
TC44-AA/BA

TC44-AA/BA STI to StorageTek 4400 ACS Interconnect Hardware Maintenance Manual

Order Number EK-TC44!-TM-001

Digital Equipment Corporation

1st Edition, January 1991

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About This Manual

INTRODUCTION

This manual provides information for testing and servicing the TC44 Standard Tape Interface (STI) to StorageTek® 4400 Automated Cartridge System (ACS) Interconnect. This manual is for Customer Services personnel, and is intended to address the maintenance aspects of the system.

- Chapter 1 provides an overview and general information about configurations, hardware, and performance.
- Chapter 2 contains troubleshooting information.
- Chapter 3 contains procedures for removing and replacing field replaceable units (FRUs).

RELATED DOCUMENTATION

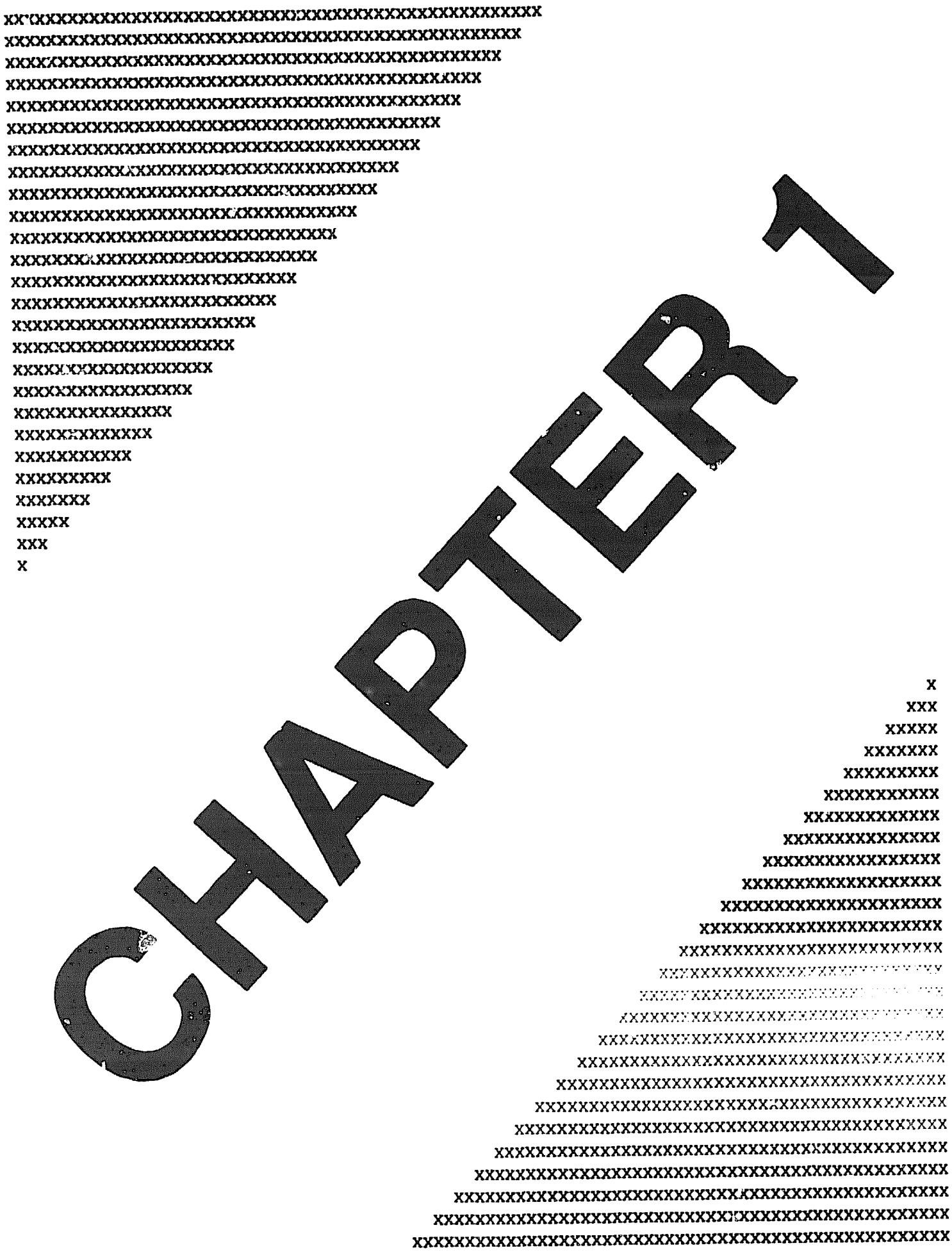
Other publications that support the TC44 STI to StorageTek 4400 ACS Interconnect are:

- *TC44-AA/BA STI to StorageTek 4400 ACS Interconnect Hardware Installation Guide* (EK-TC44I-IM)
- *TA90 Magnetic Tape Subsystem Owner's Manual* (EK-OTA90-OM)

RELATED TOOLS AND TEST EQUIPMENT

Two turnaround connectors are required:

Connector	Digital PN	Vendor PN
Tag	12-34275-01	69684-010
Bus	12-34276-01	69684-009


CHAPTER 1

1
INTRODUCTION

1.1 OVERVIEW

The TC44 STI to StorageTek 4400 ACS Interconnect adapter is the interface between a remote VAX/VMS system and a StorageTek 4400 Automated Cartridge System (ACS). The TC44 STI to StorageTek 4400 ACS Interconnect is similar to a TA90 tape control unit (TCU) except that it connects to a remote tape control unit instead of local tape transport units. The connection to the remote control unit is made over a standard IBM® channel interface (FIPS-60). The remote tape control unit is part of the StorageTek 4400 ACS. Like the TA90 TCU, the TC44 adapter connects to a hierarchical storage controller (HSC). The HSC connects to one or more VAX processors in a VAXcluster.

The TC44 adapter requires client level software on the VAX to communicate with the tape library server (TLS) over an Ethernet link. This software translates the appropriate VAX operating system commands into ACS commands.

The StorageTek 4400 ACS Interconnect contains a library storage module that can hold up to 6000 tape cartridges. A robot arm in the library inserts tape cartridges into and removes tape cartridges from the cartridge drives in response to user requests.

Figure 1–1 is a diagram showing the simplified hardware connections, data path, and control path for the TC44 adapter in a minimal system configuration.

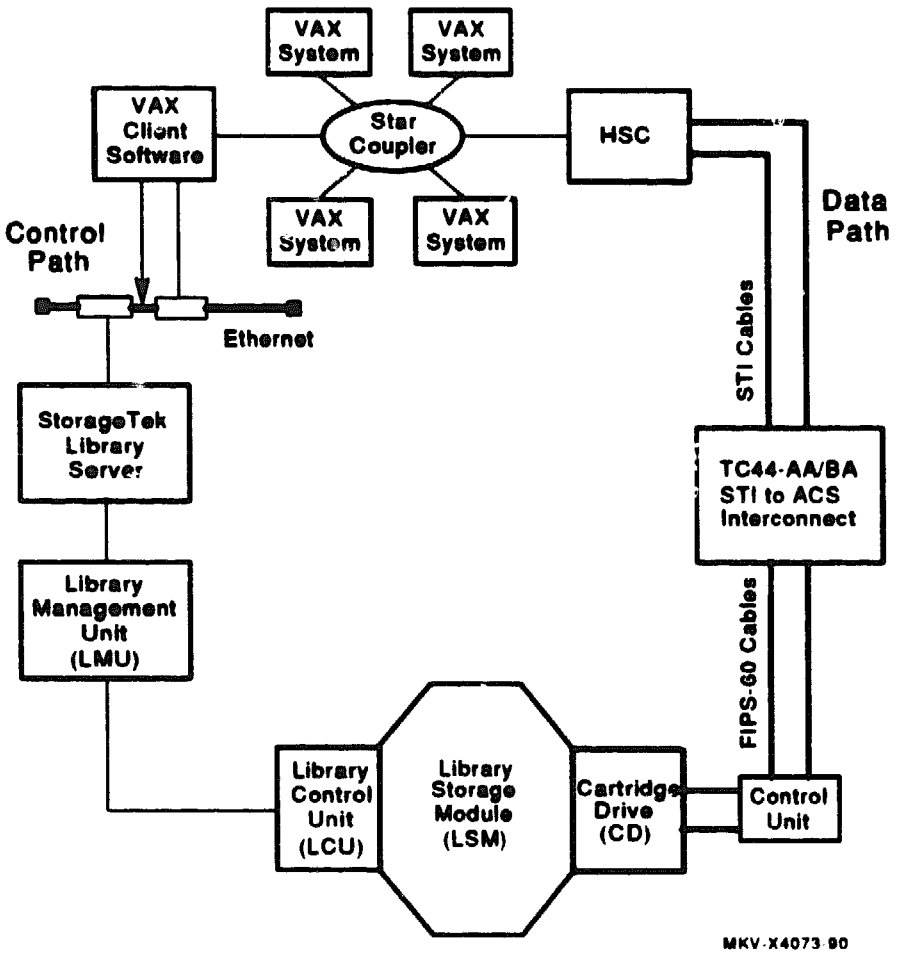


Figure 1–1 Simplified Interconnect Diagram

1.2 CONFIGURATIONS

Figure 1–1 represents a minimal system configuration comprising:

- A single HSC
- One TC44 STI to StorageTek 4400 ACS Interconnect
- One control unit and channel

Most systems have two FIPS-60 channels connected to the TC44 STI to StorageTek 4400 ACS Interconnect adapter. For systems that require high availability, the TC44 STI to StorageTek 4400 ACS Interconnect adapter can be connected in a redundant system configuration as shown in Figure 1–2. This configuration comprises:

- Two HSCs
- Two TC44 STI to StorageTek 4400 ACS Interconnect adapters
- Two control units and channels

