



**SYSTEM 64
MAINTENANCE FIELD MANUAL**

FIRST EDITION

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SYSTEM 64

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1.1 CHARACTERISTICS

The MDS Qantel System 64 uses the four board Q64 CPU. Memory for the system is provided by the Memory 64A/B and has a range of 512KB to 4MB (4112KB) of random access memory. Four Mem 64A boards may be installed, each of which may contain two 512KB Mem 64B modules.

1.1.1 Equipment Restrictions

The System 64 does not support DMA controllers, or non-DMA controllers requiring 26v (IOU-2, IOU-5, IOU-6, IOU-10, & IOU-18).

1.2 PHYSICAL REQUIREMENTS

Height: 52" Width: 30" Depth: 44" Door Clearance: 21"

Weight: Approx. 668 lbs. with tape drive and one Eagle or 14" Disk Drive

NOTE

A minimum clearance of 1/2" between the skirts on the cabinet bottom and the top surface of carpeting is required for air circulation. Allow approximately 24" area around cabinet for service access.

1.3 ENVIRONMENTAL CONSIDERATIONS

| | |
|---------------------|---|
| Ambient Temperature | 50-85F (10-30C) |
| Thermal Output | 10, 250 BTUs per hour (basic system) 18, 750 BTUs per hour (with add-on disk cabinet) |
| Relative Humidity | 20-80% during operation - no condensation 5-95% during storage - no condensation |
| Operating Altitude | 1000 feet below to 6000 feet above sea level (305 meters below to 1830 meters above sea level) |

NOTE

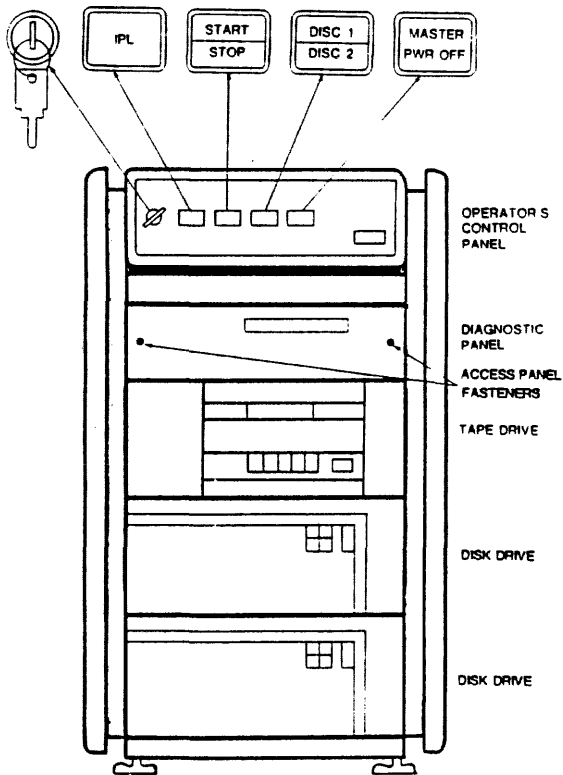
A hard disk modification is required for operation above upper altitude limit.

| | |
|------------------|---|
| Storage Altitude | 1000 feet below to 10,000 feet above sea level (305 meters below to 3050 meters above sea level) |
|------------------|---|

GENERAL

1.4 CONTROLS AND INDICATORS

System 64 Main Cabinet
Figure 1



CAUTION

THE MASTER PWR OFF SWITCH ON THE OPERATOR'S CONTROL PANEL IS FOR EMERGENCY USE ONLY - USE SWITCH ON BOTTOM REAR OF CABINET FOR ROUTINE POWER ON/OFF.

1.4.1 Operator's Control Panel

The Operator's Control Panel (Figure 1) will be modified on all systems manufactured after December 1, 1984, to allow for the installation of more than 2 disk drives in the main system cabinet (Figure 2).



Operator's Control Panel
(After 12/1/84)

Figure 2

1.5 SYSTEM INSTALLATION

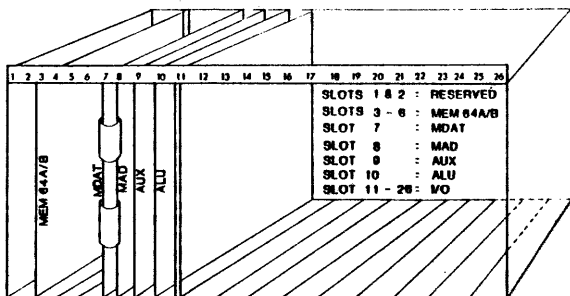
CAUTION

DO NOT APPLY POWER TO THE SYSTEM UNTIL CHECKOUT PROCEDURES ARE COMPLETED.

