PDP-11

DIAGNOSTIC USER GUIDE
CZUGAA0

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PREFACE

The Users' Guide For PDP-11 Diagnostic Software is the first part of the two-part MAINDEC Users' Manual For PDP-11 Diagnostic Software

Part I, this guide, presents the general operating procedures required to run diagnostic programs on PDP-11 computers

Part II consists of a set of appendices pertaining to diagnostic options Each appendix contains a step-by-step procedure for preparing, loading, and running the diagnostic for a specific option The appendices are used to identify problem areas If problems are encountered and more detailed diagnosis is required, the individual diagnostic listing and document must be consulted

Used together, the guide and the appendices contain the information and procedures needed to run virtually any PDP-11 diagnostic The procedures assume that the diagnostician is familiar with the hardware to be tested

In those cases where the most detailed information is required, a diagnostician must refer to the individual diagnostic program documentation

NOTE PART II, THE SET OF APPENDICES DESCRIBING THE DIAGNOSTIC OPTIONS, IS NOT INCLUDED IN THIS DOCUMENT THE APPENDICES ARE CURRENTLY IN PRODUCTION AND WILL BE RELEASED TO THE FIELD AS THEY ARE COMPLETED

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CHAPTER 1

INTRODUCTION & REFERENCES

This users' guide is intended for the person new to DEC, and especially for the person new to the diagnostic aspect of DEC's operations

the field service engineer

the manufacturing test person

the diagnostic programmer

It should help in the training of new personnel and serve as a concise reference for more experienced people Essentially, this guide presents to anyone an inclusive survey of the diagnostic software tools available for DEC PDP-11 computers

The guide follows a design that builds on information presented in previous chapters. Chapter 2 presents two general approaches to running diagnostics Chapter 3 gives directions for using a PDP-11 computer operating console Chapter 4 tells you how to load a monitor into the machine, it assumes that you know how to use the operator's console (explained in Chapter 3), and that you have decided on which approach you want to use for running the diagnostics (explained in Chapter 2) The ensuing chapters describe the operations of the various monitors under which you can execute diagnostics

The guide draws from and refers to many existing DEC documents, listed below in paragraph 1 1 There is also a short list of abbreviations in paragraph 1 2.

Used along with other diagnostic tools, this guide can help both the novice and the experienced diagnostician successfully accomplish his or her work at the machine being tested

1 1 REFERENCES

ACT System Manager's Guide
ACT Users' Guide
APT System Manager's Guide
DECX/11 Users' Documentation and Reference Guide
Diagnostic Engineering Standards and Conventions
Microcomputer Handbook
PDP-11 Computer Programming Card
PDP-11 Peripherals Handbook
PDP-11/04/34/45/55 Handbook
XXDP/DECX/11 Programming Card
XXDP Users' Manual

1 2 ABBREVIATIONS AND MNEMONICS USED IN THIS GUIDE

ACT -- automated computer test

AINT -- APT initialization utility

APT -- automated product test

BR -- bus request

CPU - central processing unit (same as processor)

DECX/11 -- Digital Equipment Corporation UNIBUS exerciser for PDP-11 computers

DMA -- direct memory access

ECO -- engineering change order

EIS -- extended instruction set

GPR - general purpose register

HW -- hardware

I/O -- input/output

LRT -- long run-time

LSI -- large-scale integration

MCO -- manufacturing change order

MLE -- multiple loading with error control (APT)

MOS -- metal-oxide semiconductor

MTTD	-- mean-time-to-detect
MTTR	-- mean-time-to-repair
NPR	-- non-processor-request
ODT-11	-- on-line debugging technique for PDP-11 computers
PC	-- program counter (register 7)
PSW	-- processor status word
Q/V	-- quick verify
RCSR	-- read control/status register
REV11	-- the DMA-refresh, bootstrap, and terminator module for the LSI-11 CPU
ROM	-- read-only-memory
SP	-- stack pointer (register 6)
SS	-- single step
SW	-- software
SWR	- switch register
TSP	-- test-software-package utility (APT)
TST	-- time-sharing terminal (APT)
UUT	-- unit under test
XXDP	-- xx diagnostic package, "xx" replaced by device mnemonic

CHAPTER 2

UNIT TESTING VS THE SYSTEM APPROACH TO USING DIAGNOSTICS

A diagnostic is a program that comprises numerous individual tests arranged in a sequence The tests detect malfunctions and help to locate their source The results of any test determine which other tests in the sequence will be executed In addition, a diagnostic program may analyze the test results and identify the failing component

There are two testing approaches unit testing, which tests single units, and UNIBUS exercising, which test several of the same or combinations of different units simultaneously

You run unit tests when you decide that a malfunction comes from a particular unit for example, a peripheral device, or the CPU, or memory Unit tests usually operate under controlled conditions in order to isolate the malfunction. The testing sequence follows a logical, "building block" structure that tests the smallest part of the unit and proceeds upward to include the entire unit. Unit tests are not generally efficient at identifying problem areas in large systems, but are the best method for correctly identifying malfunctions in a given device

You run a UNIBUS exercisec when you cannot determine the origin of a malfunction, or if unit testing does not substantiate your previous decision. A UNIBUS exerciser does not run under controlled conditions as compared to unit tests. Rather, it creates an operating environment that pushes the system to the limits of its specifications. The UNIBUS exerciser is DECX/11 (see Chapter 12 and the DECX/11 Reference Manual) A UNIBUS exerciser is designed to detect and report general malfunctions. Once the UNIBUS exerciser identifies the bad subsystem or unit, you can then run unit tests on that unit to determine the failing component. (Often, intermittent failures that are untraceable with unit tests appear when running a UNIBUS exerciser). UNIBUS exercising emphasizes detection over isolation It uses testing time efficiently, but it may incorrectly identify the source of a malfunction in a mult -problem situation

Note, too, that the multi-problem situation may occur where neither unit testing nor a UNIBUS exerciser can accurately identify a failing component In this case, a field service engineer must rely on basic tools (oscilloscope, test meters, etc) coupled with a thorough knowledge of the hardware and sound experience

PDP-11 diagnostic software, therefore, can be categorized as two main types unit diagnostics and UNIBUS exercisers.

To completely test a given unit, all unit diagnostics and the DECX/11 UNIBUS exerciser must be run

2 1 UNIT DIAGNOSTICS

Unit diagnostics include tests for the units listed below

- modules
- subassemblies
- processors
- peripherals
- controllers
- memories

Also, there may be several diagnostics for one unit, each diagnostic checking a particular function of the unit.

Diagnostics verify all logic that may be tested by program instructions with a single unit under processor control There are no other units of similar or dissimilar design under test at the same time The goal of the diagnostic is 100% coverage of the logic In reality, the coverage is 80% to 95% of the logic The remaining logic is tested by the UNIBUS exerciser

Diagnostics are usually stand-alone they require the processor to be dedicated to the unit under test (UUT).

The purposes for using diagnostics can be categorized as follows

1 Verify that the H/W functions correctly

2 Detect a H/W fault.

3 Isolate a H/W fault

4 Verify that a repair has corrected a fault

The proper use and execution sequence of diagnostics will reduce the mean-time-to-detect (MTTD) and the mean-time-to-repair (MTTR) The MTTD is the time necessary to detect that an error condition or fault exists The MTTR is the time it takes to detect and isolate the fault, repair or replace the failing component, and verify that the repair has corrected the fault

2 1 1 Error Detection Using Unit Diagnostics

Diagnostics are designed to detect the following classes of errors

	ERROR CLASS	EXAMPLE OF CAUSE
1	logical and functional errors	pin shorts, pins stuck high and low, media failures, mechanical failures.
2	timing problems	capacitance; resistance, race conditions
3	intermittent failures	vibration; loose connections, dirty connections; power-up/power-down failures.
4	heat problems	insufficient module cooling, dirty filters; defective fans, improper installation.
5	noise problems	shielding deficiencies; UNIBUS termination, UNIBUS drivers and receivers; cable problems
6	marginal components	voltage variations

Once you determine the error class, you can decide which diagnostic or series of diagnostics to run. If you do not known the source of a problem you can use a UNIBUS exerc ser to locate the fault (See paragraph 2.2)

There are two general ways to run unit diagnostics the "quick-verify" mode (Q/V mode) and the "long-run-time" mode (LRT mode)

NOTE

For the most inclusive coverage, you should run each diagnostic in all modes of operation and with all applicable switch settings.

2 1 2 Running Diagnostics In Quick-verify Mode (Q/V Mode)

The "quick-verify" or Q/V mode of running a diagnostic performs the following services:

1 Verify that all the major components are present and functioning

2 Test all the logic at least once and indicate faults.

3 Generally indicate that no "hard" errors exist, or that they no longer exist after a repair.

4 When there are many diagnostics for a single unit, provide a system that will isolate the failing component of the unit in the shortest possible time.