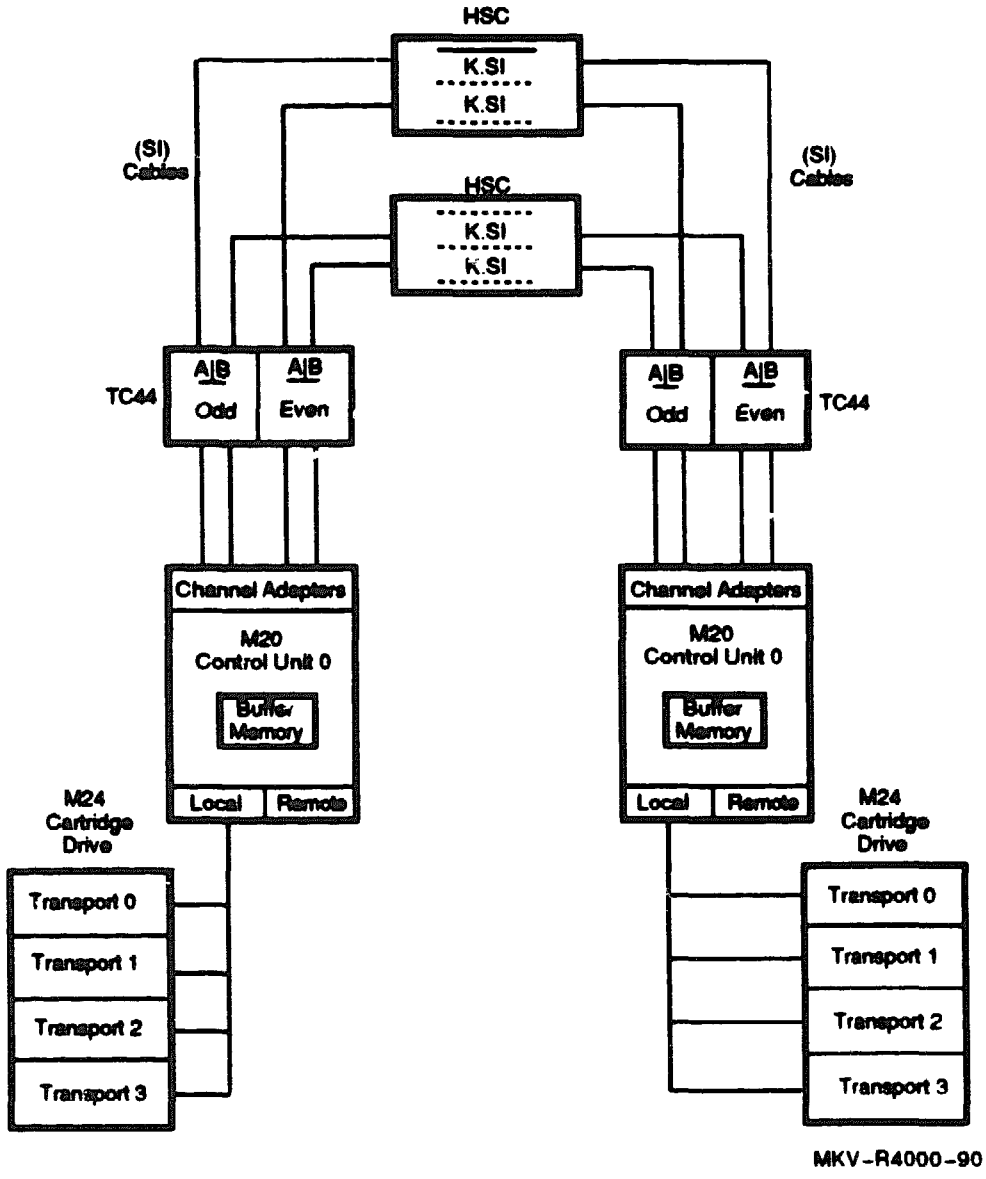


Figure 1–2 Redundant Configuration

1.3 TC44 STI TO StorageTek 4400 ACS INTERCONNECT ADAPTER HARDWARE

The TC44 adapter is designed to provide TA90 STI to FIPS functionality and connectivity with a StorageTek 4480 control unit over standard FIPS type blue cabling. The standard FIPS type blue cabling can provide reliable connectivity for distances up to 122 m (400 ft).

The TC44 STI to StorageTek 4400 ACS Interconnect adapter hardware that accomplishes the above functionality consists of:

- Two TC44 adapter modules
- One FIPS converter module
- One customer engineer (CE) panel
- One power supply
- One rackmountable enclosure
- The supporting hardware

Figure 1–3 shows the TC44 STI to StorageTek 4400 ACS Interconnect adapter hardware.

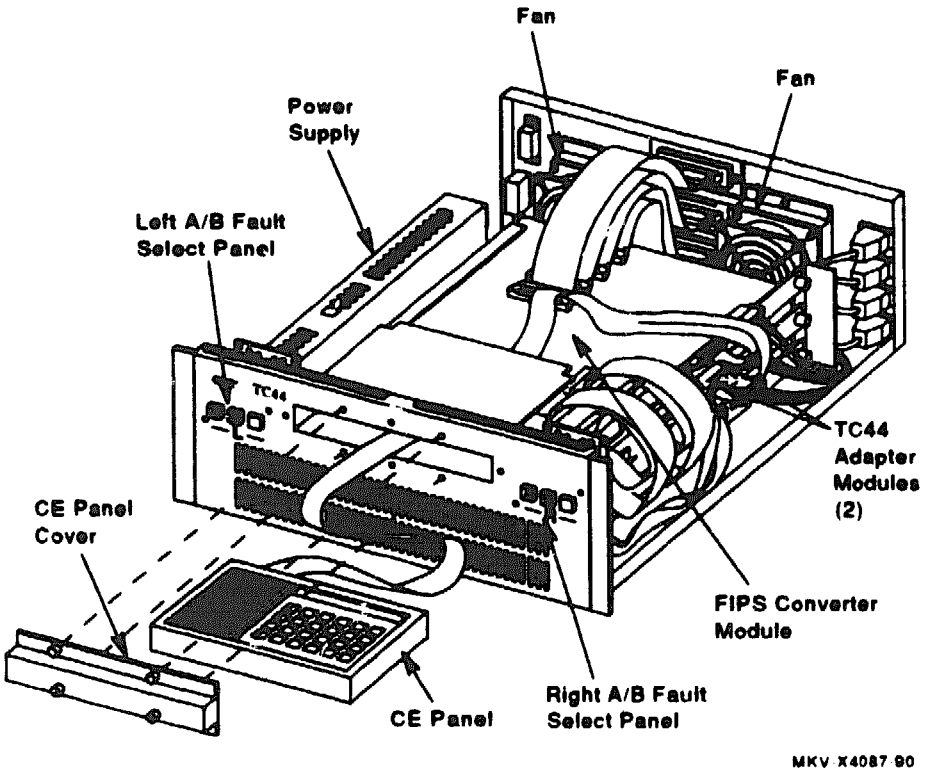


Figure 1–3 TC44 STI to StorageTek 4400 ACS Interconnect Adapter Hardware

1.4 TC44 ADAPTER MODULE

The TC44 adapter module (Figure 1–4) provides the STI to FIPS conversion. Each module has a set of A/B STI ports and supports four tape cartridge drives through a dedicated FIPS channel. The TC44 adapter module connects to the FIPS converter module over internal ribbon cables that carry TTL FIPS signals. The TC44 adapter module is divided into three major functional areas:

- The STI interface
- The microprocessor kernel
- The FIPS interface

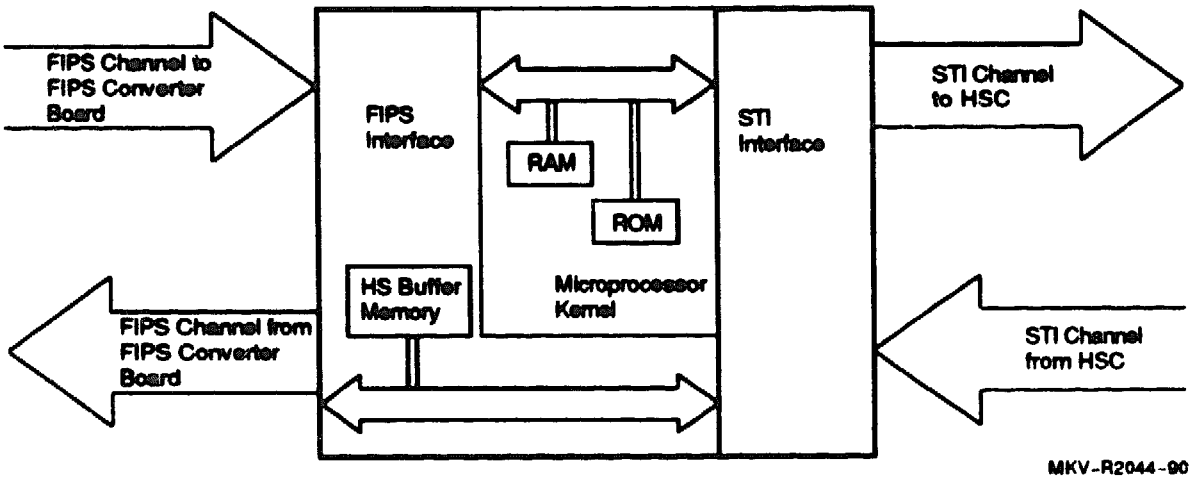


Figure 1–4 TC44 Adapter Module Block Diagram

1.4.1 STI Interface

The STI Interface consists of LSI chips designed to handle the communication with the HSC.

1.4.2 Microprocessor Kernel

The microprocessor kernel consists of a ROM, a RAM, and a bus. The microprocessor kernel handles the housekeeping functions and the command and status interpretation from both the STI and FIPS ports.

1.4.3 FIPS Interface

The FIPS interface consists of inbound and outbound state machines with their support registers and logic. High-speed transfer of data between the STI and FIPS ports is accomplished by direct memory access (DMA) to a dedicated buffer memory. This transfer takes place over a bus that is independent of the microprocessor kernel in order to meet the high throughput requirements.

1.5 FIPS CONVERTER MODULE

The FIPS converter module sends the bus and tag signals from the TC44 adapter module to the StorageTek 4400 ACS, and sends the bus and tag signals from the StorageTek 4400 ACS to the TC44 adapter module. The FIPS converter module provides drivers, receivers, terminators, and grounding for the bus and tag signals. This module is also capable of driving and receiving signals over blue FIPS cables up to 122 m (400 ft) in length.

The FIPS converter module contains a power supervisor to provide proper power-up and power-down sequencing for the digital logic on the TC44 adapter modules. The power supervisor:

- Keeps the TC44 adapter modules reset until the power is stable during power-up
- Notifies the TC44 adapter module of a power failure when the voltage drops below +5 V

The capability to add delay lines for compensation of future vendor specific timing requirements has been designed, but is not used at this time.

1.6 CE PANEL

The CE panel (Figure 1–5) is a handheld device designed for diagnostics and configuration maintenance.

NOTE
This CE panel is the same as the one used in the TA90 except that it has a shorter 2-foot cable.

The CE panel has a 20-character display that produces either half-screen or full-screen displays, and a keyboard consisting of alphanumeric keys and special function keys. For half-screen messages, the left half of the display is dedicated to the left adapter module and the right half of the display is dedicated to the right adapter module.

The CE panel is the primary maintenance tool for the TC44 STI to StorageTek 4400 ACS Interconnect adapter. It is used:

- To set a logical base drive address in the TC44 adapter modules for use in the HSC and VAX operating systems
- To "mask" drives that the system manager does not want accessed over the FIPS channel
- For diagnostics

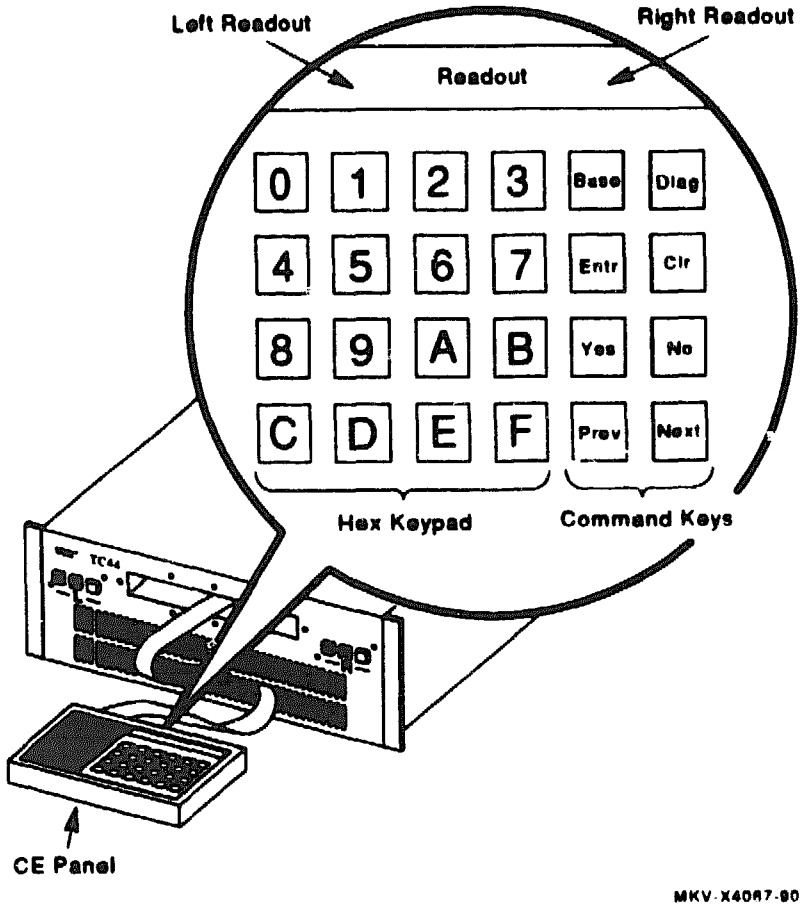


Figure 1-5 CE Panel

The TC44 adapter modules must be connected to a device or loopback connectors in order for the CE panel to operate with the TC44 adapter module.