1.5.1 System Shipping Restraints

The CPU PWAs are secured by a tie-wrap across the face of the card cage. A restraining block is tie-wrapped across the face of the card cage to secure the IO boards.

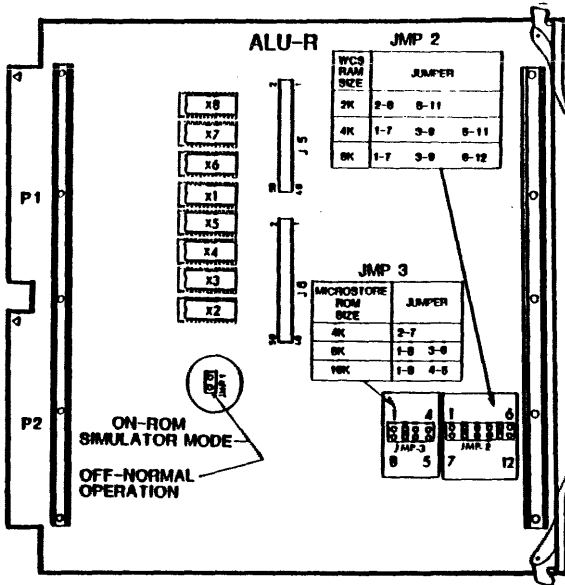
1.5.2 PWA Installation Considerations/Jumper and Switch Settings



