. Press RESET to stop tape after about five seconds.

NOTE

For next step, set tape deck into service position.

3. Move jumper plug at location 131 on read/write/serve module from normal W3 to test 31 W4-STORI. position (refer to Figure A-1).
4. Execute Field Service Test 31.
5. After test is successful (display 00), return jumper plug to normal W3 position. Close logic cage. Return tape deck to operating position.
If test is not successful, proceed with fault isolation and required actions described in *TU80 Pathfinder*.
6. With tape still threaded, but not loaded, execute Operator Diagnostic Test 01.

4.2.9 Cooling Fan Assembly**Removal**

1. Tilt tape deck in maintenance position (Paragraph 4.2.1).
2. Detach W4PS connector from power supply.
3. Remove four hex nuts and washers and pull fan assembly from mounting studs (Figure 4-8).

Replacement

Perform Removal procedure in reverse.

Verification Check

Turn on power to transport and check for air flow from fan.

4.2.14 Control Panel Assembly

1. Turn off power switch and unplug power cord.
2. Open front door. Find ground strap and remove screw that secures strap to tape deck (point E2). Remove hex nut that secures strap to rear of door (Figure 4-16).
3. Tilt tape deck in maintenance position (Paragraph 4-2.1).
4. On formatter/control module (refer to Figure A-2) detach control panel cable connector W&PI from P7 plug.
5. Remove cable chain clips on front door and cabinet (Cut straps if necessary.)
6. From front of transport, remove four hex screws that hold control panel to front door. Remove control panel assembly and cable.

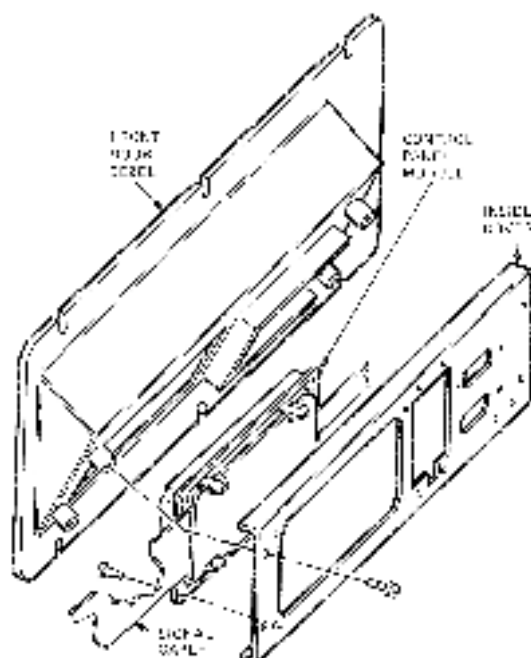


Figure 4.16 Control Panel Assembly.

Replacement

1. Insert ground strap, W3 cable, and control panel through front door opening. Then secure panel to door with four mounting screws.
2. Attach and secure ground strap and ground wire on front door and tape deck. Connect W3P1 cable connector to P3 plug on formatter/control module. Use cable clips on back of front door to secure loose cable.
3. Power on transport.

Verification Check

1. Perform functional troubleshooting procedures 1001 through 1003.
2. With tape threaded, but not loaded, execute Operator Diagnostic Test 01.

4.2.11 Power Supply**Removal**

1. Open front and rear doors. Remove frame stabilizing bar if high enough to be in the way (Figure 4-17).
2. Turn off power switch. Unplug 874 controller power cord. Tilt tape deck to maintenance position (Paragraph 4.2.1).
3. Disconnect power cable from 874 power controller and put cable aside.
4. Detach W4P4, W2P1, W7P1, and W4P3 connectors from power supply.

NOTE:

Power supply weighs approximately 4.1 kg (9 lbs). Proceed with caution when you lift it.

5. Return tape deck to operating position. From rear of unit, remove stabilizing plate mounting screw (Figure 4-17).

NOTE:

Power supply is attached to tape deck by four screws. Two screws on left are located in slots so you can slide power supply out from under these screws for removal.