No tape diagnostics are available through the CE panel; however, sense data from specific tape drives can be read.

For information on setting the base address and "masking," refer to the *TC44-AA/BA STI to StorageTek 4400 ACS Interconnect Hardware Installation Guide* (EK-TC44I-IM). For CE panel diagnostics, refer to Section 2.8.

1.7 POWER SUPPLY

The power supply provides power as indicated in Table 1–1.

Table 1–1 Basic Power Supply Specifications

Voltage	Nominal Current	Nominal Power
+5.1 V	24.1 A	123 W
–5.2 V	1.8 A	10 W
+12 V	0.8 A	10 W
–12 V	0.07 A	1 W
Total Power	N/A	144 W

1.8 PERFORMANCE

The throughput requirements are:

- STI link: 22 MHz, yielding 2.7 Mbytes/s maximum
- FIPS link: 3 Mbytes/s
- Tape rate: 3 Mbytes/s
- Sustained throughput: 2.2 Mbytes/s

NOTE
Record size and amount of memory are factors that can affect the throughput.

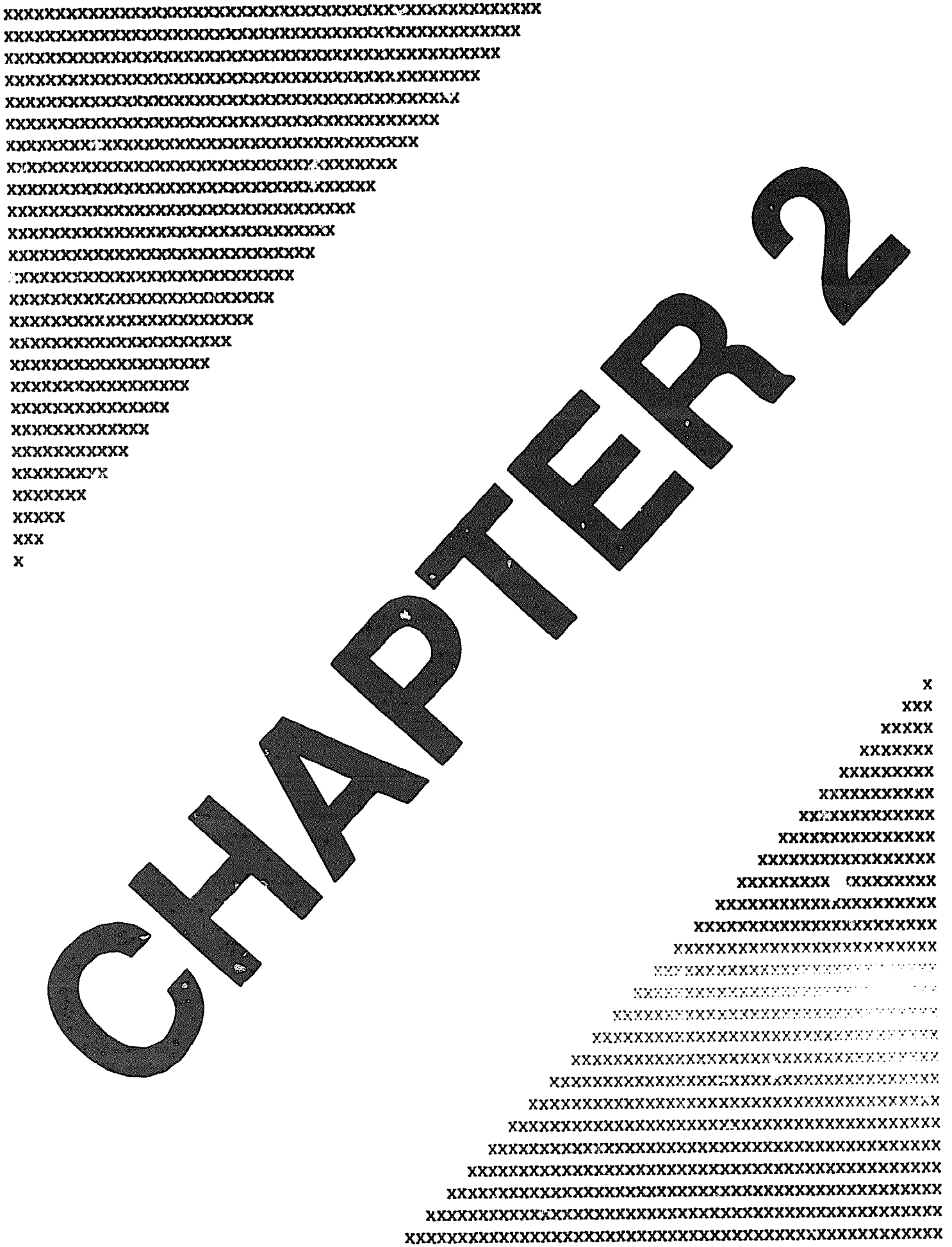
1.8.1 Cached or Noncached Operation

The TC44 can be used in cached or noncached mode. In cached mode, when the buffer receives data, it can acknowledge the receipt immediately. In noncached mode, the data must be on the media before it can be acknowledged. This means that the target drive operates in "start-stop" mode for noncached operation. Each record written to tape requires time for:

- Transmission delays on the FIPS link
- Drive connect (writing data on the media)
- Repositioning the tape

NOTE
Noncached use of a tape drive is the default for VMS.

Throughputs up to 2.5 Mbytes/s can be realized if data is packaged in large records and presented to the TC44 STI to StorageTek 4400 ACS Interconnect adapter with virtually no overhead. If noncaching is used, the maximum possible throughput drops considerably.


CHAPTER 2

2
CUSTOMER SERVICES TROUBLESHOOTING

2.1 HARDWARE TROUBLESHOOTING

Troubleshooting the STI to StorageTek 4400 ACS Interconnect consists of isolating faulty FRUs by using:

- Power-up diagnostics
- FIPS loopback diagnostics
- TC44 setup
- Front panel LED error codes
- Host system messages

2.2 POWER-UP DIAGNOSTICS

Power-up diagnostics test the TC44 adapter modules, the power supply, and the CE panel. Power-up diagnostics are started when power is applied to the STI to 4400 ACS Interconnect. While the power-up diagnostics are running, the LEDs on the TC44 adapter modules (Figure 2–1) cycle on and off. The microprocessor kernel is tested first, followed by the FIPS channel and then the STI/HSC interface. Figure 2–2 identifies the power-up conditions after a successful completion of the power-up diagnostics. If the microprocessor kernel LED (center LED) is not on, the power-up diagnostic has failed.

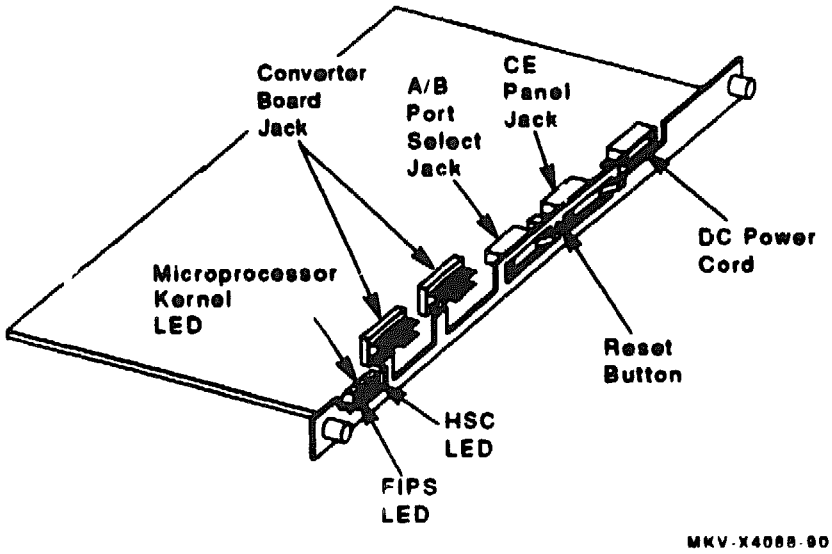


Figure 2–1 TC44 Adapter Module LEDs

TC44 Adapter Module LEDs	CE Panel Display	Front Panel Indications When Fault Switch is Pressed	Installed Condition
○ ✸ ○	•	□ □ □	With No Connections
○ ✸ ○	PWRUP OK	✸ ✸ ✸	With Loopback
✸ ✸ ✸	PWRUP OK	✸ ✸ ✸	Established FIPS and HSC Channels

✸ ON ✸ BLINKING ○ OFF

* Software and Hardware Revision of CE Panel

MKV-R2045-90

Figure 2–2 Successful Completion of Power-Up Diagnostics

If there is a problem with the system, use the following procedure to isolate the problem:

1. Power the unit down and up to start the power-up diagnostics.
2. If there is a fault indication, continue with step 3. If there is no fault indication, the system hardware is OK.
3. Remove the suspected pair of FIPS cables from the rear of the TC44 cabinet.
4. Replace the cables with a pair of loopback connectors, a bus loopback connector (Digital PN 12-34276-01), and a tag loopback connector (Digital PN 12-34275-01) on the appropriate connectors.
5. Start the power-up diagnostics.
6. If there is no fault indication, run the FIPS loopback diagnostics (Section 2.8).
7. If the fault indication reappears, the problem is internal to the TC44 STI to StorageTek 4400 ACS Interconnect cabinet. Refer to Section 2.8 and Section 2.9 for additional troubleshooting information.

2.3 A/B FAULT SWITCH LED ERROR INDICATIONS

The front panel Fault LED lights when there is a fault condition during power-up or during normal operation, or when the FIPS loopback connectors are on for more than one hour. Table 2–1 defines the areas of the failure.

Table 2–1 A/B Fault Indications

A	B	Fault	Indication
–	–	*[1]	Kernel memory error or loopback on for more than one hour
–	*	*	TCU (FIPS) interface error
*	–	*	STI interface error
*	*	*	Kernel nonmemory error

[1]An asterisk (*) indicates that the LED is lit.

2.4 FAILURE ANALYSIS

Remove the FIPS tag and bus cables from the rear of the cabinet. Install the two bus loopback connectors (Digital PN 12-34276-01) and the two tag loopback connectors (Digital PN 12-34275-01) on the appropriate connectors at the rear of the cabinet.