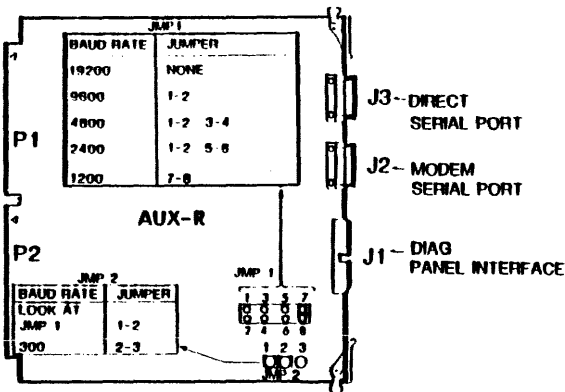
Card Cage Map

Figure 3

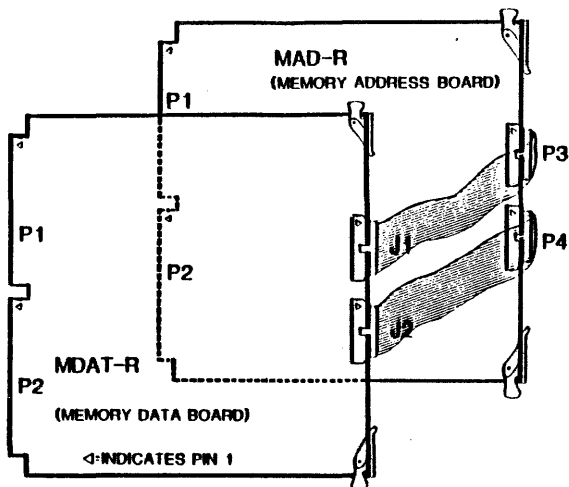
GENERAL



**ALU-R Board
Jumper Settings and
Proper ROM Sequence
Figure 4**

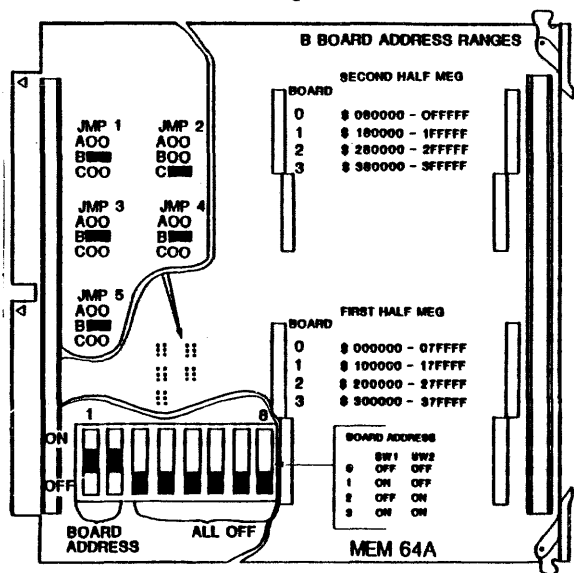


**AUX-R - Serial Port
Baud Rate Settings
Figure 5**



MAD-MDAT Interconnection

Figure 6



MEM64A Switch and Jumper Settings

MEM64B Address Ranges

Figure 7

GENERAL

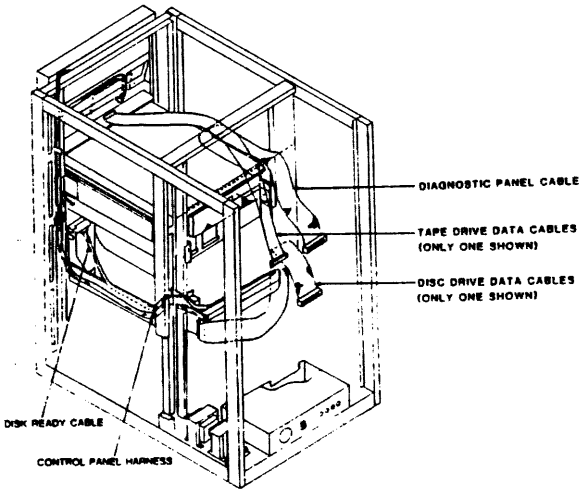
1.5.3 Preparation of the Tape Drive (Cipher)

1. Remove the shipping tape from the front and sides of the tape drives.
2. Remove the plastic foam piece from the takeup hub.
3. Remove the foam padding from the logic boards.

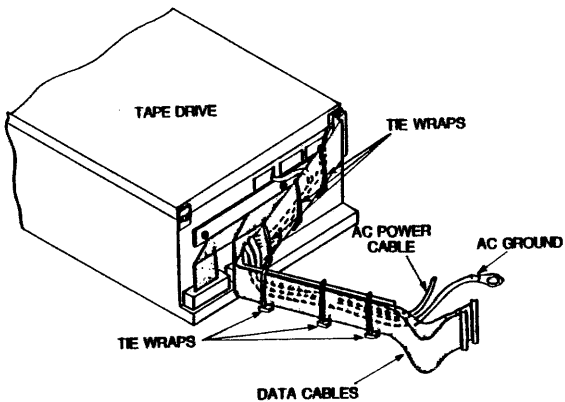
1.5.4 Preparation of the Disk Drive(s) (Eagle)

1. Remove lock nut from cable retractor bracket at rear of drive.
2. Unlock the actuator.
3. Remove foam block from under disk enclosure.
4. Check and secure flat ribbon connector to disk enclosure near card cage.

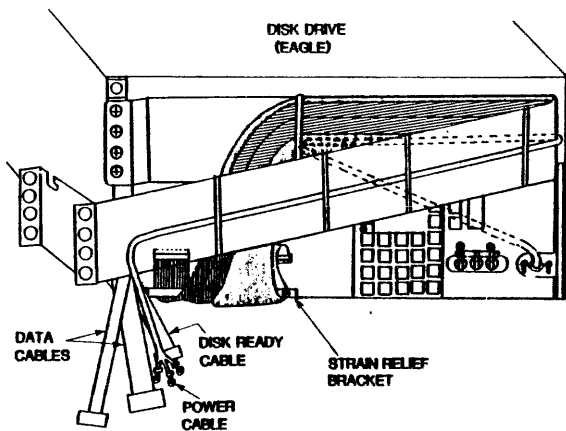
1.6 CABLING



System 64 Cable Routing
Figure 8



Tape Drive and Cable Retractor
Figure 9



Disk Drive and Cable Retractor
Figure 10

GENERAL

1.7 POWER OPTIONS

The A.C. Box may be jumpered for the following voltages: The maximum current drain is:

| | | |
|----------------|----------------|------------------------|
| 100v \pm 10% | 200v \pm 10% | For 100-127v - 24 amps |
| 115v \pm 10% | 220v \pm 10% | For 200-240v - 12 amps |
| 127v \pm 10% | 230v \pm 10% | |
| | 240v \pm 10% | |

Tolerances for DC voltages are: The maximum current drain is:

| | |
|------------------------------|-----------------|
| For +12v and -12v \pm .60v | 3 amps at +12v |
| For +5v \pm .05v | 3 amps at -12v |
| | 150 amps at +5v |

CAUTION

TWIST LOCK PLUGS ON AC CORD
CAN WORK LOOSE AND ARCING
MAY OCCUR. BE SURE PLUG IS
PROPERLY SEATED.