6. Loosen but do not remove two mounting screws on left side of power supply.

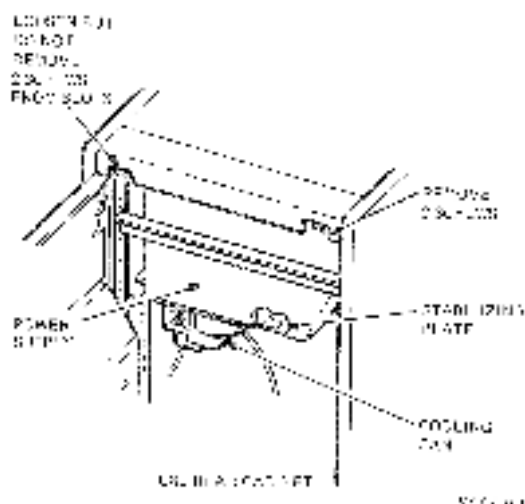


Figure 1-17 Power Supply Removal

7. Remove two mounting screws on right side of power supply while you support power supply from bottom.
8. Slide power supply out of rack on left and carefully remove power supply from cabinet.

Replacement

If your replacement power supply is PN 29 56372, you must complete the following procedure first:

1. Remove the voltage select access panel from new power supply and verify that the voltage select plug is inserted in the correct voltage acceptance. J11 is for 90 volt operation and J12 for 220-240 volt operation. Secure the voltage select access panel.
2. Check the position of the AUTO POWER ON switch. For use in a TC-80, the switch should be set in the 'OFF' position.

CAUTION

If you are installing new power supply, remove top cover from power supply enclosure and observe position of voltage select card (Figure 4-18). Position of card must correspond to input voltage as defined on transport's identification plate. Ends of card are stenciled with "120 V" and "220 V" and two indicating arrows. Make sure card is installed to match input voltage.

You can lift card, turn it upside down, and replace it into the main power supply module as required. Arrows for correct positioning are marked on module.

1. Remove top cover of power supply.
2. Make sure voltage select module (Figure 4-18) is installed in correct position. Then replace cover.
3. From rear of transport, slide power supply under two installed mounting screws.
4. Insert and tighten other two mounting screws. Then tighten two mounting screws on left.
5. Install stabilizing plate, and insert and tighten mounting screw.

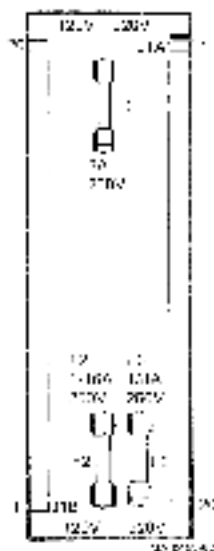


Figure 4-18 Voltage Select Card

6. Turn rmt deck to maintenance position.
7. Attach W4P4, W3P1, W7P1, and W4P3 connectors to power supply plugs.
8. Connect power cable to TU80 power supply and plug 874 controller power cord into power outlet.

Verification Check

NOTE

Power Supply is provided as completely assembled FRU and does not require verification check. However, if power problem occurs, you may check dc voltages.

DC Voltage Checks – Use a digital voltmeter to measure all dc voltages. Connect meter's ground lead to either pin 4 or 6 of the W7P1 power connector on read/write/control module (Figure 4-19). Connect other meter lead to points listed below to test all dc voltages.