2.4.1 TC44 Adapter–No PWRUP OK Displayed on CE Panel

Follow the procedure below.

1. Does the other channel work? If so, replace the TC44 adapter. If not:
   a. Check the power supply. See Section 2.4.4. If bad, replace the power supply.
   b. Check the DCOK L signal on J2 of the FIPS converter module. If the signal is high, replace the FIPS converter module. The signal should be lower than 0.5 V (Section 2.7.1).
   c. If both the power supply and DCOK L signal are OK, replace the TC44 adapter module.
2. If a known good TC44 adapter fails, check the power supply cabling.
3. If the power supply cabling is OK, check the FIPS cabling and FIPS converter module.

NOTE
For PWRUP OK to be displayed on the CE panel, the OPL_OUT_D L signal going to the FIPS converter module needs to be looped back to the TC44 adapter on OPL_IN_R L by means of the FIPS converter module and the loopback connectors.

2.4.2 CE Panel–No Display After Power-Up

Follow the procedure below.

1. Does the power supply measure +5.1 V ± .02 V at the supply? If no, adjust the +5.1 V supply (Section 2.4.6).
2. Try a known good CE panel. If good, replace the CE panel. If bad:
   a. Replace the CE cable assembly. If still bad:
   b. Replace the TC44 adapter. (The TC44 has a 2.5 A fuse that provides power to the CE panel.)

2.4.3 PWRUP OK on Wrong Side of CE Panel Display

Determine if the CE panel cable assembly is reversed at the TC44 adapter. If so, switch the connections.

2.4.4 No Power

Check incoming ac voltage to be 110 Vac. If not, troubleshoot to:

- AC cable assembly
- Circuit breaker
- Voltage select switch

2.4.5 Missing DC Voltages

Check the dc power supply wiring color code against Figure 2–3 to verify proper connections. Visually check to make sure all connections are tight and on the correct terminal, and that there are no short circuits.

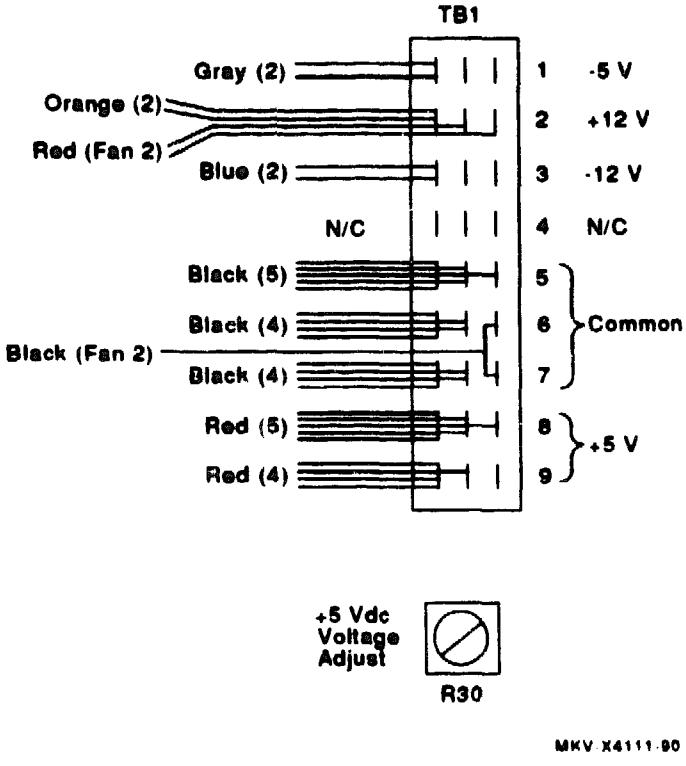


Figure 2–3 Power Supply Test and Adjustment Points

2.4.6 Voltage Settings Incorrect

Check the dc voltages for correct settings as listed below. The +5 V settings can be adjusted with the potentiometer (R30) located beneath TB1, the dc output terminal block (Figure 2–3). All others are fixed. If a voltage cannot be brought into specification, the power supply should be replaced.

NOTE
The +5.1 V setting is set by the power supply vendor and should not need adjustment.

The correct Vdc settings are:

- +5.1 V ± 0.01 V
- –5.2 V ± 0.01 V
- +12 V ± 0.2 V
- –12 V ± 0.2 V

2.5 FAN(S) INOPERATIVE

Check the dc voltage at the power supply. If faulty, replace the power supply. If OK, check the dc voltage at the fan end of the cable. If faulty, replace the cable. If OK, replace the fan(s).

2.6 FRONT PANEL AND FRONT PANEL CABLE ASSEMBLY

Press the Fault switch. If only one or two LEDs light, replace the front panel assembly.

If no LEDs light:

1. Check the cabling.
2. Switch the front panel cables at the TC44 adapters.
   a. If still bad, replace the front panel assembly.
   b. If the LEDs light, replace the TC44 adapter. (The front panel receives its power through a fuse located on the TC44 adapter. The fuse might be blown.)

2.6.1 Odd/Even Drives Connected to Top/Bottom FIPS Cables

Determine if the front panel cable assembly is plugged into the wrong TC44 adapter module. If plugged into the wrong adapter module, reinstall correctly. If OK, replace the front panel cable assembly.

2.7 FIPS CONVERTER MODULE

The last portion of the system testing is a dedicated FIPS loopback test. The FIPS converter module buffers the FIPS channels for both of the TC44 adapter modules and also provides a DCOK L signal that resets the TC44 adapter modules after power-up.

2.7.1 No PWRUP OK

If both TC44 adapter modules do not initialize and go through self-test, or if they appear to intermittently get reset and go through self-test, the DCOK L signal on J2, pins 3 and 4 in the FIPS converter module may be at fault. Check to verify that this signal is low (0.5 V or lower), and stays low (Figure 2–4).

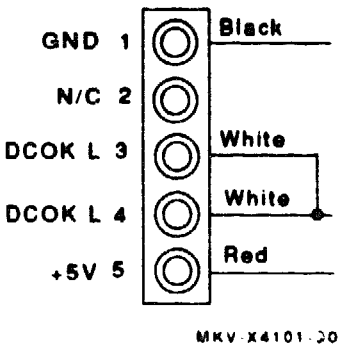


Figure 2–4 J2 Wiring

If the TC44 adapter modules go through self-test and are operational but the CE panel does not display PWRUP OK, the signal OPL_OUT_D is not being looped back to OPL_IN_R. Check the FIPS converter module and associated cabling. If still bad, see Section 2.4.1.

2.7.2 FIPS Loopback Test Fails

The detailed information that follows is for reference only because the Customer Services engineer troubleshoots to the bus/tag error only. A FIPS loopback test failure will generate one of three error codes on the CE panel: STAT A 014 for bus, STAT A 015 for tag, and STAT A 017 for parity. The loopback test goes through the channel signals one at a time, sending out a pulse on a channel output signal through a driver and checking for the signal on its respective receiver. The first time it does not detect a pulse on the return signal, the test will either terminate or start again, depending on the test mode selected. Troubleshooting after one of these failures consists of entering the FIPS loopback test in the LOOP TIL SUCCESS mode, locating the problem to the last signal being tried during the test, and troubleshooting to the area that is preventing the signal from returning. All signals with the preface P1 connect to the top TC44 adapter and the FIPS channel connectors located in the upper rear portion of the unit. All signals prefaced with a P0 connect to the bottom TC44 adapter and the FIPS channel connectors located in the lower rear portion of the unit. Signal names in this document have the P1/P0 preface deleted because they are used as references for both channels. To enter into the LOOP TIL SUCCESS mode, follow the FIPS loopback test procedure outlined in Section 2.8. When the CE panel prompts you with the questions, ONLY ONCE? and LOOP TIL ERROR?, select NO. This response causes the FIPS loopback test to default to LOOP TIL SUCCESS. As long as the test fails in this mode, it will try again.

NOTE
Tags MKO_OUT and MKO_IN are not tested during the loopback test.

2.7.2.1 STAT A 014 Error Code

STAT A 014 indicates a failure of the bus portion of the channel. Table 2–2 lists the bus signals and the priority in which they are tested (for reference only).

Table 2–2 STAT A 014

Priority	Range
1	BUS_OUT_D7 L to BUS_IN_R7 L
2	BUS_OUT_D6 L to BUS_IN_R6 L
3	BUS_OUT_D5 L to BUS_IN_R5 L
4	BUS_OUT_D4 L to BUS_IN_R4 L
5	BUS_OUT_D3 L to BUS_IN_R3 L
6	BUS_OUT_D2 L to BUS_IN_R2 L
7	BUS_OUT_D1 L to BUS_IN_R1 L
8	BUS_OUT_D0 L to BUS_IN_R0 L

If the failure is a STAT A 014, swap the bus ribbon cables at the module plug.

- If the STAT A 014 remains on the same channel, replace the FIPS converter module.
- If the STAT A 014 moves to the other channel, remove the loopback connector and check for bent pins on the original FIPS bus connector.

  If bent pins are found, straighten the pins, replace the ribbon cable in its original location, and replace the loopback connector.
- If the failure moves to the other channel and/or bent pins were not found, replace the TC44 AA/BA unit.

2.7.2.2 STAT A 015 Error Code

STAT A 015 indicates a failure of the tag portion of the channel. Table 2–3 lists the tag signals and the priority in which they are tested (for reference only).

Table 2–3 STAT A 015

Priority	Range
1	HLD_OUT_D L to REQ_IN_R L
2	SEL_OUT_D L to SEL_IN_R L
3	SUP_OUT_D L to DIS_IN_R L
4	ADR_OUT_D L to ADR_IN_R L
5	CMD_OUT_D L to STA_IN_R L
6	SRV_OUT_D L to SRV_IN_R L
7	DAT_OUT-D L to DAT_IN_R L
8	OPL_OUT_D L to OPL_IN_R L

If the failure is a STAT A 015, swap the tag ribbon cables at the module plug.

- If the STAT A 015 remains on the same channel, replace the FIPS converter module.
- If the STAT A 015 moves to the other channel, remove the loopback connector and check for bent pins on the original FIPS tag connector.

  If bent pins are found, straighten the pins, replace the ribbon cable in its original location, and replace the loopback connector.
- If the failure moves to the other channel and/or bent pins were not found, replace the TC44 AA/BA unit.

2.7.2.3 STAT A 017 Error Code

STAT A 017 on the CE panel indicates a parity error. If this error occurs during the FIPS loopback self-test, it indicates that BUS_OUT_PAR L is not being looped back on BUS_IN_PAR L.

In this case, follow the same procedures as a STAT A 014 or STAT A 015 on the appropriate bus and tag cables and plugs.

2.8 CE PANEL DIAGNOSTICS—FIPS LOOPBACK TEST

The FIPS loopback test provides a way to check the FIPS channel to the FIPS channel connectors. Successful completion of the FIPS loopback test indicates that all the FIPS channel signals can be driven/received properly, and that there are no shorts or opens.

To run the FIPS loopback test:

1. Disable the STI ports by placing the STI A/B switches in the OUT (off) position.
2. Power down the TC44 STI to ACS Interconnect adapter by disconnecting the power cord.
3. Install the tag and bus loopback connectors to the channel to be tested (if not already connected).
4. Connect the power cord and allow the power-up diagnostics to complete.
5. Ensure that the CE panel displays PWRUP OK for the channel to be tested.
6. At the CE panel, select diagnostics by pressing Diag.