1.7.1 AC Interconnection Diagram

The AC Interconnection Diagram is laminated onto the cover of the system AC Box. The diagram may be on the inside or outside of the top cover.

1.7.2 DC Voltage Measurement

The 150 ampere 5v power supply is mounted on brackets on the center of the left side of the cabinet. The 3 ampere 12v power supply is mounted on the floor in left rear of the cabinet.

The 12v DC test points listed below are accessed through a cutout on the right side of the card cage (facing the rear of the cabinet). The 5v DC test point is located on the backplane.

| | |
|---------------|---|
| Logic Ground: | J048, pin 9 |
| +12v : | J048, pin 1 or pin 10 |
| -12v : | J048, pin 3 or pin 4 |
| +5v : | wide horizontal bus strip across backplane(J049). |
| Ground: | wide horizontal bus strip across backplane(J050). |

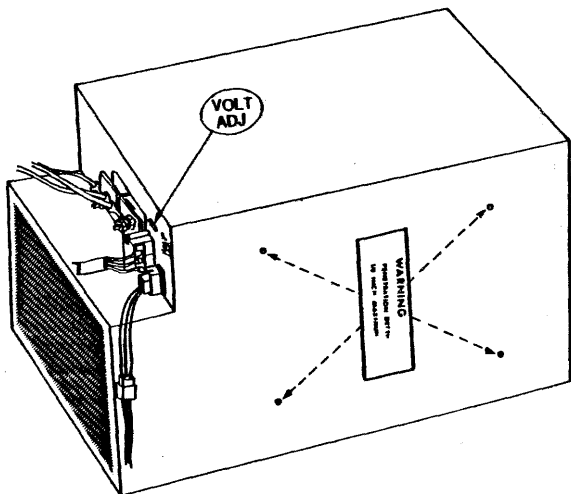
CAUTION

DO NOT CHECK VOLTAGES ON J125
OR J126 WITH BOARDS IN PLACE.

+5 5048 pin 7, 8

1. The system should be powered off.
2. Unplug all boards from the backplane.
3. Switch off all disk drive power supplies.
4. Turn on the power.
5. Measure the +12, -12, and +5 voltages. +5v should measure approximately 5.05v with no load.
6. Adjust to within tolerances if necessary (see Fig. 10 & 11).
7. Record the voltages.
8. Turn off the power.
9. Switch on all disk drive power supplies.
10. Check switch settings on all controllers, memory and CPU boards.
11. Install the boards and power up the system.
12. Measure the DC voltages again.

+ 12v should not vary more than .06v from measurements in step 7.
+ 5v should not vary more than .05v from measurements in step 7.



5v System Power Supply
Figure 11

GENERAL

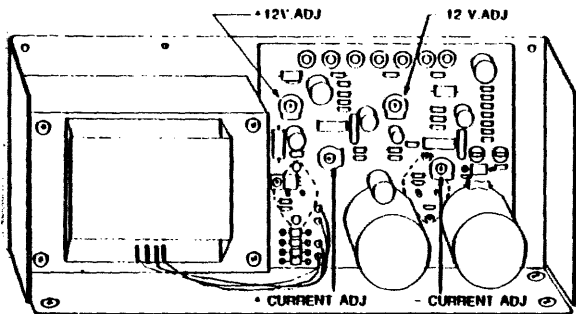
If there is a problem adjusting the +12 and/or -12 volts, current on the power supply should be adjusted as follows:

1. Turn the current adjustment pot all the way DOWN (counter-clockwise).
2. Measure the voltage while gradually increasing the current. When the voltage reaches 12.0v, rotate pot 1/4 turn further.
3. Repeat voltage measurement as listed above.

1.8 LIST OF TEST PROGRAMS

1. Start-up Diagnostics.
2. Ongoing System Diagnostics
3. CPU64 ATP.
4. MEM64 ATP.
5. Board Bug.

Refer to Maintenance Field Manual sections on peripheral equipment.



12v System Power Supply
Figure 12

ADJUSTMENTS AND ALIGNMENTS

2.1 GENERAL

Other than possible voltage adjustments, no field adjustments or alignments should be required for initial system installation. Refer to the appropriate Maintenance Field Manual Section for peripheral equipment.