The Q/V mode may, but generally does not isolate intermittent failures, marginal components, heat problems, or noise problems. The first pass of a diagnostic is a Q/V pass. Unless iterations are surpressed, after the Q/V pass, all diagnostics enter LRT mode (see paragraph 2 1.3) All diagnostics should be run at least two passes -- a Q/V pass and one LRT pass

Once the Q/V mode detects an error condition, you can use the LRT mode (below) to isolate the fault (The diagnostics provide "scope loops".)

2 1 3 Running Diagnostics in Long-run-time Mode (LRT Mode)

The "long-run-time" or LRT mode of running a diagrostic detects the following

1 noise problems.

2 heat problems

3 marginal components

4 timing problems

5 intermittent failures

6 vibration problems and bad connections

The LRT mode also tests that a H/W repair holds up, and that the H/W that was repaired was the H/W at fault. If the UUT successfully completes at least two passes in LRT mode, then you can assume that you have verified its operation as much as possible in a stand-alone environment However, additional successful passes will increase the confidence in the reliability of the hardware

2 2 UNIBUS EXERCISERS

UNIBUS exercisers are designed to test all logic that is not tested or cannot be tested with unit diagnostics. UNIBUS exercisers detect faults that result when multiple units are in the system, and also when the given unit is in a system with other dissimilar units UNIBUS exercisers test all the devices in the system simultaneously; the processor is not dedicated to only one unit

UNIBUS exercisers are effective at isolating problems that arise when units interact with other units The units may be the same type, or completely different in form and function

The problems that arise from this interact on are noise, priority arbitration, timing, marginal components, and elusive and intermittent problems

Typically the UNIBUS exerciser tests the units in a "worst-case" manner. This, in combination with the multiple units both similar and dissimilar on the system, creates an environment that cannot be duplicated by a stand-alone diagnostic. This is why UNIBUS exercisers can isolate interaction problems so well

The design of a UNIBUS exerciser emphasizes the isolation of interaction problems Therefore, they verify a large portion of the units' logic However, this percentage is less than what can be verified by a stand-alone diagnostic Additionally, the general constraints of the system environment limit which logic may be tested and to what degree Careful design of the UNIBUS exerciser maximizes the coverage

Fault isolation using a UNIBUS exerciser includes the following procedures

1 Making a system inventory

2 Detecting a fault

3 Identifying the fault

4 Isolating the fault

5 Making and verifying the repair

2 2 1 System Inventory

You make a system inventory to define the H/W configuration Use the following recommended procedure

1 Describe the CPU

- model (11/03, 11/34, 11/40, 11/45, 11/60, 11/70)
- processor type (KD11-A, KD11-D)
- ECO tally
- options (floating point processor, memory management, cache)

2 Define memory

- size (4K, 8K, 16K, 32K, etc)
- type (core, MOS, bipolar)
- parity controller
- error correcting

3 Determine small options

- serial line units (DL11)
- interprocessor links
- DMA drivers (DR11B)
- line clocks (KW11-P, KW11-L)
- communications modules (DUP11)
- DECwriters (LA30, LA36)
- DECscopes (VT50, VT52)

In all cases determine the applicable baud rates, line frequency, device addresses, vector addresses, bus request interrupt level (BR), relative position on the UNIBUS

4 Determine large options

- mass storage devices (magnetic tape, DECtape, disk, floppy disk)

Determine for all devices the unit numbers, device addresses, vector addresses, BR level, relative positon on the UNIBUS, and whether the device is DMA or proccessor-controlled

5 Ensure that any equipment that is known to be down is still on the UNIBUS and is receiving power. If the equipment is not receiving power, you should remove it from the UNIBUS

6 Ensure that the bus-grant-continuity cards are in place.

7 Ensure that the UNIBUS is properly terminated.

8 Determine whether any equipment is missing, for example, is a controller present with no drive? Or, is a BR plug missing?

9 Visually inspect the system fuses, boards, cables

2 2 2 Fault Detection

You start fault detection only after taking a system inventory In other words, you must confirm that a reported problem on the system does, in fact, exist If you observe the source of the failure without a doubt, then you can run the unit diagnostics directly, without a UNIBUS exerciser However, when you cannot locate the source of failure, you must configure and run a UNIBUS exerciser When the UNIBUS exerciser has detected the source of failure, it will point to the unit This can be any of the following a peripheral controller or drive, the CPU, memory, an option module such as floating-point or memory management Now you have to isolate the failing component within the unit

2 2 3 Fault Isolation

Use the following procedure to isolate faults

1 See what diagnostics are available for the failing unit

2 Determine which of these diagnostics to run, and in what order

3 Run all the diagnostics for one Q/V pass. (This may be a chain file under the XXDP monitor See paragraph 7.7.)

4 From the results of step 3, determine which diagnostic has detected any errors, provided the most information, tests the smallest logical block, and provides features such as "loop-on-test" or "loop-on-error"

5 Run the specific diagnostic resulting from step 4 in order to isolate the failing logic. You may have to use the diagnostic program listing, the device logic prints, and an oscilloscope.

6 For total coverage, run all diagnostics in all modes of operation, with all applicable switch settings

2 2 4 Repair And Verify

After making the necessary repair or replacement, follow this procedure for verifying i'

1 Run all the unit diagnostics in the Q/V mode A successful Q/V pass indicates that the diagnosis and repair were correct for the problem Generally it also ndicates that the H/W is complete and has no "hard" errors

2 Run all unit diagnostics in LRT mode for several passes This is "worst-case" testing of the repaired unit Run the diagnostics in all modes of operation and with all combinations of applicable switch settings Successful LRT passes indicate that the unit functions correctly in a stand-alone environment

3 Run the UNIBUS exerciser to verify that the unit functions correctly in a "system" environment Successful passes of the UNIBUS exerciser indicate that the repaired unit causes no system interference, or interaction and noise problems

When you perform these three steps after making a repair, and receive successful end-of-pass messages, you can consider the unit correctly repaired and in good working order

2 3 SPECIAL CONSIDERATIONS

1 In some rare instances, a UNIBUS exerciser may not detect a unit failure Should this occur, the best method to detect the failure is to run all the standalone diagnostics for all the units in a system, using Q/V mode, followed by LRT mode Start the testing with the diagnostics for the most suspect unit After making the repair, verify it as described in paragraph 2 2 4

2 If you replace a unit or module rather than repair it, you should run all the diagnostics for that unit. This will verify that you have replaced the correct failing unit, and that no other, different problems exist in the new unit The verification process is the same one described in paragraph 2 2 4

3 Here is the recommended order for running unit diagnostics

   1 CPU diagnostics (basic instruction tests)

   2 memory diagnostics

   3 CPU options (floating-point processor, memory management, cache, EIS)

   4 small options

   5 large options

   6 data reliability tests

CHAPTER 3

OPERATOR'S CONSOLE

This chapter explains how to use the CPU operator's console PDP-11 processors have three types of consoles

1 those with a sw tch panel, discussed in paragraph 3 1

2 those with a 20-button keypad, discussed in paragraph 3 2

3 those with a separate terminal device, discussed in paragraph 3 3

Identify the type of console on your processor and proceed to the appropriate paragraph Also, consult the appropriate Processor Handbook

3 1 SWITCH-PANEL CONSOLES

Switch-panel consoles have a switch panel, control switches, and indicators

3 1 1 Switch Pane

The switch panel is a set of physical switches that correspond bit-by-bit to the hardware switch register, or HW/SWR (refer to chapter 6) When the CPU is running, the switch panel setting is the current value of the HW/SWR When the CPU is not running, you can use the switch panel to define either the address number or the contents of any PDP-11 location, using the console control switches below A PDP-11 location can be a memory word, a processor register, or a peripheral device register

3 1 2 Control Switches

The control switches provide specific functions as described in Table 3-1. You must HALT the CPU before using them. Also, if your console has control knobs for address and data display, then turn these knobs to select the CONSOLE PHYSICAL and DATA PATHS positions.