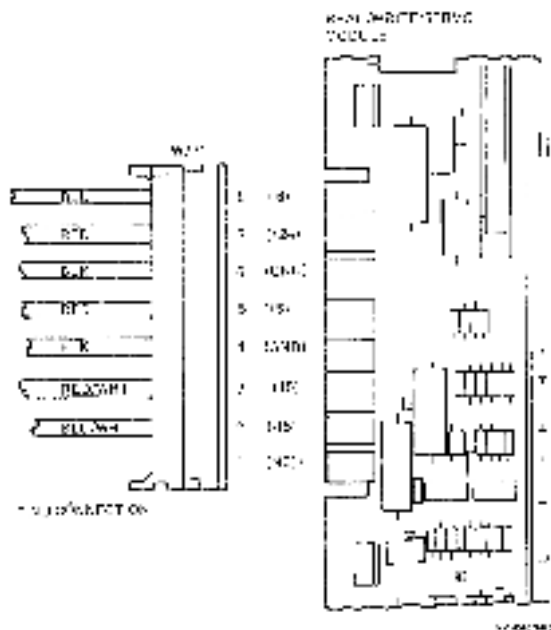


Figure 4-19 DC Voltage Check

DC Voltages and Tolerances

Location	Voltage	Tolerance
P1-5*	-5 V	±3% (-4.90 to -5.10)
P1-7*	-12 V	±10% (-13.5 to -10.5)
P1-9*	-12 V	±10% (-13.5 to -10.5)
P1-7*	-24 V	±10% (-27.6 to -20.4)
P1-8*	0 V	±2% (-0.4 to +0.6)
PA-6†	32 V	±2% (+31.2 to +32.8)

4.2.12 Read/Write/Servo Module

Removal

1. Turn off power switch.
2. Tilt tape deck into maintenance position (Paragraph 4.2.1).
3. Detach all cable connectors from read/write/servo module connectors (Figure A-1).
4. To release read/write/servo module, loosen thumbscrews in logic cage (Figure 4-20) as follows:
 - a. To open logic cage, loosen top and bottom thumbscrews.
 - b. To separate modules, loosen middle thumbscrews.

NOTES

1. Avoid undue stress on modules by loosening thumbscrews alternately until modules are separated.
2. There are two screws in each hinge of logic cage. The screws are never removed. They are loosened only enough to clear module they hold.
3. Loosen and back out top screws on each hinge of logic cage (three) to release read/write/servo module (Figure 4-20).
4. Pull read/write/servo module from P1 connector and remove module from logic cage.

* P1 is power connector on read/write/servo module.

† PA is power connector on power amplifier module.

70 REMOVAL AND REPLACEMENT

1. TOP SCREW TOP BOTTOM BEZEL LATCHES TO REMOVE FRONT WITH 8000 MODULES.
2. BEZEL LATCHES RELEASED WITH ACCESS LOCKED TO PREVENT OTHER FROM REMOVING MODULE.

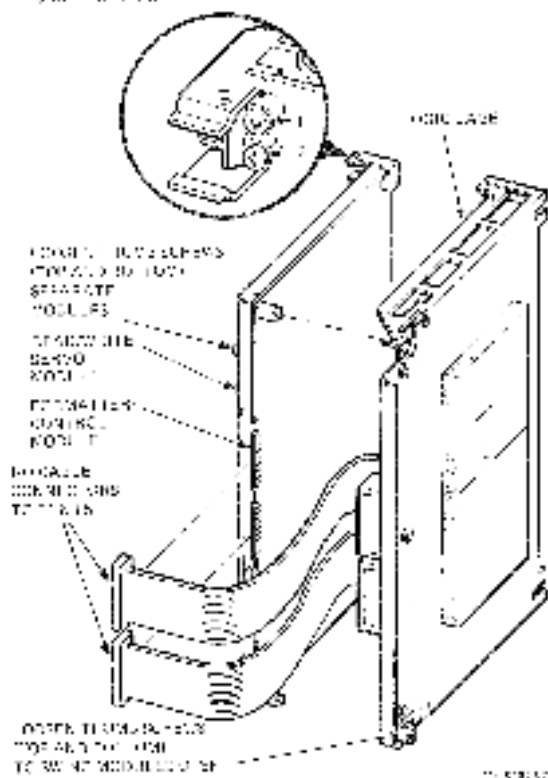


Figure 4-20 Logic Modules - Logic Caps

Replacement

NOTE

If you are installing a new logic module, remove R224 and R225 write resistors from removed module and insert these resistors into new module.

1. Insert new read/write/serve module in its place in logic cage. Make sure module is fully inserted into top and bottom hinge slots.
2. Pull in and tighten hinge screws to lock read/write/serve module in position.
3. Attach cable ships P5 and P3 from formatter/control module to J2 and J3 connectors on read/write/serve module (Figure A-11).
4. Attach remaining cable connectors to module plugs as listed below.