REMOVAL AND REPLACEMENT

3.1 GENERAL

CAUTION

THE REMOVAL OR REPLACEMENT
OF A TAPE OR DISK DRIVE REQUIRES
TWO (2) PERSONS.

3.2 TAPE DRIVE

1. Remove cabinet door.
2. Remove the cabinet side panels.
3. Disconnect data and power cables from rear of unit.
4. Disconnect cable retractor from rear of unit.
5. Pull tape drive out as far as it will go on the slide rails.
6. Depress rail lock buttons on outside of each rail.
7. Slide unit the rest of the way out of the cabinet.
8. Remove cable retractor bracket.

If the tape drive is to be replaced by a like unit, the cable retractor bracket should be mounted on the rear of the replacement unit and the procedure above reversed to install.

NOTES

When ordering a replacement for a CIPHER Tape Drive, check the power cord on the one to be replaced. If it is hard-wired, order a cable retractor mounting bracket (P.N. 042877001) to replace existing bracket on rear of unit.

If a tape drive is to be replaced with an unlike unit (e.g. Cipher for Pertec), the rail mounting brackets must be replaced. Be sure to order the Cipher Installation Hardware Kit (P.N. 043009201).

REMOVAL AND REPLACEMENT

3.2.1 Tape Drive Rail Mounting Brackets

The rail mounting brackets for the tape drive are located directly behind the card cage, and the screw heads are inaccessible with the card cage in place. To remove the mounting brackets:

1. Remove the rear panel and both sides panels.
2. Remove the rear panel mounting rails (4 screws each rail).
3. Remove the eight screws that mount the card cage to rails.
4. Pull the card cage toward the rear of the cabinet approximately 1-1/2" and rest it on the lower fan assembly.
5. Using a right-angle screwdriver, remove the tape drive rail mounting brackets.

Reverse the procedure to install the replacement brackets.

3.3. DISK DRIVES

1. Remove cabinet door and both side panels.
2. Lock the spindle and actuator if required (refer to Section on the appropriate disk drive).
3. Disconnect cables from rear of disk drive.

NOTE

The Disk Ready Interface Cable connects to the disk PCB on the bottom of the disk drive and also connects to the indicators on the front panel of the disk drive. It must be carefully threaded through the unit to avoid damage to the connectors.

4. Disconnect cable retractors from mounting brackets.
5. Slide unit out of cabinet until rails lock.
6. Depress rail lock buttons on outside of each rail.
7. Slide the unit all the way out.
8. Remove cable retractor mounting bracket(s).

If the same type of disk drive as the one that is removed is installed, the cable retractor mounting brackets should be mounted on the replacement unit and the procedure above reversed to install the replacement unit.

REMOVAL AND REPLACEMENT

Any mounting hardware that is removed and replaced should be packaged for shipment separately from the tape or disk drive.

3.4 5V. POWER SUPPLY

1. Remove left side panel.
2. Disconnect cables and wire harnesses from power supply.
3. Remove four screws used to mount power supply on brackets.

Reverse the procedure to install new unit. Be sure to observe caution on depth of screws (printed label on both sides of power supply). Test voltages using procedure listed in Section 1.7.2.

NOTES

There are two versions of the 150 ampere, +5v power supply (P.N. 042646501). Each version should have a label which indicates the revision (Rev. 2 or Rev. A) and states whether or not an adapter harness is required for the power sensing circuitry. The adapter harness (P.N. 042681201) is required for Rev. 2.

On the Rev. 2 power supply with no power applied, the resistance between pin 4 of the external connector and the negative terminal of the power supply will measure 90 to 110 ohms. On the Rev A. power supply with no power applied, the resistance between pin 2 of the external connector and the negative terminal will measure 90 to 110 ohms.

3.5 12V. POWER SUPPLY

1. Remove left side panel.
2. Disconnect AC Harness from AC Box (5 wires).
3. Disconnect DC Harness at molex connector.
4. Remove 3 screws that mount power supply to floor of cabinet. (Requires offset phillips screwdriver).
5. Remove power supply.

Reverse procedure to install. Test voltages using procedure listed in Section 1.7.2.

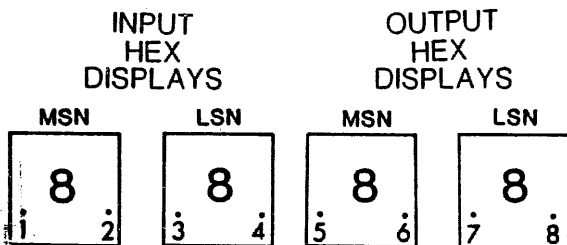
TROUBLESHOOTING

4.1 GENERAL

The primary troubleshooting techniques for the Q64 CPU and MEM64A/B are discussed below. Refer to the appropriate section of the Maintenance Field Manual for instructions on troubleshooting the peripheral equipment.