Table 3-1 Console Control Switches

SWITCH	FUNCTION	EXPLANATION
LOAD ADRS (depress)	load an address value	Transfers the value on the switch panel to the CPU and displays the address number
EXAM (depress)	examine	Displays the contents of the location defined by a LOAD ADRS operation. Successive EXAM operations display the contents of sequential locations If you try to EXAM a nonexistent address, the operation fails, you must repeat LOAD ADRS with a legitimate address.
ENABLE/HALT (select)	enable/halt	ENABLE allows the CPU to execute instructions; HALT stops it after the current instruction (and any interrupts and traps). See also CONT
CONT (depress & release)	continue	If the CPU is in ENABLE, then CONT causes it to continue operating from the point at which it stopped, without a system reset. IF the CPU is in HALT, repeated CONT operations execute the program instruction by instruction. CONT does not work in the RUN state

Table 3-1 (Continued)

SWITCH	FUNCTION	EXPLANATION
DEP (raise & release)	deposit	Loads the value on the switch panel into the location defined by a LOAD ADRS operation Successive DEP operations load sequential locations. If you try to DEP a non-existent location, the operation fails, you must repeat LOAD ADRS with a legitimate location
START (depress & release)	start	CPU starts executing instructions at the location defined by a LOAD ADRS operation NOTE START issues a system reset Do not press START when the CPU is already in the RUN state You may have to reload the program The usual sequence for starting a program is HALT LOAD ADRS (starting ENABLE address) START
Some consoles also have the following control switches		
REG EXAM (depress)	examine GPR	Displays the contents of a GPR defined by a LOAD ADRS operation
REG DEP (raise & release)	load GPR	Loads the value on the switch panel into the GPR defined by a LOAD ADRS op
S/INST-S/BUS (select)	single-step	Modifies the operation of CONT (above) as follows S/INST causes CONT to execute the next single instruction and stop; S/BUS causes CONT to complete the next bus operation and stop

3 1 3 Console Indicators

The console indicators vary among consoles, but here is a general list For more information, refer to the PDP-11 Processor Handbook

RUN -- glows when the CPU is executing instructions

ADDRESS/DATA -- displays an address or the contents of an address, depending on the operation Some consoles have separate indicators for address and data display

PROC -- glows when the CPU has control of the bus

CONSOLE -- glows when the CPU is not executing the stored program, i e , the CPU is under manual control

3 2 KEYPAD CONSOLES

Keypad consoles have a 20-button keypad, a LED digital display, and ndicators

3 2 1 Keypad

The keypad contains number buttons and control buttons. You use the number buttons to load numerical information into the CPU The control buttons provide functions as described in Table 3-2 The keypad has a safety feature that prevents certain unintended control operations This is the CNTRL button. You must depress CNTRL simultaneously with the following control buttons to make them work. INIT, BOOT START, CONT, HALT/SS (first hit only; you can single step without CNTRL)

Table 3-2 Console Control Buttons

BUTTON	FUNCTION	EXPLANATION
CLR	clear	Clears the current keypad entry. There is no operation.
LAD	load address	Loads an address number (the address of a memory word, a processor register, or a peripheral device register) from the keypad to the CPU.
DIS-AD	display address	Displays the address number of the location the CPU is currently manipulating.
EXAM	examine	Displays the contents of the location the CPU is currently manipulating.
DEP	deposit	Loads a value from the keypad into the location the CPU is currently manipulating.
LSR	load switch register	Loads a value from the keypad to the hardware switch register (see paragraph 3.2.4 and Chapter 6).
The following control buttons require simultaneous pressing of CNTRL		
HLT/SS (CNTRL)	halt/single-step	Puts the CPU in HALT state. Also, if you continue to press this button without CNTRL, it provides single-step execution of a program.
CONT (CNTRL)	continue	Allows the CPU to continue program execution from the point at which it stopped. CONT does not issue a system reset.

Table 3-2 (Continued)

BUTTON	FUNCTION	EXPLANATION
START (CNTRL)	start	Issues a system reset and starts executing instructions at the address specified by a previous LAD operation
BOOT (CNTRL)	bootstrap	Starts a bootstrap operation
INIT (CNTRL)	initialize	Causes a system reset

3 2 2 LED Digital Display

The LED digital display that shows address/data values has a shift feature The lights show the value you enter on the keypad up to the maximum digits on the display. If you enter more than the display can show, you lose the high-order digits, they shift off the display.

3 2 3 Indicators

The only indicators you need to know at this time are the RUN indicator, which glows when the CPU is executing macro instructions, and the SR DISP indicator, which tells you that the LED display is showing the contents of the hardware switch register (The 11/40 has no SR DISP indicator and its RUN light is always on)

3 2 4 Loading The Switch Register

Unlike CPU's with a switch panel, keypad consoles have no direct physical connection with the HW/SWR, at location 177570, or 777570 with memory management (see 3.1.1 and Chapter 6) On a keypad console you can load the HW/SWR at any time, but only by using the LSR button (load-switch-register). A LAD+DEP operation on the HW/SWR address will not load the HW/SWR. Similarly, a LAD+EXAM operation will not display the contents of the HW/SWR The CPU displays the HW/SWR contents only at CNTL/START or CNTL/CONT. If you have cleared the display and need to know the HW/SWR value, depress CNTL/CONT

3 3 TERMINAL DEVICE CONSOLES

Some PDP-11 processors do not have an operator's console for controlling the CPU These CPU's do not have a HW/SWR either (See Chapter 6) You operate these processors with a separate terminal device and a console emulation routine that is built into the processor. In addition, some PDP-11 processors with an operator's console may have a terminal device as well You can operate these processors from either the operator's console or the terminal

Several console emulators are available However, this manual discusses only the REV11 and ODT-11 programs (for LSI-11 and 11/03) and the M9301 program (for other processors)

NOTE

Although the CUR light is extinguished during any ODT-11 console emulation operations, the CPU is still executing the ODT console emulation routine. The processor, technically, is running.

3 3 1 Using ODT-11

ODT-11 is part of the LSI-11 hardware and requires no additional software to operate To use ODT-11, prepare the CPU as follows.

1 Before power-up, put the HALT/ENABLE switch to HALT position

2 Power-up the CPU

3 ODT-11 will issue the prompt character, @, and accept any of the commands in Table 3-3 ODT accepts only these command characters and the numbers 0-7 on a command line The underlined characters in the examples are the ones ODT prints

NOTE

For console ODT communication, the DLV11 must be configured for console bus addresses 177560 through 177566 These addresses are included in the LSI-11 processor's microcode and cannot be changed If no device responds to the above addresses, the processor will go into loop. You can get out of this loop by cycling the power off and then on

Table 3-3 ODT-11 Commands

KEYBOARD CHARACTER	COMMAND	EXPLANATION & EXAMPLE
/	examine	Displays the contents of the specified location; if you do not specify a location, ODT operates on the last location used. Example: examine location 100 @100/025200
CR (CARRIAGE RETURN)	deposit/ return to ODT command level	Deposits a value into the specified location and returns you to ODT command level. If you do not enter a value, you will not alter the location Example. deposit 7317270 in location 100, and verify the operation @100/025200 7317270CR @/112220 (note high-order truncation)

Table 3-3 (Continued)

KEYBOARD CHARACTER	COMMAND	EXPLANATION & EXAMPLE
LF (line feed)	deposit/ examine next	Deposits a value into the specified location and examines the next higher location Example: put the numbers 1-5 into the five consecutive locations starting at location 100; then return to command level @100/112220 1LF 000102/000123 2LF 000104/055200 3LF 000106/132104 4LF 000110/000000 5CR @
G	start (go)	Starts executing instructions at the specified location. Example. start the program at address 200 @200G (also. @200,G)
P	proceed	Continues program execution from the location in the PC (See also CONT, Table 3-1) Example resume execution @P (also, @,P)

Table 3-3 (Continued)

KEYBOARD CHARACTER	COMMAND	EXPLANATION & EXAMPLE
L	load bootstrap loader	Loads a program, in bootstrap loader format, from the device whose read control status register address is given If RCSR is invalid, the CPU will hang; you must power off/on again Example load a program from the console device @177560L
RO(rubout) DEL(delete)	correct entry	Corrects one or more erroneous numerical entries ODT prints a backslash, ( ), for RO or DEL You cannot delete a command with this character Also, it will not correct erroneous GPR numbers Example. deposit 167106 in location 100, then verify the operation @100/000120 5632 7106CR @/162106 (note truncation)
R S	register designator	Used with an ODT command to operate on a GPR (specify 0-7) or the PSW (specify S) Example examine GPR 5, deposit zeroes, then examine PSW @R5/012345 OCR or, @S5/012345 OCR @RS/000200 or, @SS/000200

3 3 2 REV11-A And REV11-C Options

REV11 is the MA-refresh, bootstrap, and terminator module for the LSI-11 CPU To use REV11-A or REV11-C, prepare the CPU as follows

1 Before power-up, put the HALT/ENABLE switch to ENABLE

2 Power-up the CPU

3 REV11 normally displays the prompt character, $, and accepts any of the commands in Table 3-4 below The underlined characters are those printed by REV11