J1	W5P3 connector (write/erase heads)
J4	W5 cable 2 (supply read location sensor)
J5	W5P6 connector (BOT/TOT sensors, cover interlock, power amplifier, lights)
J6	W6P2 connector (read head)
J7	W5 cable (take up read location sensor)
5. Push two modules together and tighten thumbscrews to secure read/write/serve module in logic cage.

Verification Checks

1. With tape threaded, but not loaded, execute Operator Diagnostic Test 02.
2. Move jumper plug at location 170 on read/write/serve module from normal W3 to test W4-STORE position.
3. With tape not threaded, execute Field Service Test 27.
4. Load known good quality white-coated tape.
5. Execute Field Service Test 18 to move tape away from BOT. Press RESET to stop tape motion after about five seconds.
6. Execute Field Service Test 31.

7. After test is complete (display 00), return jumper plug to W3 position. Otherwise, proceed with fault isolation and required actions.
8. With tape threaded, but not loaded, execute Operator Diagnostic Test 01.

4.2.13 Formatter/Control Module

1. Turn off power switch.
2. Tilt tape lock to insurance position (Paragraph 4.3.1).
3. Remove two screws from each I/O cable plug secured in logic cage mounting bracket. Then detach two external interface shielded cables (Figures 4-17 and 4-20).

NOTE

Tighten the screws to leave two ribbon I/O cables in slots inserted in logic cage mounting bracket.

4. Detach all remaining cable connectors (Figure 4-3) from board connectors.
5. To release formatter/control module from logic cage (Figure 4-20) loosen thumbscrews on each side of cage:
 - a. To open logic rack, loosen top and bottom thumbscrews.
 - b. To separate modules, loosen module thumbscrews.

NOTE

Avoid undue stress on modules by loosening thumbscrews alternately until modules are separated.

7. Loosen and back out (but do not remove) bottom screws on each hinge (three) to release formatter/control module.
8. Pull formatter/control module from P1 connector and remove module from logic cage.

Replacement

NOTE

Before you install formatter/control module, set all jumpers and switches to position they were set at in removed module (Figure 2-1). Set all switches (S1-S4) of four-segment DIP switch at location U21 to off. Also make sure jumpers (J45) at location U16 are in NORMAL position.

1. Install formatter/control module in top and bottom hinge slots of logic cage. Make sure module is fully inserted.
2. Pull in and tighten hinge screws (three) to lock formatter/control module in position.
3. Attach I/O ribbon cables to P4 and P4 connectors on module. Refer to Figure 3-5 for correct I/O cable interconnections.
4. Push two modules together. Then align and tighten thumbscrews.
5. Attach cable connectors to module plugs as listed below.

P1	W7 cable (power amplifier module and power supply)
P2 and P3	Cables from J2 and J3 connectors on read/write/servo module
P4 and P5	Flat I/O cables to bulkhead bracket connectors
P6	W2P1 cable connector (power supply)
P7	W8P1 cable connector (servo panel)

Verification Check

1. With tape threaded, but not locked, execute Operator Diagnostic Test (1).

NOTE

After you successfully complete module replacement and checking, reattach and secure two external interface cables on mounting plate bracket of logic cage. Return tape deck to operating (horizontal) position.

4.2.14 Power Amplifier Module

Removal

1. Turn off power switch. Unplug power cord.
2. With tape deck in maintenance position (Paragraph 4.2.1), remove acoustic cover (Paragraph 4.2.2).
3. Detach cable connectors J1 through J4 from module (Figure A-3).
4. Remove three screws along outside edge of module to release it from mounting rack (Figure 4-8). Remove module.

Replacement

1. Insert new module into slots in mounting rack. Make sure module is in place.
2. Replace and tighten three screws to secure module in rack.
3. Reattach cable connectors as follows.