4.2 START-UP DIAGNOSTICS

Start-up Diagnostics are run whenever the system is powered-on or IPL'ed. The Diagnostic Panel digital displays are used during Start-Up Diagnostics to display the status of the tests run and monitor specific micro and macro flags.



| DECIMAL POINT | MEANING | NORMAL STATUS |
|---------------|---------------------------|---------------|
| 1 | CONT - Clocks are running | OFF |
| 2 | HALT - Clocks halted | OFF |
| 3 | MINT - Micro interrupt | ON |
| 4 | HELP - Macro interrupt | ON |
| 5 | Not used | OFF |
| 6 | Not used | OFF |
| 7 | PARR - Parity Error | ON |
| 8 | STOP - Executions stopped | OFF |

If decimal point status is opposite of that shown, an error condition exists.

Diag Panel Digital Display
Figure 13

TROUBLESHOOTING

The failure of a Start-up routine will cause the hex code for the routine to be continuously displayed in the output hex displays. The table below indicates the most likely boards to swap in the event of a Start-Up test failure:

| Code Displayed | Board | | | | |
|------------------------------------|-------|-----|-----|------|-----|
| | ALU | AUX | MAD | MDAT | MEM |
| 00 | X | X | | | |
| 01 | X | X | | | |
| 02 | | X | | | |
| 03 | | | X | X | |
| 04 | | | X | X | X |
| FF(7F) | X | X | | | |
| 05 System checked okay - no errors | | | | | |

IF START-UP DIAGNOSTICS FAIL WITH SOMETHING OTHER THAN THE CODES LISTED, RESEAT THE BOARDS AND REPEAT POWER-ON SEQUENCE.

4.3 ONGOING SYSTEM DIAGNOSTICS

The following status codes may be displayed on the Diagnostic Panel and a message may appear on Device 0:

| CODE DISPLAYED | SCREEN MESSAGE | MEANING |
|----------------|------------------|---|
| B0 | None | Serial Port in use. |
| B1 | None | Serial Port used since last IPL. |
| BB | None | Breakpoint set. |
| E0 | None | No device 0 detected (halt light on) |
| E1 | None | Power fail detected. |
| E2 | None | IPL warning detected. |
| E3 | None | Seek to non-disk device. |
| E4 | "MEM PAR ERR" | Memory Parity Error - address will also be displayed. |
| E5 | "INDIRECT" | 16 levels of indirect addressing has occurred. |
| E6 | "ILLEGAL" | An illegal instructions has been fetched. |
| E7 | "HARDWARE ERROR" | An illegal condition has occurred. |
| E8 | "FETCH ERROR" | An illegal fetch vector occurred. |

WHEN ERRORS E4-E8 OCCUR, THE IPL LIGHT WILL COME ON AND REMAIN ON UNTIL THE SYSTEM IS IPL'ed. The ONLY escape from these errors is an IPL.

TROUBLESHOOTING

4.4 ATPs

CPU64 and MEM64 may be run for testing the CPU and Memory. Refer to the ATP Operating Instructions manual for details.

4.5 BOARD BUG

Board Bug is run interactively with the Diagnostic Panel on the System 64. Two fasteners must be loosened to remove the CE access panel covering the Diagnostic Panel (see Figure 2).

Board Bug Diagnostics are contained in a special ROM set that is put in place of the Microstore ROMs on the ALU Board. After power is restored to the system, the CE enters data into the system through the keypad on the Diagnostic Panel.

4.5.1 Execution of Board Bug

There are 5 modes of operation for Board Bug:

Mode 1 - Sequential execution of all tests (except memory -see below).

Method Enter \$00 into the keypad and turn the IPL key.

Results The tests will be continuously executed unless a test fails. Program loops on error, outputting failing test number with \$80 weight bit set (test number plus \$80) to hex display.

Mode 2 - Single test execution.

Method Add \$80 to test number (set \$80 weight bit) and enter result into keypad and turn IPL key. (To run test 29, enter \$A9).

Results Test will be executed once. If it passes, test number will be displayed. If it fails, test number plus \$80 will be displayed.