NOTE

Certain processor/terminal jumper configurations may put the CPU in ODT-11 at power-up (see 3 3 1) You can manually start REV11 under ODT with the ODT go command, G Specify address 173000 (REV11's starting address) as follows

```
@173000G
$
```

The ,o command does not require a carriage return

Refer to the Microcomputer Handbook for more information

Table 3-4 REV11 Commands

Command	Function	Explanation
OD	ODT-11 mode	Processor will respond to ODT commands discussed in 3.3.1. This command does not require a carriage return. To return to REV11, issue the ODT-11 command, P, if you have not changed the PC. If the PC has changed, issue the G command, and specify address 165006. Example: under REV11, transfer control to ODT-11 $OD pppppp (the PC value) @P
AL<cr> or ALdddddd<cr>	absolute loader	Load the absolute loader program using the console paper tape read device (default) or the device whose RCSR address you specify, dddddd. The loaded program self-starts, or else a halt occurs at 165626.
AR<cr>, or ARdddddd<cr>	absolute/relocated loader	Execute absolute loader program for relocated loading operation using console device (default) or device RCSR = dddddd. Before using the AR command, you must prepare the CPU as follows: put the CPU in ODT mode, deposit the relocation address bias (nnnnnn) into R4 (the SW/SWR), and return control to REV11. Then you can issue AR $OD (transfer to ODT) pppppp (PC value) @R4/xxxxxx nnnnnnCR (deposit relocation @P (return to REV11) bias $AR<cr> Successful load results in automatic program start. Otherwise, the program halts with 165412 display.

Table 3-4 (Continued)

Command	Function	Explanation
DX<cr>, or DXn<cr>	floppy disc bootstrap	Execute RXV11 floppy disk system bootstrap for disk 0 (default) or disk n (0 or 1)
DK<cr> DKn<cr>	RK05 bootstrap	Execute RK05 bootstrap for disk 0 (default) or disk n (0 or 1)

NOTE

1 AL, AR, DX, and DK also execute a memory and processor diagnostic program before loading

2 <cr> is a carriage return (octal code=015) command delimiter required by all commands except OD

3 REV11-A and REV11-C ROM starting address is 173000, resulting in non-memory-modifying processor diagnostic test execution Successful completion results in the $ prompt character being displayed

3 3 3 The M9301 Console Emulator

The M9301 module contains a console emulator routine When this routine is used in conjuction with the user's terminal, it generates functions quite similar to those found on the programmer's console of traditional PDP-11 family computers

Summary of the Console Emulator Functions

LOAD - this function loads the address to be man pulated into the system

EXAMINE - allows the operator to examine the contents of the address that was loaded and/or deposited

DEPOSIT - allows the operator to write into the address that was loaded and/or examined

START - initializes the system and starts execution of the program at the address loaded

BOOT - allows the booting of a spec fied device by typing in a two character code and optional unit number

CONSOLE EMULATOR OPERATION

The console emulator allows the user to perform load, examine, deposit, start, and boot functions by typing in appropriate code on the keyboard

There are three ways of entering the console emulator

1 Move the power switch to the on position

2 Depress the boot switch

3 Automatic entry on return from a power failure

After the console emulator routine has started and the basic CPU diagnostics have all run successfully, a series of numbers representing the contents of R0, R4, SP and PC respectively, will be printed by the terminal This sequence will be followed by a $ on the next line

****

EXAMPLE--A TYPICAL PRINTOUT ON POWER UP

```
XXXXXX          XXXXXX          XXXXXX          XXXXXX
$
   R0             R4              R6              PC
                                  stack           program
prompt                            pointer         counter
character                           (sp)
```

NOTE

x signifies an octal number (0-7)
Whenever there is a power up routine, or the BOOT switch is released from the INIT position, the PC at this time will be stored The stored value is printed out as above (noted as the PC)

****

USING THE CONSOLE EMULATOR

Once the system has been powered up or booted, and R0, R4, SP, PC and $ have been printed, the console emulator routine can be used

Keyboard input symbols--the discussion of keyboard input format uses THE FOLLOWING SYMBOLS

1 space bar (SB)

2 carriage return key (CR)
All commands are terminated with a carriage return

3 any number 0-7 (octal number) key (x)

Keyboard input format--load, examine, deposit, start. All character keys shown in the following discussion respresent themselves with the exception of those in parentheses

FUNCTION							
LOAD ADDRESS	L (SB)	(x)	(x)	(x)	(x)	(x)	(x)
EXAMINE	E (SB)						
DEPOSIT	D (SB)	(x)	(x)	(x)	(x)	(x)	(x)
START	S (CR)						

Order of significance of input keys--the first character that is typed will be the most significant character Conversely, the last character thut is typed is the least significant character

Number of characters---the console emulator routine can accept up to six octal numbers in the range of 0-32k If all six numbers are input, the most significant number should be a one or a zero

Leading zeros--when an address or data word contains leading zeros, these zeros can be omitted when loading the address or depositing the data

NOTE

Even addresses only--the console emulator routine will not work with odd addresses Even numbered addresses must always be used

****

Example using the load, examine, deposit, and start function--assume that a user wishes to

1 turn on power

2 load address 700

3 examine location 700

4 deposit 777 into location 700

5 examine location 700

6 start at location 700

	USER	TERMINAL DISPLAY
1	turns on power	xxxxxx xxxxxx xxxxxx xxxxxx
2	L (SB) 700 (CR)	$ L 700
3	E (SB)	$ E 000700 xxxxxx
4	D (SB) 777 (CR)	$ D 777
5	E (SB)	$ E 000700 000777
6	S (CR)	$ S

****

SUCCESSIVE OPERATIONS

EXAMINE--successive examine operations are permitted The address is loaded for the first examine only Successive examines cause the address to increment by two and will display consecutive addresses along with their contents

****

Example of successive examine operations--examine addresses 500-506

OPERATOR INPUT	TERMINAL DISPLAY
L (SB) 500 (CR)	$L 500
E (SB)	$E 000500 xxxxxx
E (SB)	$E 000502 xxxxxx
E (SB)	$E 000504 xxxxxx
E (SB)	$E 000506 xxxxxx

****

DEPOSIT--successive deposit operations are permitted The procedure is identical to that used with examine

****

Example of successive deposit operations

Deposit 60 into location 500
2 into location 502
4 into location 504

OPERATOR INPUT	TERMINAL DISPLAY
L (SB) 500 (CR)	$L 500
D (SB) 60 (CR)	$D 60
D (SB) 2 (CR)	$D 2
D (SB) 4 (CR)	$D 4

****

ALTERNATE DEPOSIT-EXAMINE OPERATIONS---this mode of operation will not increment the address The address will contain the last data which was deposited.

****

Example of alternate deposit-examine operations---load address 500, deposit the following numbers with examines after every deposit 1000, 2000, 5420

OPERATOR INPUT	TERMINAL DISPLAY
L (SB) 500 (CR)	$L 500
D (SB) 1000 (CR)	$D 1000
E (SB)	$E 000500 001000
D (SB) 2000 (CR)	$D 2000
E (SB)	$E 000500 002000
D (SB) 5420 (CR)	$D 5420
E (SB)	$E 000500 005420

****

LIMITS OF OPERATION--The M9301 console emulator routine can directly manipulate the lower 28K of memory and the 4K I/O page Refer to the PDP-11/34 Processor Handbook for a procedure to utilize the memory management unit to examine or deposit in expanded memory

CHAPTER 4

BOOTSTRAP PROCEDURES

This chapter explains how to bootstrap a CPU. Bootstrapping is a procedure that starts a CPU. Essentially, you load and execute a very short program called a bootstrap loader, whose only function is to load and start a larger monitor program (for example, the absolute loader or an XXDP monitor).

Here are the general methods for bootstrapping a CPU:

1. key-in the bootstrap loader program manually and execute it.
2. load the starting address of a bootstrap ROM (a bootstrap loader program contained in read-only-memory) and start the CPU.
3. activate a "boot" button or switch on the console.
4. issue bootstrap commands under ODT-11 or REV11 (LSI-11 and 11/03).

This chapter assumes that you understand all the information in Chapter 3 that relates to your operator's console.

4.1 TOGGLE-IN THE BOOTSTRAP LOADER PROGRAM

If the CPU you are using has no bootstrap ROM and no bootstrap switch on the console, then you must manually key-in the bootstrap loader program into memory and execute it. This is called the toggle-in procedure. The bootstrap loader program that you toggle-in varies according to the device you are using to load the monitor (the monitor load device). The following are the actual toggle-in programs, arranged by monitor load device (controller/drive). The programs are also listed on the XXDP/DECX11 Programming Card.