J1	B3P1 cable connector (take-up reel motor)
J2	W3P1 cable connector (read/write/servo module)
J3	B1P1 cable connector (supply reel motor)
J4	W3P2 cable connector (power supply)

Verification Check

Individually execute Operator Diagnostic Tests 03 (tape not threaded), 02 (tape threaded, but not loaded), and 01 (tape threaded, but not loaded).

NOTE

After you successfully complete module replacement and checking, replace protective acoustic cover and return tape deck to operating (horizontal) position.

4.2.15 Top Cover Interlock Switch

Removal

1. With tape deck in maintenance position (Figure 4-21), remove four labeled slip-on connectors from interlock switch connectors. (If any wires are not labeled, identify and mark each wire for proper reattachment.)
2. Remove two mounting screws that secure switch plate to tape deck. Remove switch and switch plate.
3. Press top and bottom release tabs on switch to separate switch from switch plate.

Replacement

1. Assemble switch to switch plate.
2. Position switch assembly on rear of tape deck so connector numbers on switch correspond to numbers on tape deck.
3. Insert two hex mounting screws. Position top cover door so interlock switch can be aligned with actuating stud on door. Tighten switch mounting screws when center of switch front is aligned with actuating stud.
4. Attach slip-on connectors to appropriate studs of interlock switch (Figure 4-21).

Verification Check

With tape threaded, but not loaded, execute Operator Diagnostic Test 01.

4.2.16 Capacitor Assembly

Removal

1. Lift protective tape door to maintenance position and remove cassette cover.
2. Detach capacitor connector from J5 on power amplifier module.

NOTE

Do not remove protective terminal caps on top of capacitor during removal or replacement procedures.

3. Remove three screws from capacitor mounting assembly. Remove capacitor assembly.

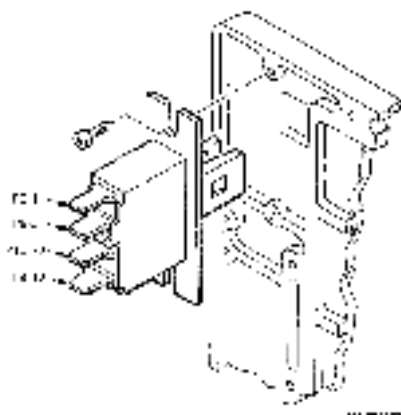


Figure 4-21 Door Interlock Switch (Mechanical View)

Replacement

1. Mount replacement capacitor assembly as shown in Figure 4-22 and install three screws. Tighten securely.
2. Install capacitor connector to J5 on power amplifier module.

Verification Check

Thread tape (m. loaded) and run Operation Diagnostic Tests 01 and 02.