Mode 3 - Halt on Error.

Method Enter \$40 into keypad and turn IPL key.

Results Same as Mode 1, but halts on error instead of looping.

Mode 4 - Single Loop

Method Enter \$20 into keypad and turn IPL key.

Results Single loop through tests. If error occurs, the test number plus \$80 will be displayed. If all pass, \$7F will be displayed.

Mode 5 - Single Loop and Halt on Error.

Method Enter \$60 into keypad and turn iPL key.

Results Single loop through tests. Halts on error and displays test number plus \$80.

NOTES

The memory test is not run during normal execution of the diagnostics. The memory test requires an IOU-39Q set at address 0 and a VT3 also set at address 0. To run the memory test, \$C6 must be entered through the diagnostic panel keyboard. A test menu will appear on the terminal which requires a selection before any test will be executed.

Since the Board Bug Routine loops on a failing test, tests with a higher number will not be run. To execute tests beyond the failing test, Mode 2 execution is required.

4.5.2 Failure Table

The following table indicates the board(s) to check when a test fails.

| TEST NUMBER | BOARD TESTED | | | | | TEST NUMBER | BOARD TESTED | | | | |
|-------------|--------------|---|---|---|---|-------------|--------------|---|---|---|---|
| | A | A | M | M | M | | L | U | D | A | E |
| 00-05 | X | X | | | | 2B-30 | | | X | X | X |
| 06-10 | | X | | | | 31 | | | | X | X |
| 11-13 | | X | X | | | 32 | | | | X | X |
| 14-1D | | X | | | | 33-35 | | | X | X | |
| 1E | | | X | | | 36 | | X | | X | |
| 1F-20 | | | X | X | | 37-38 | | X | | | |
| 21-23 | | | | X | | 39-44 | | | X | X | |
| 24-28 | | | X | X | | 46 | | | X | X | X |
| 29-2A | | | X | | | FF | X | X | | | |

\$7F indicates all tests finished (Mode 4) or illegal test number. Any other test number not defined in the table above is invalid.

TROUBLESHOOTING

4.8 REMOTE DIAGNOSTICS

Remote diagnostics for testing the Q64 CPU and MEM64A/B are available through Technical Support, Western Operations. The Auxiliary Board Remote Serial Port *must* be set to 1200 baud, and a Bell 212A compatible modem must be connected to the system via an RS232C cable.

PREVENTIVE MAINTENANCE

5.1 GENERAL

1. Remove and dust all CPU, Memory and I/O PWA's. Clean edge connectors using tex-wipe or isopropal alcohol pad. **DO NOT USE ABRASIVE ERASER.**
2. Remove accumulated dust and dirt from inside and outside of cabinet.
3. Clean system air filter.
4. Inspect AC line, twist-lock plugs and receptacles for signs of overheating or arcing. Reset twist-lock plugs. Replace if worn or discolored.
5. Verify DC voltages within tolerances.
6. Run CPU64 ATP.
7. Run limited MEM64 ATP - DO NOT RUN MULFIL OR ROWPAT.
8. Verify ability to enter Operating System and access all peripheral devices.

Refer to appropriate section of the Maintenance Field Manual on peripheral equipment.