4 1 1 PC11 And DL11

(high-speed paper tape reader, teletype console paper tape reader)

1 Halt the processor

2 Choose a 3-digit number from Table 4-1, corresponding to the memory available

Table 4-1 Address Prefixes for Paper Tape Bootstrap Loader

MEMORY SIZE	PREFIX
4K	017
8K	037
12K	057
16K	077
20K	117
24K	137
28K or greater	157

3 Deposit the following bootstrap loader program into memory, using the 3-digit prefix from Table 4-1 for the first 3 digits of each address, and also for the first 3 digits of the contents of location xxx 766

ADDRESS	CONTENTS	
xxx 744	016 701	
xxx 746	000 026	
xxx 750	012 702	
xxx 752	000 352	
xxx 754	005 211	
xxx 756	105 711	
xxx 760	100 376	
xxx 762	116 162	
xxx 764	000 002	
xxx 766	xxx 400	
xxx 770	005 267	
xxx 772	177 756	
xxx 774	000 765	
xxx 776	177 560	if load device is teletype reader
	177 550	if load device is PC11

4 Place the absolute loadec papec tape in the reader

NOTE

The absolute loader is the only monitor for use with paper tape systems You must have a copy of the absolute loader on paper tape to use this procedure There is a separate absolute loader for CPU's that have HW/SWR's and for those with SW/SWR's

1 Load address xxx 744

2 Put the HALT/ENABLE switch to ENABLE

3 Start the CPU.

4 You have loaded the absolute loader It is not self-starting it requires your intervention to load and execute programs Proceed to Chapter 5

4 1 2 RK11/RK05 (DECpack Disk Cartridge)

1 Halt the CPU

2 Prepare the monitor load device, mount the monitor DECpack volume on drive 0, start the device, and write-protect it

3 Deposit the following values at the specified locations

ADDRESS	CONTENTS
010 000	012 737
010 002	000 005
010 004	177 404
010 006	000 001

4 Load address 010 000

5 Put the HALT/ENABLE switch to ENABLE

6 Start the CPU

7 Wait one second and halt the CPU

8 Load address 000 000

9 Put the HALT/ENABLE switch to ENABLE

10 Start the CPU again

11 The monitor is loaded. Proceed to the chapter that describes the monitor you are using

4 1 3 IC11/IU56 (DECtape)

1. Halt the CPU
2. Prepare the monitor load device mount the monitor DECtape volume on drive 0, start the device, and write-protect it
3. Deposit the value 004 003 at location 177 342 The tape will rewind and stop in the end zone The "remote" light on the drive should remain lit
4. Examine the current location
5. Deposit the value 000 001 in the current location The remote light should go out
6. Deposit the following values at the locations specified

ADDRESS	CONTENTS
000 216	012 737
000 220	000 005
000 222	177 342
000 224	000 777

7. Load address 000 216
8. Put the HALT/ENABLE switch to ENABLE
9. Start the CPU
10. The monitor is loaded Proceed to the chapter that describes the monitor you are using

4 1 4 IM11/IU10 (7-track Magtape) And IM11/IS03 (9-track Magtape)

1 Halt the CPU

2 Prepare the monitor load device mount the monitor magtape volume on drive 0, start the drive, and write-protect it

3 Rewind drive 0 to "bot" and set "on-line"

4 Deposit the following values at the specified locations

ADDRESS	CONTENTS
010 000	005 137
010 002	172 524
010 004	012 737
010 006	060 011
010 010	172 522
010 012	000 777
010 014	012 737
010 016	060 003
010 020	172 522
010 022	105 737
010 024	172 522
010 026	100 375
010 030	000 137
010 032	000 000

5 Load address 010 000

6 Put the HALT/ENABLE switch to ENABLE

7 Start the CPU

8 Wait one second and halt the CPU

9 Load address 010 014

10 Put the HALT/ENABLE switch to ENABLE.

11 Start the CPU again

12 The monitor is loaded Proceed to the chapter that describes the monitor you are using

4 1 5 IB02/IU16 (9-track Magtape)

1 Halt the CPU

2 Prepare the monitor load device mount the monitor magtape volume on drive 0, start the drive, and write-protect it

3 Rewind drive 0 to "BOT" and set "on-line"

4 Deposit the following values at the specified locations

ADDRESS	CONTENTS
010 000	012 737
010 002	001 300
010 004	172 472
010 006	012 737
010 010	177 777
010 012	172 446
010 014	012 737
010 016	000 031
010 020	172 440
010 022	105 737
010 024	172 452
010 026	100 375
010 030	012 737
010 032	177 400
010 034	172 442
010 036	005 037
010 040	172 444
010 042	042 737
010 044	000 007
010 046	172 452
010 050	012 737
010 052	000 071
010 054	172 440
010 056	105 737
010 060	172 440
010 062	000 100
010 064	000 375
010 066	000 137
010 070	000 000

5 Load address 010 000

6 Put the HALT/ENABLE switch to ENABLE

7 Start the CPU

8 The monitor is loaded Proceed to the chapter that describes the monitor you are using

4 1 6 I811/IU60 (Cassette)

1 Halt the CPU

2 Prepare the monitor load device mount the monitor cassette on drive 0, and write-protect it

3 Deposit the following values at the specified locations

ADDRESS	CONTENTS
001 000	012 700
001 002	177 500
001 004	005 010
001 006	010 701
001 010	062 701
001 012	000 052
001 014	012 702
001 016	000 375
001 020	112 103
001 022	112 110
001 024	100 413
001 026	130 310
001 030	001 776
001 032	105 202
001 034	100 772
001 036	116 012
001 040	000 002
001 042	120 337
001 044	000 000
001 046	001 767
001 050	000 000
001 052	000 755
001 054	005 710
001 056	100 774
001 060	005 007
001 062	017 640
001 064	002 415
001 066	112 024

4 Load address 001 000

5 Put the HALT/ENABLE switch to ENABLE

6 Start the CPU

7 The monitor is loaded Proceed to the chapter that describes the monitor you are using

4 1 7 RX11, RXV11/RX01 (Floppy Disk)

1 Halt the CPU

2 Prepare the monitor load device mount the monitor floppy disc volume on drive 0 and start the device

3 Deposit the following values at the specified locations

ADDRESS	CONTENTS
001 000	005 000
001 002	012 701
001 004	177 170
001 006	105 711
001 010	001 776
001 012	012 711
001 014	000 003
001 016	005 711
001 020	001 776
001 022	100 405
001 024	105 711
001 026	100 004
001 030	116 120
001 032	000 002
001 034	000 770
001 036	000 000
001 040	005 000
001 042	000 110
001 044	000 000
001 046	000 000
001 050	000 000

4 Load address 010 000

5 Put the HALT/ENABLE switch to ENABLE

6 Start the CPU

7 The monitor is loaded Proceed to the chapter that describes the monitor you are using

4.1.8 RP11/RP02, RP03 (Multi-surface Disk Pack)

1. Halt the CPU
2. Prepare the monitor load device: mount the monitor disk pack volume on drive 0, start the device, and write-protect it
3. Deposit the following values at the specified locations

ADDRESS	CONTENTS
001 000	012 705
001 002	176 716
001 004	012 715
001 006	177 400
001 010	012 745
001 012	000 005
001 014	105 715
001 016	100 376
001 020	005 007

4. Load address 001 000
5. Put the HALT/ENABLE switch to ENABLE
6. Start the CPU
7. The monitor is loaded. Proceed to the chapter that describes the monitor you are using

4 1 9 RH11, RH70/RP04, RP05, RP06 (multi-surface Disk Pack)

1 Halt the CPU

2 Prepare the monitor load device mount the monitor disk volume on drive 0, start the device, and write-protect it

3 Deposit the following values at the specified locations

ADDRESS	CONTENTS
010 000	012 700
010 002	176 700
010 004	012 710
010 006	000 023
010 010	005 060
010 012	000 034
010 014	005 060
010 016	000 006
010 020	012 760
010 022	177 400
010 024	000 002
010 026	012 710
010 030	000 071
010 032	105 710
010 034	100 316
010 036	005 007

4 Load address 010 000

5 Put the HALT/ENABLE switch to ENABLE

6 Start the CPU

7 The monitor is loaded Proceed to the chapter that describes the monitor you are using

4 1 10 RH11, RHZ02/RSQ3, RSQ4 (Single-disk, Fixed Head)

1. Halt the CPU
2. Prepare the monitor load device mount the monitor disk volume on drive 0, start the device, and write-protect it
3. Deposit the following values at the specified locations