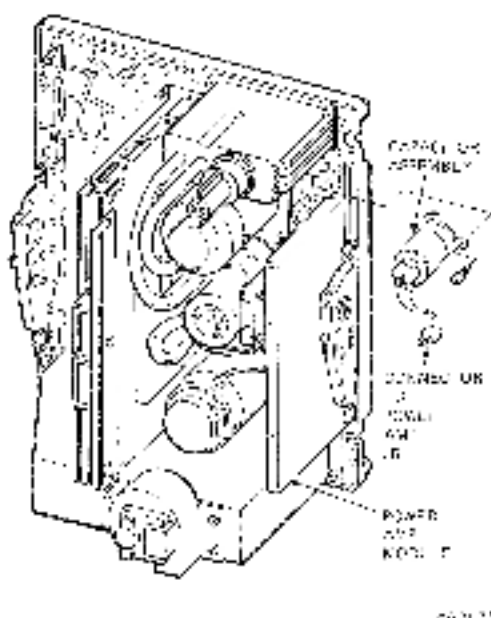


Figure 4-77 Camera Assembly

A MODULE LAYOUTS

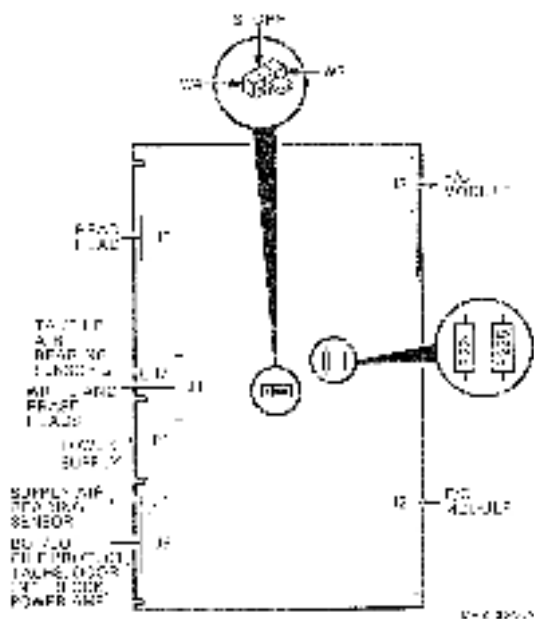


Figure A-1 Read/Write/Serve Module Layout

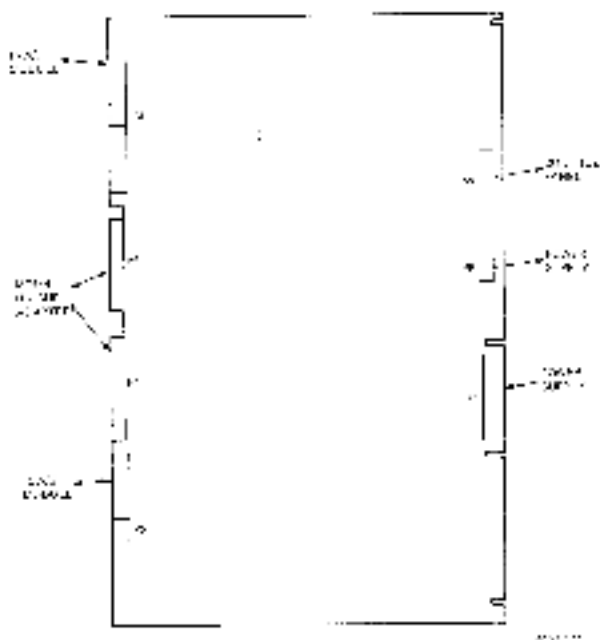


Fig. 4-3 Frontier/Control Module

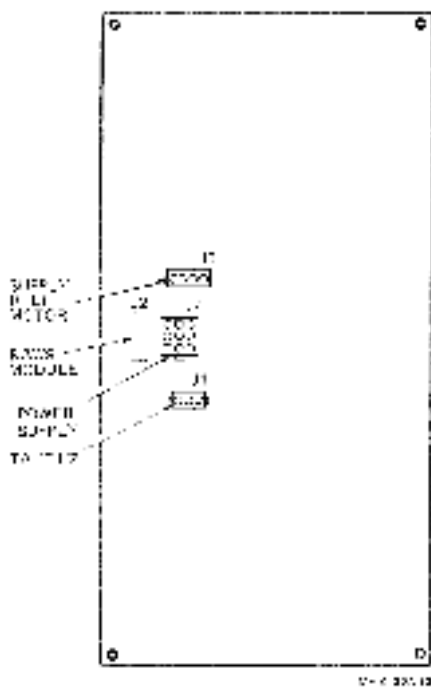


Figure 6-3 shows a typical module.

B TUN80 REGISTERS

BUS ADDRESS REGISTER (EL1)