6.1 FIELD SERVICE LEVEL PARTS LIST - SYSTEM 64

| DESCRIPTION | PART NO. |
|---|----------------------|
| AC BOX ASSEMBLY, 110 VAC 50/60HZ | 042645705 |
| AC BOX ASSEMBLY, 220 VAC 50/60HZ | 042858601 |
| BRACKET, CABLE RETRACT FUJI | 042678801 |
| BRACKET, CABLE RETRACT TAPE DR | 042678801 |
| BRACKET, CABLE RETRACTOR, EAGLE | 042678801 |
| BRACKET, CABLE RETRACTOR, RAIL MOUNT (EAGLE) | 042678801 |
| CABLE, 14" DISK DRIVE CONTROL PANEL | 042669801 |
| CABLE, AC POWER 2.65' | 042654801 |
| CABLE, AC POWER 2.75' | 042647601 |
| CABLE, AC POWER 3.58' | 042647701 |
| CABLE, AC POWER 4.0' | 042669701 |
| CABLE, BUS, 5', 1ST DISK DRIVE | 041406401 |
| CABLE, BUS, 9', 2ND DISK DRIVE | 041800401 |
| CABLE, BUS, 9', CIPHER TAPE DRIVE | 042645601 |
| CABLE, DIAG PANEL TO AUX PWA | 042700201 |
| CABLE, EAGLE CONTROL PANEL | 042647401 |
| CABLE, GROUND, 3" | 042673501 |
| CABLE, RADIAL, 5', 1ST DISK DRIVE | 041406501 |
| CABLE, RADIAL, 9', 2ND DISK DRIVE | 041800501 |
| CARD CAGE, SYS 64 | 042646002 |
| CIRCUIT BREAKER, 15A 1 POLE | 042874301 |
| CIRCUIT BREAKER, 15A 230 V | 042874101 |
| CIRCUIT BREAKER, 30A 230 V | 042874201 |
| CIRCUIT BREAKER, 7.5A 1 POLE | 042874401 |
| CONTROL PANEL, 2 DISK, SYS 64 | 042648102 |
| CONTROL PANEL, 4 DISK, SYS 64 | 043010401 |
| CORD, POWER 125V | 041799501 |
| CORD, POWER 250V | 041799601 |
| DIAG PANEL ASSEMBLY, Q64 | 042674002 |
| FAN ASSEMBLY, 115V EXHAUST | 042648301 |
| FAN ASSEMBLY, 115V INTAKE | 042648501 |
| FAN ASSEMBLY, 220V EXHAUST | 042648401 |
| FAN ASSEMBLY, 220V INTAKE | 042648601 |
| FILTER, AIR | 042651201 |
| FILTER, RFI 20A | 042680701 |
| FILTER, RFI 30A | 041925001 |
| FUSE HOLDER | 041225901 |
| HARNESS ASSEMBLY, PS1-W10 | 042648001 |
| HARNESS ASSEMBLY, PS1-W11 | 042647901 |
| HARNESS ASSEMBLY, PS2-W9 | 042647801 |
| HARNESS, +-12V DC INTERCONNECT | 042788401 |
| HARNESS, 2ND DISK DRIVE | 042713201 |
| HARNESS, AC RCPT | 042673401 |
| HARNESS, CIRCUIT BREAKER | 042655101 |

PARTS LISTING

| | |
|---|-----------|
| HARNESS, CONTROL PANEL | 042671602 |
| HARNESS, CONTROL PANEL, DISK DRIVE | 042713101 |
| HARNESS, DISK READY, 14" DISK | 043010301 |
| HARNESS, DISK READY, 8" DISK | 043010201 |
| HARNESS, DISK READY, EAGLE | 043010501 |
| HARNESS, EXHAUST FAN | 042671701 |
| HARNESS, REV A PS1 ADAPTER | 042681201 |
| INDICATOR, 1 LAMP | 042854001 |
| INDICATOR, 2 LAMP DISK READY | 042854101 |
| INSTALLATION HARDWARE KIT, CIPHER TAPE DRIVE | 043009201 |
| LAMP, 6.3V CONTROL PANEL | 042684201 |
| LENS, DISC 3 & 4 | 043010101 |
| LENS, DISK 1 & 2, GREEN | 042853501 |
| LENS, IPL, WHITE | 042853101 |
| LENS, POWER, RED | 042853701 |
| LENS, START/STOP, WHITE | 042853601 |
| PS, +-12V +-15V, 3A VDE (INTERNATIONAL) | 042858801 |
| PS, +-12V +-15V, 3A (DOMESTIC) | 041909801 |
| PS, +-12V, 3A | 042724201 |
| PS, +5V 150A 110 VAC | 042646501 |
| PS, +5V 150A 230 VAC | 042874501 |
| PWA, CPU Q64 ALU-R | 042709001 |
| PWA, CPU Q64 AUX-R | 042645303 |
| PWA, CPU Q64 MAD-R | 042692902 |
| PWA, CPU Q64 MDAT-R | 042693001 |
| PWA, MEM64A | 042645202 |
| PWA, MEM64B | 042645001 |
| PWA, Q64 BACKPLANE | 042645103 |
| PWA, Q64 DIAGNOSTIC PANEL-R | 042690301 |
| RETRACTOR, RIBBON CABLE | 042679201 |
| SWITCH, IPL LOCK | 042682601 |
| SWITCH, SPDT 2 LAMP START/STOP | 042853901 |
| SWITCH, SPDT MOM 1 LAMP | 042853801 |
| SWITCH, SPDT MOM 2 LAMP | 042690601 |
| TRANSFORMER, AUTO | 042654401 |
| TRANSFORMER, AUTO 100/240/260V | 043002701 |