ADDRESS	CONTENTS
001 000	012 705
001 002	172 044
001 004	012 745
001 006	177 400
001 010	012 745
001 012	000 071
001 014	032 715
001 016	100 200
001 020	001 775
001 022	100 762
001 024	005 007

4. Load address 001 000
5. Put the HALT/ENABLE switch to ENABLE
6. Start the CPU
7. The monitor is loaded Proceed to the chapter that describes the monitor you are using

4 1 11 RK611/RK06 (Double High-density Disk Cartridge)

1 Halt the CPU

2 Prepare the monitor load device mount the monitor RK06 pack on drive 0, start the device, and write-protect it

3 Deposit the following values at the specified locations

ADDRESS	CONTENTS
010 000	012 737
010 002	000 003
010 004	177 440
010 006	012 737
010 010	177 000
010 012	177 442
010 014	012 737
010 016	000 021
010 020	177 440
010 022	000 001

4 Load address 010 000

5 Put the HALT/ENABLE switch to ENABLE

6 Start the CPU

7 Wait one second and halt the CPU

8 Load address 000 000.

9 Put the HALT/ENABLE switch to ENABLE

10 Start the CPU again

11 The monitor is loaded Proceed to the chapter that describes the monitor you are us ng

4.2 BOOTSTRAPPING WITH THE M9301 MODULE

1. Halt the CPU
2. Load the M9301 start address 173000, or 773000 under memory management
3. If the CPU has HALT/ENABLE switch, place it in the ENABLE position.
4. Start the CPU. You should receive a prompt character, $
5. Prepare the monitor load device. Load the monitor volume on unit 0, start the device, and write-protect it
6. Determine the two-character code for that device from Table 4-2
7. Issue the two-character code as a command. (You can append a number from 0-7 to the command if you wish to specify a device unit.)
8. The monitor is loaded. Some monitors are self-starting, others, such as the absolute loader, require your intervention to load and execute programs. Proceed to the chapter that describes the monitor you are using.

Table 4-2 Bootstrap Device Codes Supported By M9301

CONTROLLER/DEVICE	DESCRIPTION	BOOT COMMAND
RK11/RK05	DISK CARTRIDGE	DK
RP11/RP02,03	RP02/03 DISK PACK	DP
TC11/TU56	DECTAPE	DT
TM11/TU10,TS03	800 BPI MAGTAPE	MT
TA11/TU60	MAGNETIC CASSETTE	CT
RX11,RXV11/RX01	DISKETTE	DX
DL11/TTY	ASR-33 TELETYPE	TT
PC11	PAPERTAPE	PR
RH11,RH70/RS03,04	FIXED HEAD DISK	DS
RH11,RH70/RP04,05,06	DISK PACK	DB
TM02/TU16	MAGNETIC TAPE	MM
RK611/RK06	DISK	DM

NOTE

Be sure that your version of M9301 supports the load device you are using

4 3 BOOTSTRAP LOADER ROM'S

Here is the procedure for loading a monitor with a bootstrap ROM

1 Determine the bootstrap ROM included in your CPU

2 Halt the CPU

3 Prepare the monitor load device. load the monitor volume on unit 0, start the device, and write-protect it

4 Determine the ROM start address for that device from Table 4-3.

NOTE

For multi-unit devices, the default load unit is unit 0 Consult the PDP-11 Programming Card for ROM start addresses for loading device units other than unit 0

5 Load the ROM start address for the device into the CPU.

6 If the CPU has a HALT/ENABLE switch, put it to the ENABLE position

7 Start the CPU

8 The monitor is loaded Some monitors are self-starting, others, such as the absolute loader, require your invention to load and execute programs Proceed to the chapter that describes the monitor you are using

Table 4-3 Bootstrap ROM Starting Addresses for Specific Devices

CONTROLLER/DEVICE	BM873-YB	BM873-YA	MR11-DB	BM792
RX11, RXV11/RX01	n s	n s.	n s.	773400
RK11/RK05	773030	773010	773110	773100 (SWR=777406)
TC11/TU56	773070	773030	773120	773100 (SWR=777344)
TM11/TU10, TS03	773110	773050	773136	n. s
TM02/TU16	773150	n s	n. s	n s
TA11/TU60	773524	773230	n. s	773300
RP11/RP02, 03	773350	773100	773154	n s
RH11, RH70/RP04, 05, 06	773320	n s.	n s	n s
RH11, RH70/RS03, 04	773000	n s	n s	n s.
RF11	773136	773000	773100	n. s
RC11	773212	773144	773220	n s
PC11	773620	773312	n s.	n s
KL11, DL11/TTY	773510	n s.	n s	n s

NOTE

When loading from RK11 (RK05 DECpack) and TC11 (DECtape) using the BM792 bootstrap ROM, you must also set the switch register to the values given in the table before you start the CPU

n s means that the device s not supported by that ROM

4 4 USING A BOOT SWITCH OR BOOT BUTTON

Some CPU's have a "boot" switch or button on the operator's console The operation of this switch depends on the design of the system, but in any case, it is a fast convenient way to execute the program contained in a bootstrap ROM

In some systems the ROM will display a prompt character, $ Here, you must direct the ROM to the loading device by specifying a two-character code (refer to Table 4-2) Then the ROM will load the monitor

In other systems the switch or button starts a ROM that reads from a predetermined hardware-specified device You have only to prepare that device and activate the switch or button the ROM will then load the monitor automatically

As with any of the other bootstrap procedures, some monitors will self-start, others, such as the absolute loader require your intervention to load and execute programs When you have loaded the monitor, proceed to the chapter that describes the monitor you are using

4 5 USING A ROM AT POWER-UP

Power-up bootstrap ROM's operate exactly like the "boot" switch procedures that display the prompt character, $. (Refer to 4.4 above) You direct the ROM to the monitor loading device by specifying a two-character code (see Table 4-2)

4.6 BOOTSTRAPPING UNDER ODT-11 (LSI-11 OR 11/03)

1. Ensure that the CPU is at ODT command level with a prompt character, @. Refer to 3.3.1.
2. Prepare the device from which you are loading the monitor.
3. Determine the read-control-status-register address (RCSR address) for that device.
4. Issue the ODT load command, L, using the device RCSR address.

   @nnnnnnL where nnnnnn is RCSR
5. The monitor is loaded. Some monitors will self-start, others, such as the absolute loader require your intervention to load and execute programs. Proceed to the chapter that describes the monitor you are using.

4.7 BOOTSTRAPPING UNDER REV11 (LSI-11 OR 11/03)

1. Ensure that the CPU is at REV11 command level with the prompt character, $. Refer to 3.3.2.
2. Prepare the device from which you are loading the monitor.
3. Determine the RCSR address for that device.
4. Issue one of the following REV11 commands:
   - AL, if you are loading the absolute loader.
   - AR, if you are loading the absolute relocatable loader.
   - DX, if you are loading the monitor from floppy disc. This command does not require RCSR, but you may specify a device unit.
   - DK, if you are loading the monitor from RK05. This command does not require RCSR, but you may specify a device unit.
5. The monitor is loaded. Some monitors are self-starting, others, such as the absolute loader, require your intervention to load and execute programs. Proceed to the chapter that describes the monitor you are using.

Examples	$AL	loads the absolute loader from the console teletype reader, the default device
	$AL177550	loads the absolute loader from PC11 paper tape reader
	$AR	loads absolute relocatable loader from console teletype reader
	$AR177550	loads absolute relocatable loader from PC11 paper tape reader
	$DX	loads monitor from floppy disk 0.
	$DX1	loads monitor from floppy disk 1.
	$DK	loads monitor from RK05 disk 0
	$DK1	loads monitor from RK05 disk 1

For more information on REV11 commands, see paragraph 3 3.2.

CHAPTER 5

THE ABSOLUTE LOADER

The absolute loader is the monitor for paper-tape-based systems. The basic operating procedure is as follows:

1. Load if necessary, and execute a bootstrap loader that will--
2. load the absolute loader, which in turn will enable you to--
3. load your programs from paper tape

5.1 LOADING THE ABSOLUTE LOADER

If your system requires you to toggle-in the bootstrap loader, then follow the procedure given under 4.1.1.

If you are operating under an M9301 module, then bootstrap the monitor as described under 4.2.

If your system has a bootstrap ROM, then follow the instructions under 4.3.

When you have bootstrapped the absolute loader, proceed to paragraph 5.2.

5.2 LOADING DIAGNOSTIC PROGRAM TAPES

Once you have loaded the absolute loader, you can then load your diagnostic programs from paper tape.