ADDRESS ADDRESS 0 ADDRESS 15 (TOTAL 16) 16384

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	0
A[15]	A[14]	A[13]	A[12]	A[11]	A[10]	A[9]	A[8]	A[7]	A[6]	A[5]	A[4]	A[3]	A[2]	A[1]	A[0]	A[0]
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	0
DEFINITION																
15	ADDRESS					DEFINITION										
15	ADDRESS					ADDRESS 0 (EL1) 16384										
14	ADDRESS					ADDRESS 1 (EL1) 16385										
13	ADDRESS					ADDRESS 2 (EL1) 16386										
12	ADDRESS					ADDRESS 3 (EL1) 16387										
11	ADDRESS					ADDRESS 4 (EL1) 16388										
10	ADDRESS					ADDRESS 5 (EL1) 16389										
9	ADDRESS					ADDRESS 6 (EL1) 16390										
8	ADDRESS					ADDRESS 7 (EL1) 16391										
7	ADDRESS					ADDRESS 8 (EL1) 16392										
6	ADDRESS					ADDRESS 9 (EL1) 16393										
5	ADDRESS					ADDRESS 10 (EL1) 16394										
4	ADDRESS					ADDRESS 11 (EL1) 16395										
3	ADDRESS					ADDRESS 12 (EL1) 16396										
2	ADDRESS					ADDRESS 13 (EL1) 16397										
1	ADDRESS					ADDRESS 14 (EL1) 16398										

6.1.1.1

Figure B-2 Bus Address Register

DATA BUFFERING REGISTER (EL1)

ADDRESS ADDRESS 0 ADDRESS 15 (TOTAL 16) 16384

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	0
A[15]	A[14]	A[13]	A[12]	A[11]	A[10]	A[9]	A[8]	A[7]	A[6]	A[5]	A[4]	A[3]	A[2]	A[1]	A[0]	A[0]
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	0
DEFINITION																
15	ADDRESS					DEFINITION										
15	ADDRESS					ADDRESS 0 (EL1) 16384										
14	ADDRESS					ADDRESS 1 (EL1) 16385										
13	ADDRESS					ADDRESS 2 (EL1) 16386										
12	ADDRESS					ADDRESS 3 (EL1) 16387										
11	ADDRESS					ADDRESS 4 (EL1) 16388										
10	ADDRESS					ADDRESS 5 (EL1) 16389										
9	ADDRESS					ADDRESS 6 (EL1) 16390										
8	ADDRESS					ADDRESS 7 (EL1) 16391										
7	ADDRESS					ADDRESS 8 (EL1) 16392										
6	ADDRESS					ADDRESS 9 (EL1) 16393										
5	ADDRESS					ADDRESS 10 (EL1) 16394										
4	ADDRESS					ADDRESS 11 (EL1) 16395										
3	ADDRESS					ADDRESS 12 (EL1) 16396										
2	ADDRESS					ADDRESS 13 (EL1) 16397										
1	ADDRESS					ADDRESS 14 (EL1) 16398										

6.1.1.2

Figure B-3 Data Buffer Register

STATUS REGISTER (SER)

SERIAL STATUS REGISTER (SER) (R/W)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0			0	0	0	0	0	0	0	0	0	0	0	0	0
1			0	0	0	0	0	0	0	0	0	0	0	0	0

15	000000	TESTING MODE
14	0000	00
13	0000	00
12	0000	00
11	0000	00
10	0000	00
9	0000	00
8	0000	00
7	0000	00
6	0000	00
5	0000	00
4	0000	00
3	0000	00
2	0000	00
1	0000	00
0	0000	00

SERIAL STATUS REGISTER

Figure D.4 Serial Register

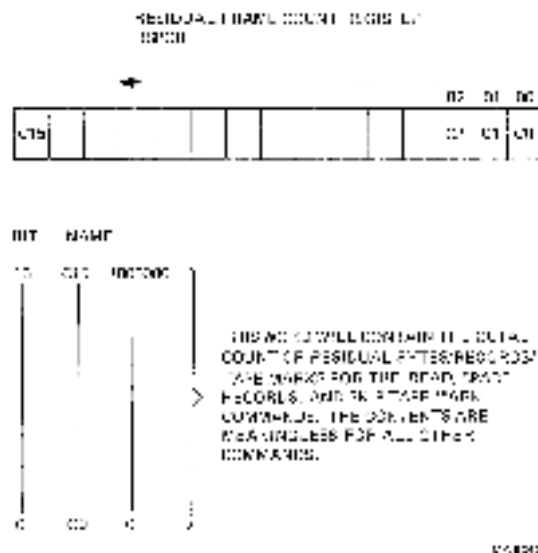


Figure D.5 Residual Byte Count Register

EXTENDED STATUS REG. STEP 2 (XSTAT2)

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	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