   The message, USE LEFT ADAPTER? is displayed on the CE panel.
7. To test the left adapter, press Yes. To test the right adapter, press No.

   The CE panel displays either DIAG: LEFT CONTROL or DIAG: RIGHT CONTROL.
8. Type D001 and press Entr.
9. Press Yes in response to the question, REBOOT FOR DIAGS?

   The CE panel displays the revision levels of the CE panel hardware and software, and then displays the message, SPECIALS: HIT ENTR.
10. Press Entr in response to the message, SPECIALS: HIT ENTR.
11. When SPECIAL TEST NUMBER? is displayed, type F and press Entr.
12. To test only once, press Yes. Successful completion will be indicated by STAT.....0.

    FIPS line errors will be indicated by:

    STAT....14 = Bus error
    STAT....15 = Tag error
    STAT....17 = Parity error
13. To loop the test, press No in response to the question, ONLY ONCE?
14. Press Yes in response to the question, LOOP TIL ERROR?

    While the test is running, the CE panel displays the message, F TIL ERROR ....

    The test will run for a maximum of one hour, then the Fault LED will light.
15. To stop the test and/or check the status of the test, press Diag.

    The CE panel displays DID xxxxx ... STOP?, where xxxxx is the number of test passes.
16. To stop the test and display its status, press Yes.

    The CE panel displays the status of the test and asks for a test number. The test can be re-entered by typing F and pressing Entr.

17. To stop the test, press Diag.

    The CE panel displays ALL DONE AND REBOOT?

18. Press Yes to stop the test and reboot the TC44 STI to ACS Interconnect adapter.

2.9 TROUBLESHOOTING CHART

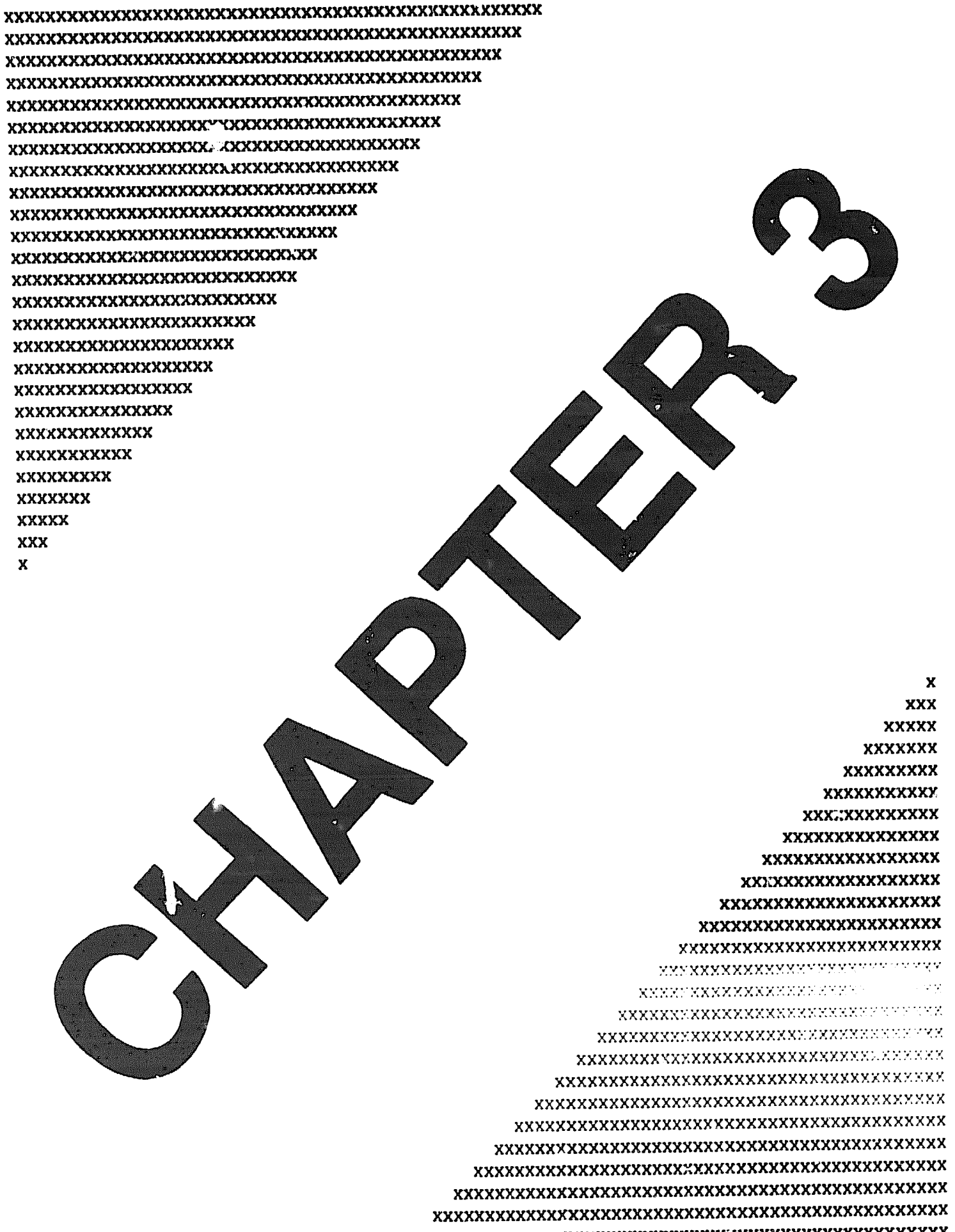
Table 2–4 is a troubleshooting chart that can be used to isolate problems in the event that diagnostics do not reveal the problem or if diagnostics cannot be run.

Table 2–4 Troubleshooting Chart

Symptom	Probable Cause	Suggested Corrective Action
DIAG 8002 is displayed on CE panel.	No –5.2 V from the power supply	1. Power down the unit and disconnect the power cable from one of the TC44 adapter modules.
None of the LEDs on the TC44 adapter module are on.	–5.2 V short circuited on one of the TC44 adapter modules	2. Power up the unit. If the symptoms remain, continue with the next step. If the symptoms are no longer present, the disabled TC44 adapter module is faulty.
The A and Fault LEDs are blinking on both front panels.		3. Power down the unit.
		4. Replace the previously removed TC44 adapter module power cable and disconnect the other TC44 adapter module power cable.
		5. Power up the unit. If the symptoms remain, suspect the power supply. If the symptoms are no longer present, the disabled TC44 adapter module is faulty.
Neither fan is operating.	No +12 V from the power supply	1. Power down the unit and disconnect the power cable from one of the TC44 adapter modules.
PWRUP OK appears on the CE panel display, but pressing the Fault switch does not light any LEDs on either front panel.	+12 V short circuited on one of the TC44 adapter modules	2. Power up the unit. If the symptoms remain, continue with the next step. If the symptoms are no longer present, the disabled TC44 adapter module is faulty.
PWRUP OK does NOT appear on the CE panel display.	No –12 V from the power supply	3. Power down the unit.
Pressing the Fault switch does not light any LEDs on either front panel.	–12 V short circuited on one of the TC44 adapter modules	4. Replace the previously removed TC44 adapter module power cable and disconnect the other TC44 adapter module power cable.
		5. Power up the unit. If the symptoms remain, suspect the power supply. If the symptoms are no longer present, the disabled TC44 adapter module is faulty.

Table 2–4 (Cont.) Troubleshooting Chart

Symptom	Probable Cause	Suggested Corrective Action
Fans are operating, but no LEDs on the TC44 adapter modules, the CE panel, or the front panels are on.	No +5.1 V from the power supply	1. Power down the unit and remove the FIPS converter module.
	+5.1 V grounded on the TC44 adapter modules	2. If the symptoms remain, continue with the next step. If the symptoms change, the FIPS converter module is faulty.
	+5.1 V grounded on the FIPS converter module	3. Power down the unit and disconnect the power cable from one of the TC44 adapter modules.
		4. Power up the unit. If the symptoms remain, continue with the next step. If the symptoms are no longer present, the disabled TC44 adapter module is faulty.
		5. Power down the unit.
		6. Replace the previously removed TC44 adapter module power cable and disconnect the other TC44 adapter module power cable.
		7. Power up the unit. If the symptoms remain, suspect the power supply. If the symptoms are no longer present, the disabled TC44 adapter module is faulty.


CHAPTER 3

3
REMOVING AND REPLACING THE FIELD REPLACEABLE UNITS

3.1 ACCESSING AND REPLACING THE FIELD REPLACEABLE UNITS

This chapter contains the procedures to access and replace the field replaceable units (FRUs). The FRUs are listed in Table 3–1.

Table 3–1 Field Replaceable Units

No. of Pieces	Part Name	Part Number
2	TC44 modules	54-20041-01
1	Converter module	54-20003-01
1	Power supply	30-33085-01
2	Port select/fault switch assemblies	54-20017-01
2	Fan assemblies	70-22821-01
1	CE panel	70-25967-02

3.1.1 Removal from the Rackmount

To remove the TC44-AA/BA from its rackmount, proceed as follows (Figure 3–1):

1. Unplug the ac power cord from the rackmount ac distribution outlet.
2. Disconnect the FIPS cables from the rear of the TC44-AA/BA.
3. Disconnect the STI/HSC cables from the rear of the TC44-AA/BA.
4. Remove the four (4) Phillips retaining screws from the front of the TC44-AA/BA.
5. Remove the two (2) rear retaining screws if the unit is shipped with a cabinet.
6. Slide out the unit from the front of the rackmount cabinet.