Here is the normal procedure for loading program tapes

1 Place the diagnostic paper tape into the paper tape reader (Set HW/SWR to zeroes--all switches down)

2 If your CPU console has a CONT control switch, activate it The absolute loader should load the diagnostic paper tape (Go to Step 5) If it doesn't load it go to Step 4

3 If you are operating from a terminal device, issue the ODT proceed command, P The absolute loader should load the diagnostic paper tape (Go to Step 5) If it doesn't, go to Step 4

4 Some systems require you to start again after loading the absolute loader In this case you must load the starting address of the absolute loader, xxx500 (xxx determined from Table 4-1), and start the CPU (Under ODT you would issue the Go command, G, with the absolute loader starting address @xxx500G)

5 The diagnostic is loaded The absolute loader will not automatically start execution of diagnostic programs Proceed to paragraph 5 4

NOTE

There is a separate absolute loader for CPU's with HW/SWR's and for those with SW/SWR's The two absolute loaders function alike, but they access d fferent locations to read switch settings (See also Chapter 6)

If you are using the version of the absolute loader that reads HW/SWR's and your CPU has SW/SWR's, then you must make the following alterations to the absolute loader in the CPU before loading your diagnostic program tapes (If the absolute loader version matches the CPU, then use the normal program loading procedure above)

1 Load address xxx516 (xxx determined from Table 4-1) This location is the pointer to the CPU HW/SWR

2 Deposit the value 000176 in location xxx516. Now the pointer contains the address of the SW/SWR.

3 Load address 000176 and deposit zeroes (unless you need a specific switch setting). You are setting the SW/SWR to zeroes

4 Follow instructions 1, 4, and 5 of the normal procedure above

5 3 OVERLAYING ANOTHER DIAGNOSTIC PROGRAM

You can use the procedure described in Step 4 of the normal procedure above to load in another diagnostic program at any time It will overlay the one currently in memory However, that program currently in memory must not have altered the absolute loader during its execution

5 4 EXECUTING THE PROGRAM

The program loaded and the switch register set (Chapter 6), you are ready to begin program execution Follow this procedure

For CPU's without terminals

1 HALT the CPU

2 LOAD address 200

3 ENABLE the CPU

4 Activate START switch

For CPU's with terminals

1 Put CPU at terminal command level ODT or M9301 command level (See 3 3)

2 Under ODT issue a Go command, G, and specify address 200
@200G

3 Under M9301 load address 200 and issue a start command
$ L 200 <CR>
$ S

CPU is now under program control

5 5 RESTARTING THE PROGRAM

Refer to the appropriate appendix for specific restart addresses Restarting allows you to resume program execution without going through the whole start procedure again

CHAPTER 6

SWITCH REGISTERS

A switch register is a set of switches that a program looks at in order to determine which paths of execution it should take

6.1 HARDWARE SWITCH REGISTER

The hardware switch register, or HW/SWR, is a one-word hardware location at UNIBUS address 177570, or 777570 with memory management. You load the HW/SWR with an appropriate value, depending on what you want the program to do. If you do not know the specific switch settings for a program, then set the HW/SWR to zeroes. This is the standard setting. (If you load a HW/SWR with all ones, a diagnostic program will look instead at location 000176, the software switch register, for its directions. See paragraph 6.2).

Some processors allow you to load the HW/SWR at any time during program execution using the console switch panel. The switch panel corresponds bit-by-bit to the HW/SWR. If a panel switch is up, the corresponding bit in the HW/SWR is "on" or equal to 1, down is "off" or 0. When the CPU is running, the switch panel setting is the current value of the HW/SWR.

Processors with keypad consoles allow you to load the HW/SWR at any time by using the LSR button (load-switch-register). You can enter up to six octal digits, the CPU truncates to the low-order sixteen bits. You cannot load the HW/SWR on a keypad console with LAD + DEP operation. Likewise, you cannot display the contents of the HW/SWR with a LAD + EXAM operation. The CPU does display the HW/SWR contents at START or CONT time.

6.2 SOFTWARE SWITCH REGISTER

Some CPU's do not have a HW/SWR (e.g., LSI-11 or 11/03). In these CPU's diagnostic programs refer instead to location 000 176 called the software switch register, or SW/SWR. The SW/SWR provides the same function as the HW/SWR. However, the loading procedures are different. See paragraph 6.3.

NOTE

You can force a diagnostic to treat a HW/SWR CPU as though it were a SW/SWR CPU. There are two ways to do this:

1. Set the HW/SWR to ALL ones. Most diagnostics will refer to location 000176 for the switch register setting under this condition.

2. Halt the CPU after loading the diagnostic, but before starting it. Using the cross-reference table in the diagnostic's program listing, find the location labelled "SWR" or "SWREG". Change the contents of this location to 000176 (i.e., load its address and deposit 000 176). Return control to the CPU. either load address 200, enable and start the CPU, or, load the XXDP restart address given in the ready message, enable and start the CPU, and issue an XXDP start command, S. (See 7.4.3)

6.3 LOADING THE SOFTWARE SWITCH REGISTER

When you start a diagnostic, it will check to see whether the processor has a HW/SWR. If there is no HW/SWR (or if you have set it to all ones), the diagnostic will look at location 000 176 the software swi' h register, for the switch setting

Some diagnostics allow you to modify the SW/SWR while they are executing This is called dynamic switch register modification Such a diagnostic will give you the following message

SWR = nnnnnn NEW SWR =

and expect you to enter the value you need, nnnnnn is the current setting. At any time thereafter, you may change the SW/SWR by typing a G (or CNTRL G) at the terminal The value you enter can be up to six octal digits; the diagnostic will truncate the number to the low-order sixteen bits in case of overflow. If you do not enter a new value, the old SW/SWR setting remains You must complete the operation with a carriage return

In addition, if you enter a erroneous value, you can delete it before you have done a carriage return by typing U (or CNTRL U) The diagnostic will then accept the corrected switch register setting

NOTE

All CNTRL operations ( ) mean that you press the CNTRL-key (-key) simultaneously with a letter key.

If the diagnostic does not provide dynamic switch register modification, then you must set the SW/SWR before starting the diagnostic program You do this by halting the CPU, loading address 000 176, and depositing the switch register value that the diagnostic requires. Then you load either the program's start address (usually location 200) or the monitor's restart address (given in the .eady message); then enable and start the CPU If you are returning to the monitor, then you must issue a start command, S, to start the diagnostic program (see 7 4 3)

6 4 STANDARD SWITCH SETTINGS

Most diagnostics use switches to set test parameters The following are standard switch settings A sw tch is set when it equals one

Table 6-1 Switch Register Settings

HW SWITCH	KEYPAD CPU & SW/SWR SETTING	OPTION
15	100 000	halt on error
14	040 000	loop on test
13	020 000	inhibit error typeouts
12	010 000	inhibit trace trap
11	004 000	inhibit iterations
10	002 000	bell on error
9	001 000	loop or error
8	000 400 to 000 777	loop on test specified in bits 0-7 of SWR

NOTE

The keypad and SW/SWR settings are accumulative. If you want more than one option, then add the SWR values and enter the sum as the SWR setting. For example, if you want to designate the first four options in the list, add the first four SWR settings. Then enter 170 000 as the SWR setting. Likewise, choosing the first, third, fifth and seventh options will give a SWR setting of 125 000

SWITCH 15 - HALT ON ERROR

This switch is checked in the error routines and when found to be on a one the program will halt

SWITCH 14 - LOOP ON TEST

When set, this switch will cause the diagnostic to loop on the test presently being executed

SWITCH 13 - INHIBIT ERROR TYPEOUTS

When set, error messages will not be typed (output) on the console

SWITCH 12 - INHIBIT TRACE TRAP

Normally a program will run with the "T" bit set on alternate passes of the program. If this switch is set (equal to one) the "T" bit will not be set.

SWITCH 11 - INHIBIT ITERATIONS

If this switch is set, the subtest being performed will be iterated only one time

SWITCH 10 - BELL ON ERROR

If set, and error will cause the TTY bell to ring

SWITCH 09 - LOOP ON ERROR

If this switch is set, the diagnostic will loop on the test that caused the error. If the error goes away during the looping, the diagnostic will proceed to the next test.

SWITCH 08 - LOOP ON TEST IN SWR<07-00>

If this switch is set, the diagnostic will loop on the test number specified by bits <07 00> of the switch register (SWR)

NOTE

Many diagnostics do not use this convention Such diagnostics need specific input parameters and therefore need special switch settings

CHAPTER 7

LOADING & RUNNING DIAGNOSTICS UNDER XXDP

XXDP is a group of PDP-11 diagnostic software monitors that includes the following

TCDP - TC11 diagnostic package (DECTAPE)
RKDP - RK11 diagnostic package (DECPACK)
TMDP - TM11/TM02 diagnostic package (7 or 9 track MAGTAPE)
9 track can be loaded from TU10 or TU16
TADP - TA11 diagnostic package (TM11 Cassettes)
RXDP - RX11 diagnostic package (Floppy Disk)
RPDP - RP11 diagnostic package.
RBDP - RH11/RP04 diagnostic package.
RSDP - RH11/RS03 diagnostic package.
RMDP - RK06 diagnostic package.