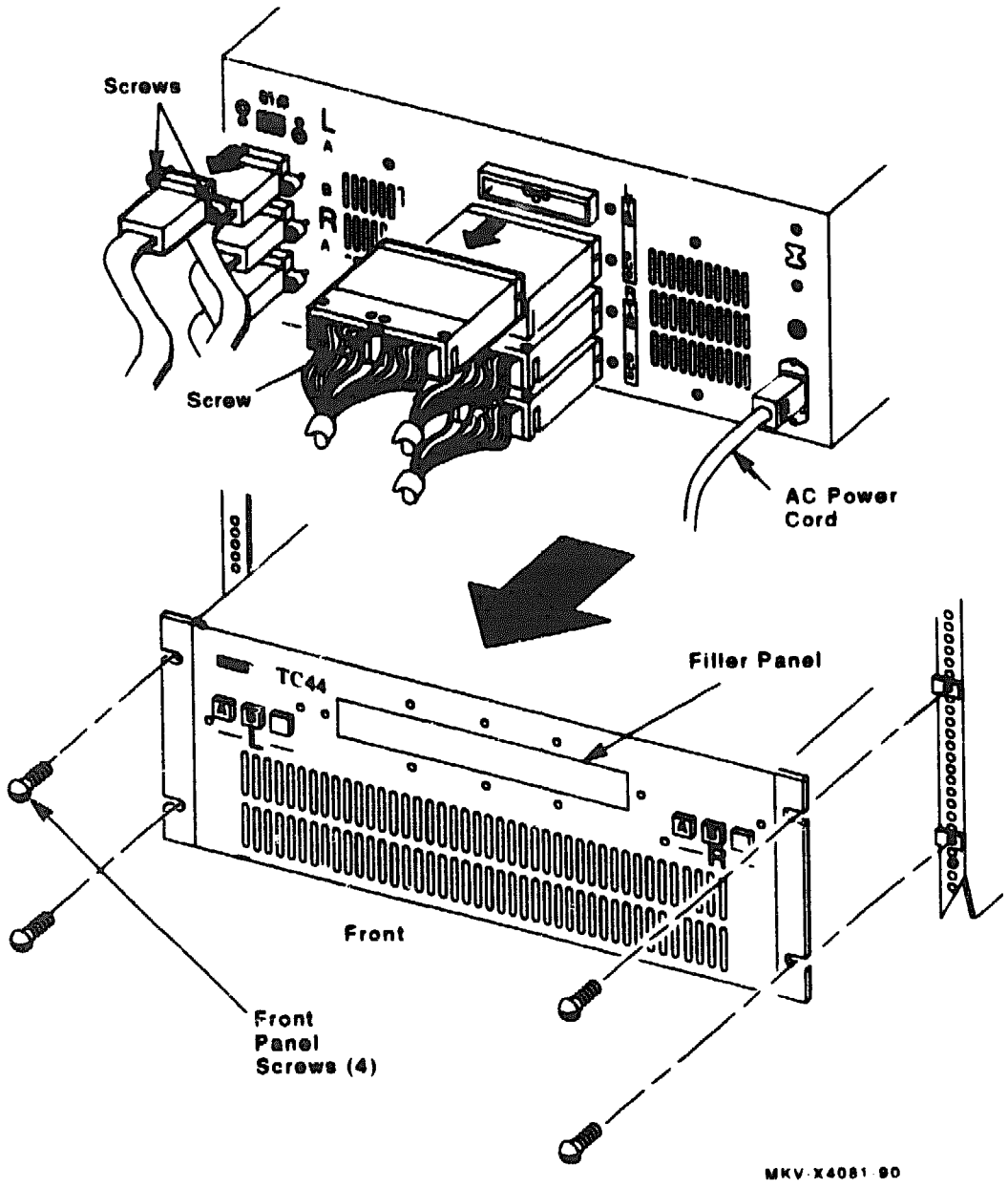


Figure 3–1 Removal from the Rackmount

3.1.2 Opening the Enclosure

Proceed as follows to access the internal components (TC44 boards, converter board, power supply, port select/fault switch assembly, fans, and wire harness assemblies):

WARNINGS

Hazardous voltages are present with the enclosure cover removed. Observe all safety precautions and warning label(s). Figure 3–2 shows the warning label on the power supply (actual location may vary).

To prevent shock, be sure that the power plug is disconnected from the power source before removing the cover.

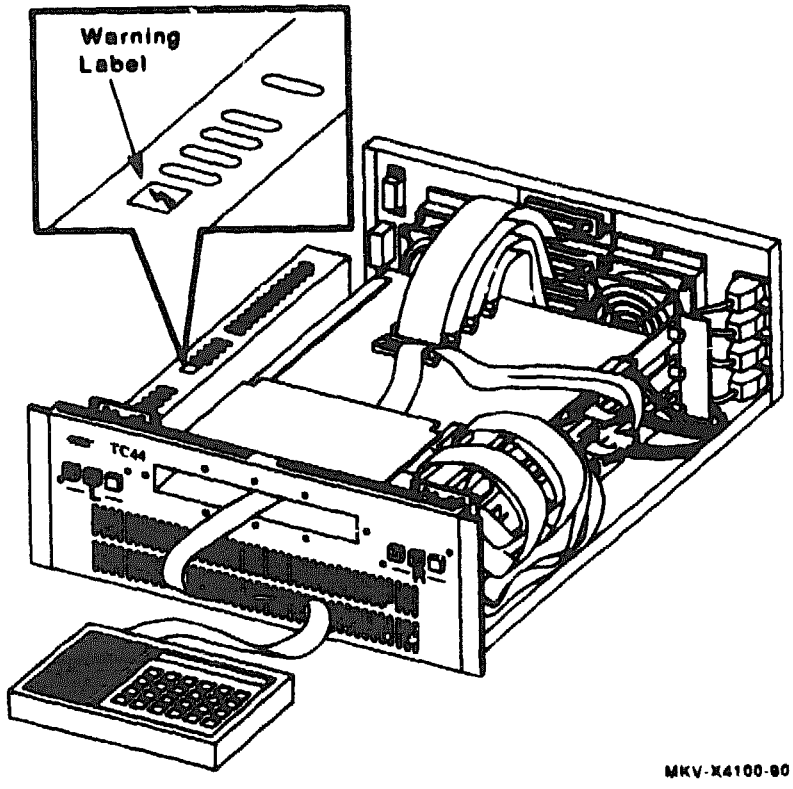


Figure 3–2 Warning Label

1. Remove the twelve (12) Phillips screws from the top of the cover (Figure 3–3).
2. Loosen the six (6) Phillips screws at the bottom of both sides of the cover.
3. Remove the eight (8) Phillips screws from both sides of the cover.
4. Lift the enclosure cover up and off the TC44-AA/BA unit.

To close the enclosure, reverse the steps for opening the enclosure.

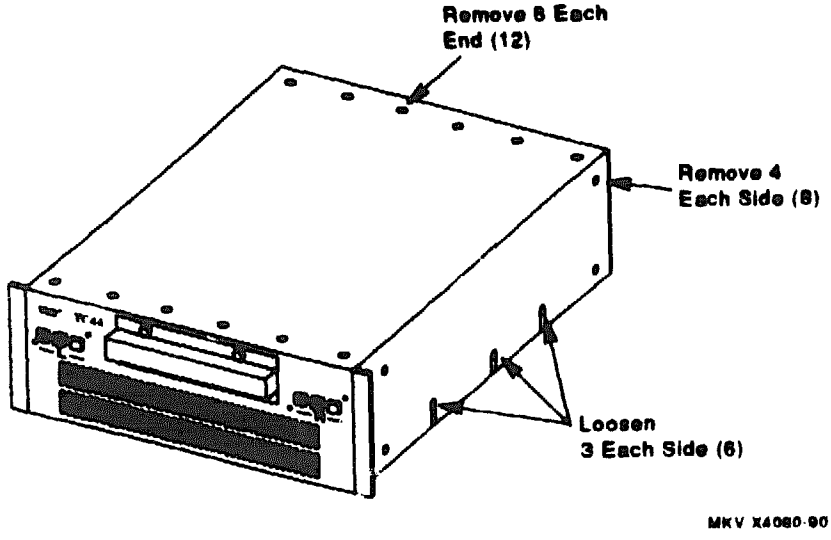


Figure 3–3 Cover Screws

3.2 FIELD REPLACEABLE UNIT REMOVAL AND REPLACEMENT

The field replaceable units (FRUs) for the STI to StorageTek 4400 ACS Interconnect are:

- Two TC44 adapter modules
- One FIPS converter module
- One dc power supply
- Two A/B fault switch assemblies
- Two fan assemblies
- One CE panel

Figure 3–4 shows the location of the nine FRUs, and Figure 3–5 is an internal cabling diagram showing power and signal connections for all the FRUs. The removal and replacement procedures for each of these FRUs are provided in Section 3.2.1 through Section 3.2.6.

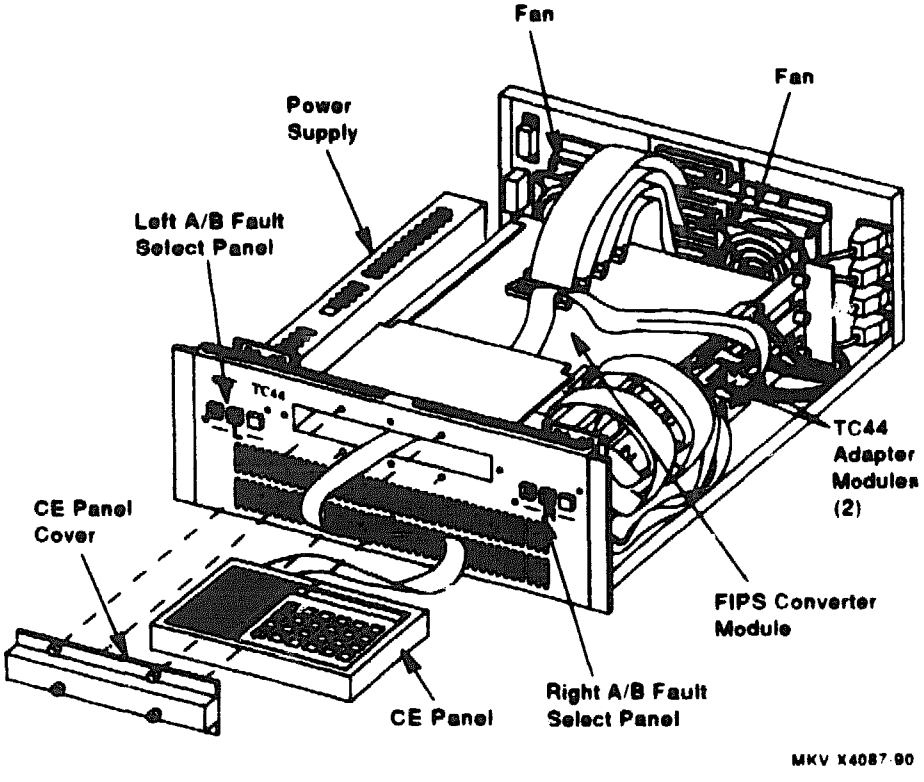


Figure 3–4 Locating the FRUs

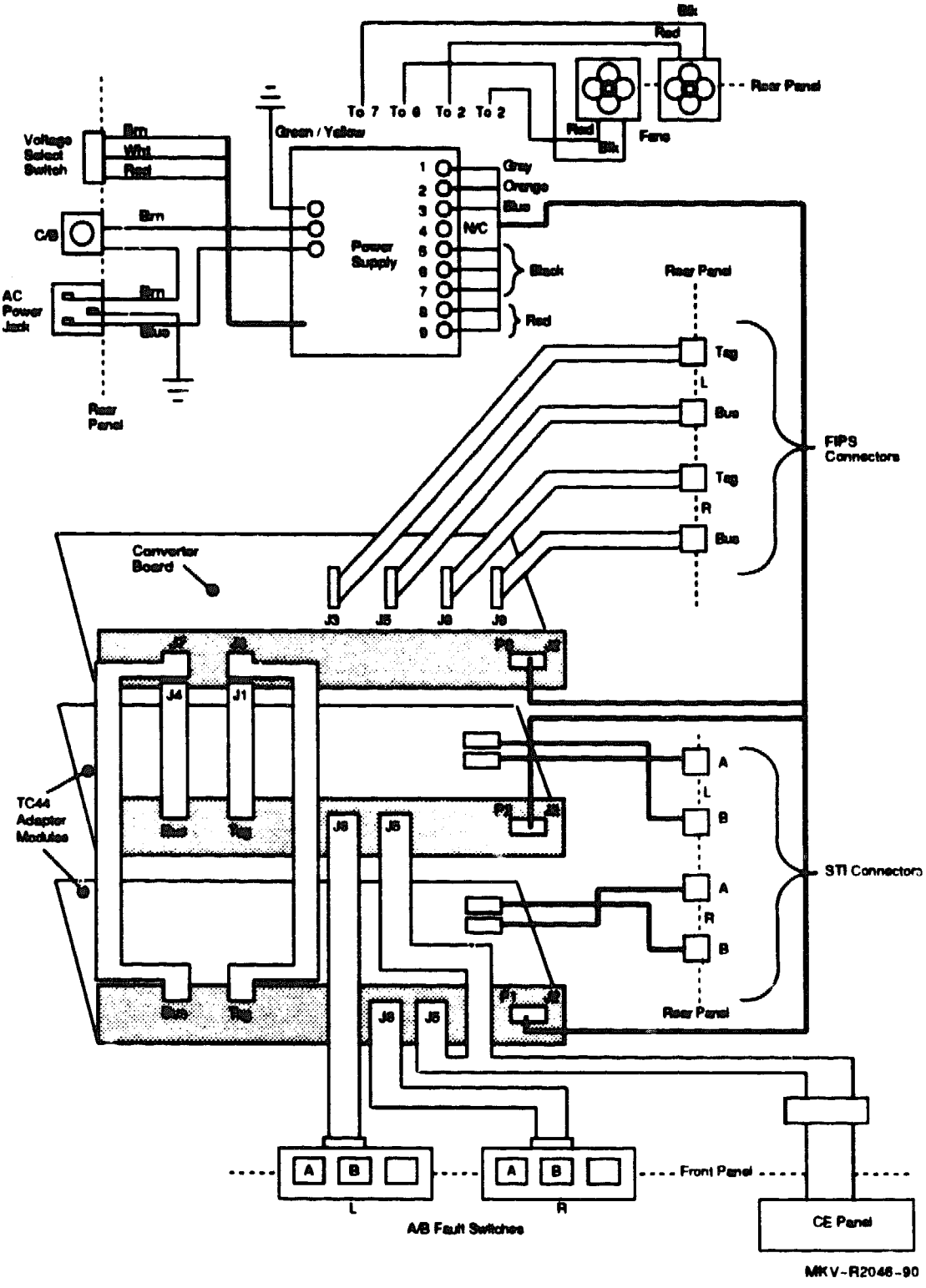


Figure 3-5 Internal Cabling Diagram

3.2.1 TC44 Adapter Module Removal/Replacement

To remove the TC44 adapter module:

1. Disconnect the power cord from the wall outlet.
2. Remove the top cover (Section 3.1.2).
3. Disconnect the two tag and two bus ribbon cables (J1, J4, J6, and J7) from the FIPS converter board (Figure 3–6).

   NOTE
   To remove the bottom TC44 adapter module, only the FIPS ribbon cables connected to J6 and J7 need to be disconnected.

4. Disconnect the front panel ribbon cable (left for top module and right for bottom module) from the TC44 adapter module.
5. Disconnect the CE panel ribbon cable from the TC44 adapter module.

   NOTE
   If the top module is being replaced, the CE panel ribbon cable must be disconnected from both modules.

6. Disconnect the power connector from the TC44 adapter module.
7. Loosen the two knurled captive screws to free the module.
8. Carefully remove the module from the unit.

To replace the TC44 adapter module, reverse the removal procedure.

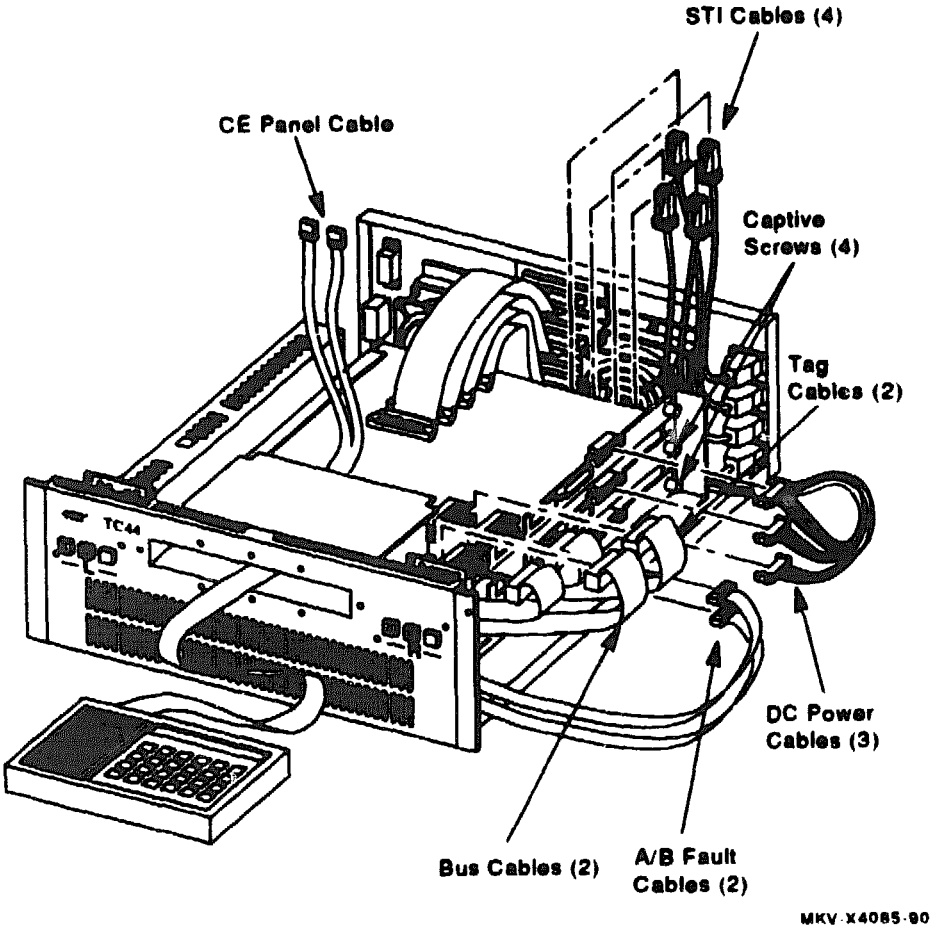


Figure 3–6 Replacing the TC44 Adapter Module

3.2.2 FIPS Converter Module Removal/Replacement

To remove the FIPS converter module:

1. Disconnect the power cord from the wall outlet.
2. Remove the top cover (Section 3.1.2).
3. Disconnect the two tag and two bus ribbon cable connectors (J1, J4, J6, and J7) from the FIPS converter module (Figure 3–7).
4. Disconnect the four internal FIPS ribbon cable connectors (J3, J5, J8, and J9) from the FIPS converter module.
5. Disconnect the power cable from the FIPS converter module.
6. Disconnect the CE cable from the CE panel assembly.

7. Loosen the knurled captive screws until the module is free.
8. Carefully remove the module.

To replace the FIPS converter module, reverse the removal procedures.

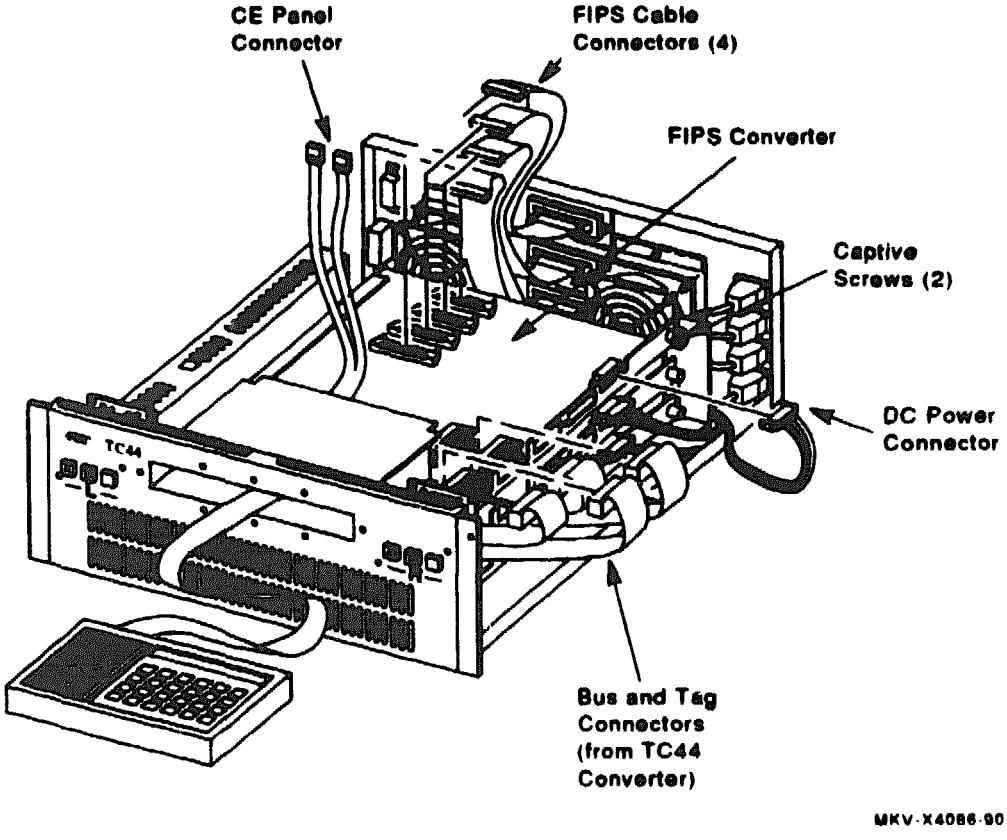


Figure 3–7 Replacing the FIPS Converter Module

NOTE
When connecting the ribbon cables to J1, J4, J6, and J7, the cables from the bottom TC44 adapter module connect to J6 and J7 on the converter module. The top internal FIPS ribbon cable connects to J3, the second from the top connects to J5, the third from the top connects to J8, and the bottom connects to J9.

3.2.3 DC Power Supply Removal/Replacement

To remove the power supply:

1. Disconnect the power cord from the wall outlet.
2. Remove the top cover (Section 3.1.2).
3. Disconnect the brown, white, and red wires from the voltage select switch (Figure 3–8).
4. Disconnect all remaining wires at the power supply.
5. Tip the unit on its side.
6. Support the power supply and remove the five (5) Phillips screws securing the supply to the unit.
7. Remove the power supply from the unit.

To replace the power supply, reverse the removal procedure.

NOTE
When connecting the wires to the voltage select switch, connect the brown wire to the top connector; the white wire to the center connector; and the red wire to the bottom connector.

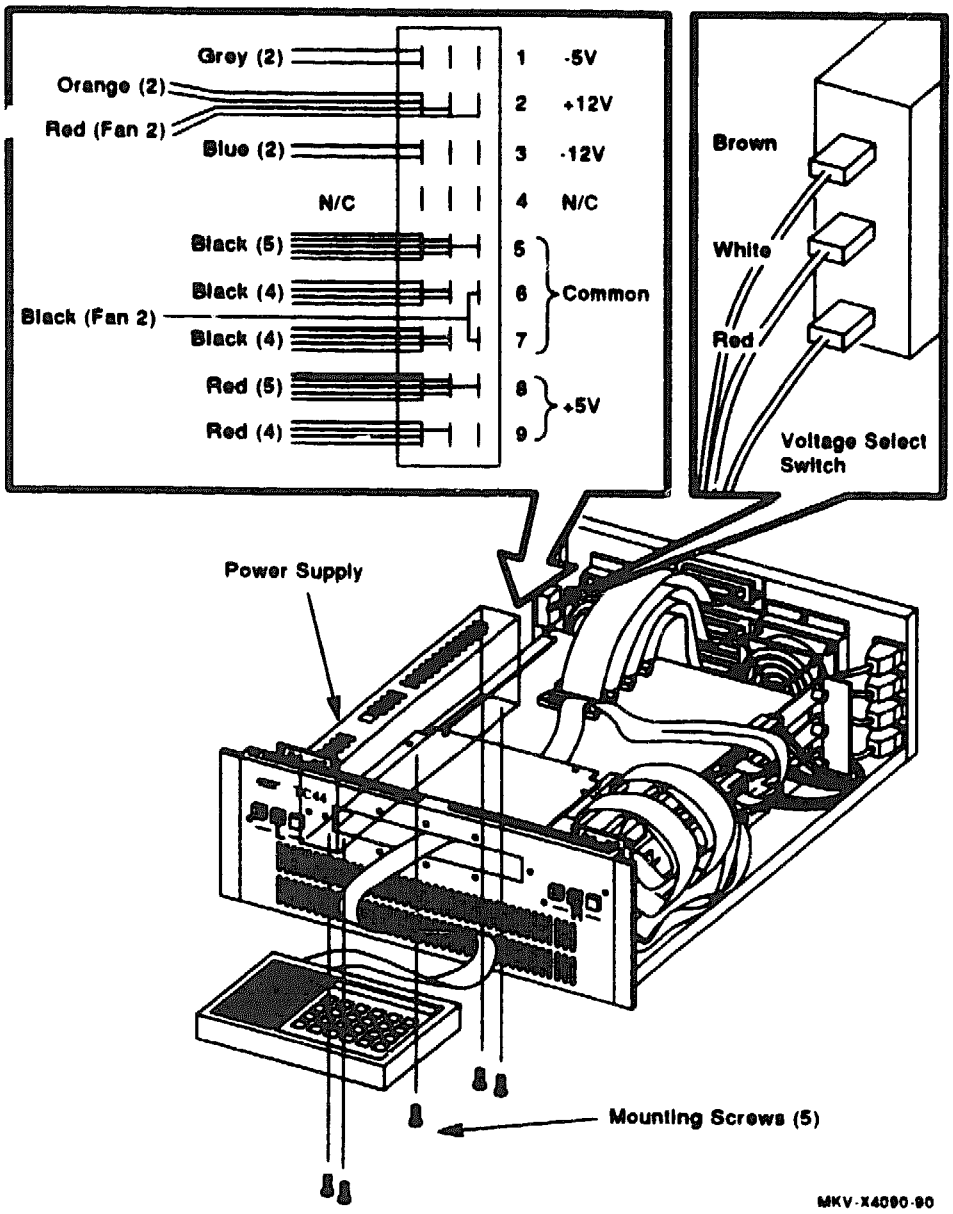


Figure 3–8 Replacing the Power Supply

3.2.4 Port Select A/B Fault Switch Assembly Removal/Replacement

To remove the port select A/B fault switch assembly:

1. Disconnect the power cord from the wall outlet.
2. Remove the top cover (Section 3.1.2).
3. Disconnect the ribbon cable from the assembly (Figure 3–9).
4. Remove the two (2) nuts securing the assembly to the unit.
5. Remove the assembly.

To replace the port select A/B fault switch assembly, reverse the removal procedure.

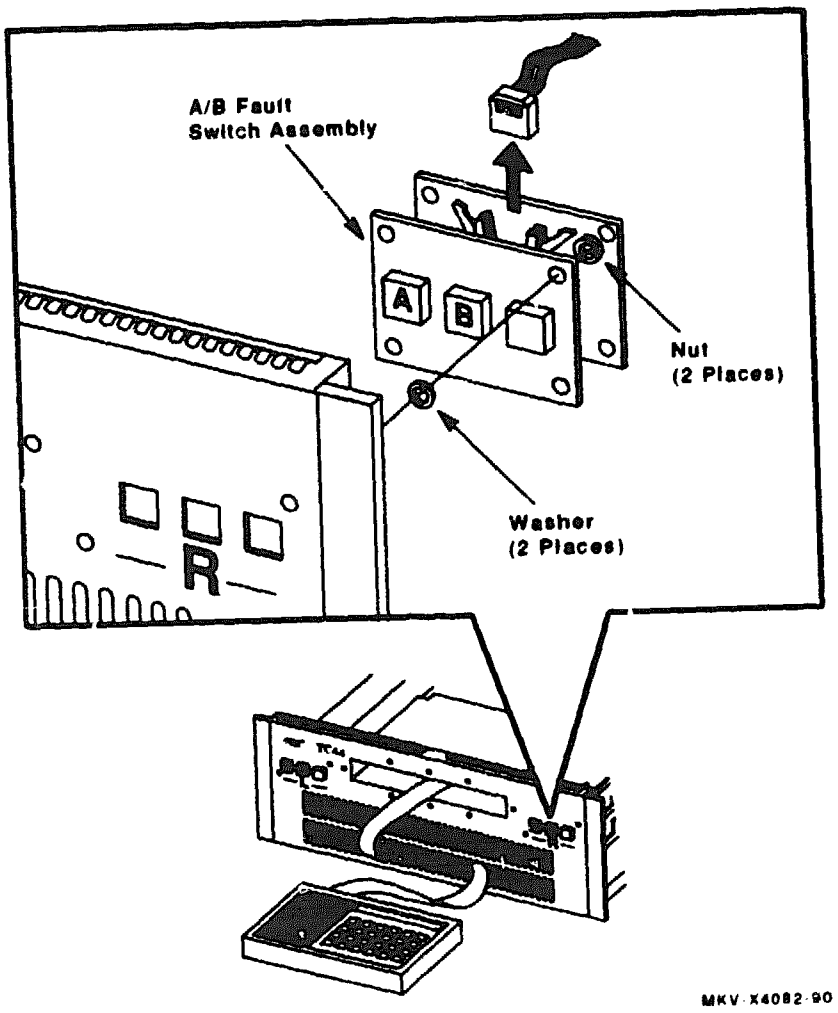


Figure 3–9 Replacing the A/B Fault Switch Assembly

3.2.5 Fan Assembly Removal/Replacement

To remove the fan assembly:

1. Disconnect the power cord from the wall outlet.
2. Remove the top cover (Section 3.1.2).
3. Refer to Figure 3–10 and perform the following steps:
   a. Disconnect the fan power wires from the power supply.
   b. Cut the cable tie-wraps that secure the fan power wires.
   c. Remove the two (2) Phillips screws and washers securing the fan assembly to the unit.
   d. Remove the fan assembly.

To replace the fan assembly, reverse the removal procedure.

NOTE
When connecting the fan power wires to the power supply, connect the red wire to terminal 2, and connect the black wire to terminal 6 or 7.

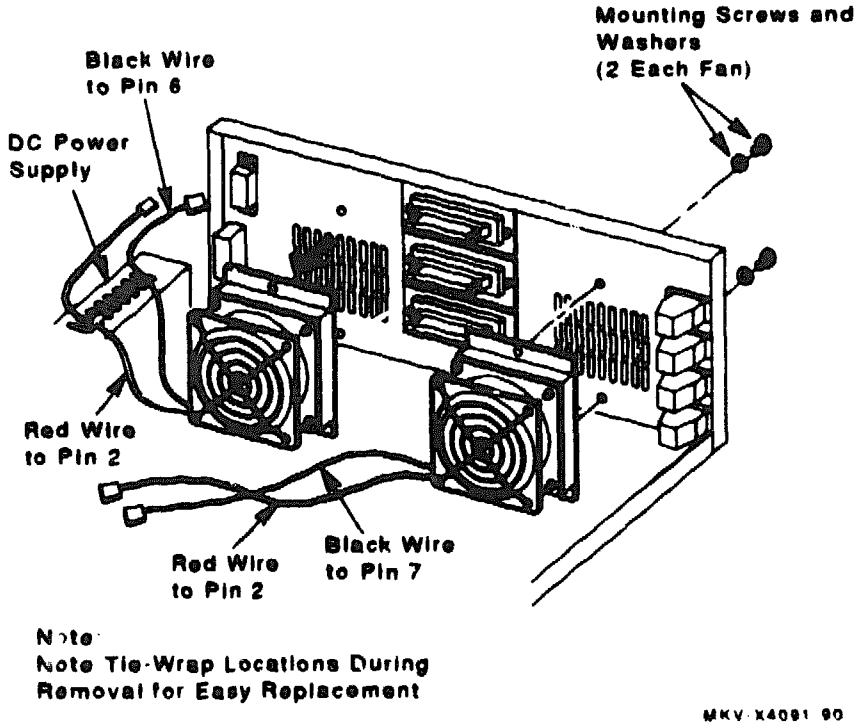


Figure 3–10 Replacing the Fan Assembly

3.2.6 CE Panel Removal/Replacement

To remove the CE panel:

1. Disconnect the power cord from the wall outlet.
2. Remove the top cover (Section 3.1.2).
3. Loosen the four (4) captive screws and remove the CE panel cover from the front of the unit.
4. Slide out the CE panel from its housing.
5. Remove the six (6) cover screws and two (2) cover nuts securing the CE panel housing cover, and remove the cover (Figure 3–11).
6. Disconnect the cable that connects to the TC44 adapter modules at the rear of the CE panel housing.
7. Remove the screws that secure the CE panel cable to the inside of the CE panel housing.
8. Remove the CE panel.

To replace the CE panel, reverse the removal procedure.

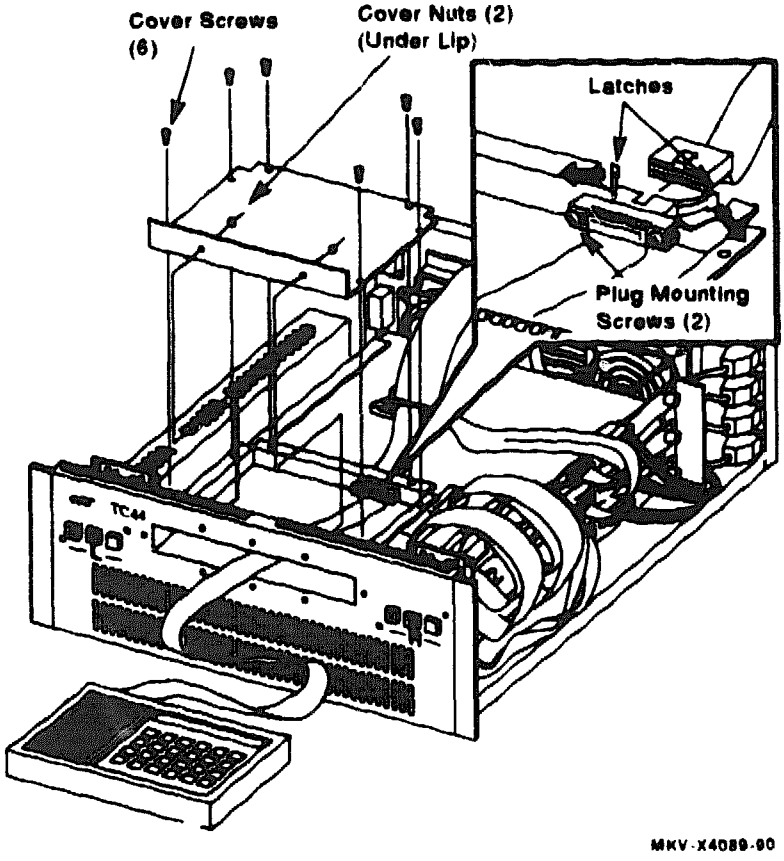


Figure 3–11 Replacing the CE Panel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