The XXDP packages contain the diagnostic monitors, diagnostic utilities, and diagnostic programs on media other than paper tape. XXDP packages have the following advantages

1 Easy and convenient means of loading programs under keyboard control

2 Means are provided for updating and modifying programs

3 Possible to sequentially run a series of programs through use of the "chain mode" feature Programs must be chainable See paragraph 7 7

All XXDP packages require

1 PDP-11 processor with at least 8K storage

2 Console terminal device

3 One of the diagnostic package media

- 1 TC11 dectape control and TU56 transport or,
- 2 RK11 disk control and RK03 or RK05 drive or,
- 3 TA11 control and TU60 cassette drive or,
- 4 TM11 magtape control and TU10 magtape drive or,
- 5 TM02 magtape control unit and TU16 drive or,
- 6 RX11/RXV11 floppy control unit and RX01 floppy drive or,
- 7 RP11 disk controller and RP03 drive or,
- 8 RH11/RH70 disk controller and RP04/RP05/RP06 drive or,
- 9 RH11/RH70 disk controller and RS03/RS04 drive or,
- 10 RK611 disk controller and RK06 drive.

The above requirements are for loading and running diagnostic programs already stored on one of the diagnostic package media

7 1 LOADING AN XXDP MONITOR

You load an XXDP monitor as described under Chapter 4 Bootstrap Procedures

First, determine your processor configuration does it have bootstrap ROM's or M9301? a "boot" button or switch? must you toggle-in? etc

Then, depending on the load medium you are using, refer to the appropriate paragraph to see how to bootstrap from that device

When you have successfully loaded the monitor, it gives you the following message

```
aaaaa-a          dd-mmm-yy       xxxx-xxxx MONITOR    nnK
RESTART ADDRESS:  rrrrrr
BOOTED VIA UNIT#   b
TO ABORT THE FOLLOWING HELP MESSAGE TYPE CTRL C ( C)

TYPE
F<CR> TO SET CONSOLE FILL COUNT
D<CR> FOR DIRECTORY ON CONSOLE
D/F<CR> FOR SHORT DIRECTORY ON CONSOLE.
D/L<CR> FOR DIRECTORY ON LINE PRINTER.
D/L/F<CR> FOR SHORT DIRECTORY ON LINE PRINTER
R COPY<CR> TO RUN COPY PROGRAM
R FILENAME<CR> TO RUN ANY OTHER PROGRAM.
L FILENAME<CR> TO LOAD A PROGRAM ONLY.
S<CR> TO START THE PROGRAM JUST LOADED
S ADDR<CR> TO START THE PROGRAM AT SPECIFIC ADDRESS
C FILENAME<CR> TO RUN A CHAIN.
C FILENAME/QV<CR> TO RUN A CHAIN IN QUICK VERIFY MODE
REFER TO XXDP MANUAL MD-11-DZQXA FOR ADDITIONAL HELP
```

```
  aaaaa-a  -- the name of the MAINDEC program module
dd-mmm-yy  -- the module release date
xxxx-xxxx  -- the name of the monitor
      nnK  -- the system storage up to 28K
   rrrrrr  -- the monitor's restart address (see 7 2)
        b  -- the device unit or device drive number
              from which you bootstrapped the monitor,
              the default drive or unit is 0
           -- the monitor is ready to accept commands
```

7.2 HOW TO USE AN XXDP MONITOR

XXDP issues a prompt character, the period (.), when it is loaded and ready to accept XXDP commands. A description of these commands appears below, paragraph 7.4.

However, while operating under XXDP, you can at any time put the CPU at the console command level. Use the HALT/ENABLE switch, or equivalent means, to stop processing. (See also paragraph 3.3, "Terminal Device Consoles".) This will allow you to modify memory locations, or "toggle-in" a patch to a program, or manually start or restart a program, or reset the software switch register, etc.

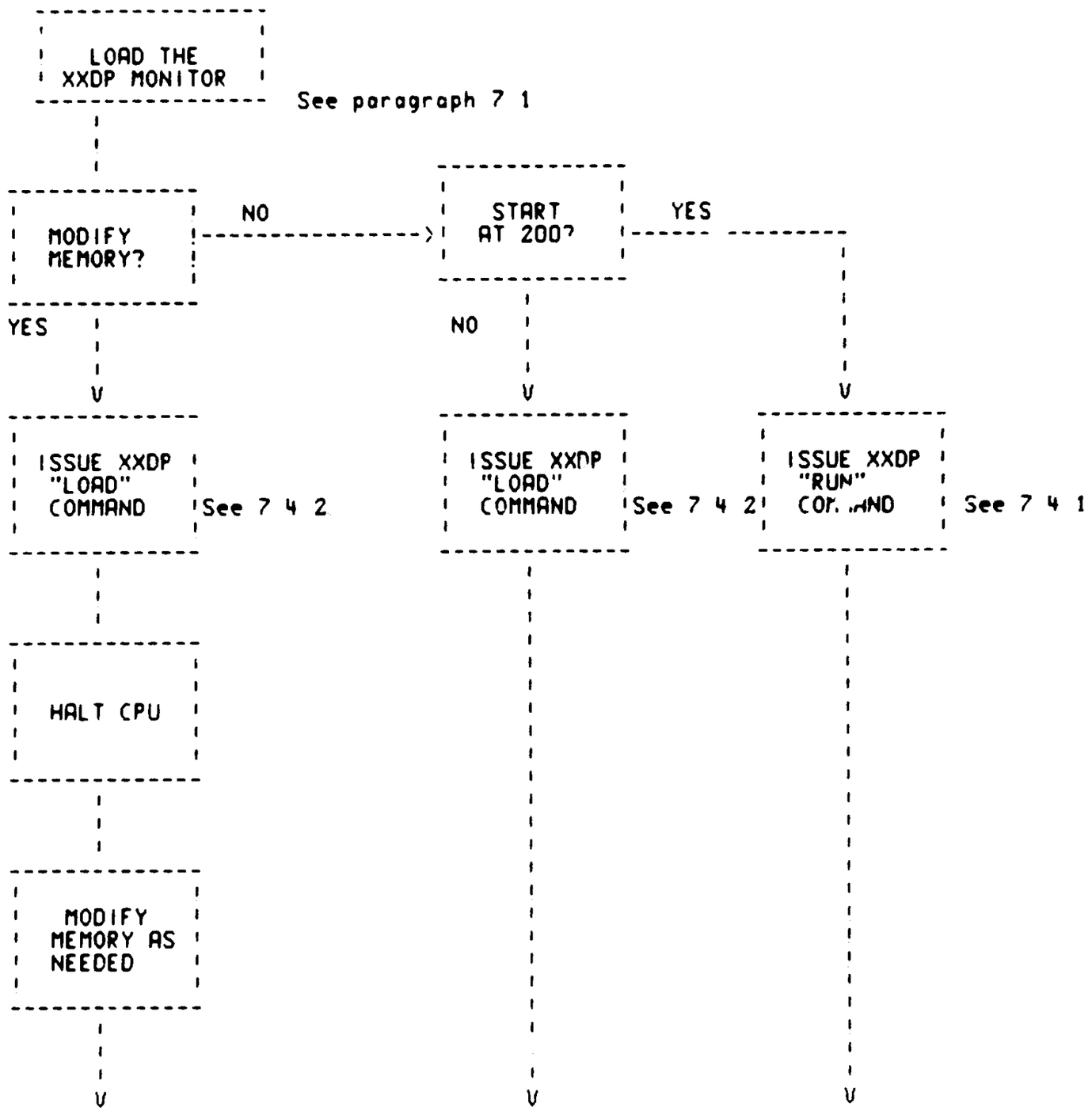
After you have halted the CPU and modified memory as needed, you can then return control to whichever program you want -- the XXDP monitor or a diagnostic program. To resume or start execution of a program, not the XXDP monitor, simply load the start address (usually location 200), or the restart address of that program and start the CPU.

If you are returning control to the XXDP monitor, then load its restart address (given in the ready message), and start the CPU. NOTE: If you or an executing program have destroyed any of the XXDP monitor in memory, the results of this restart are unpredictable.

Also remember that when you reload an XXDP monitor, your memory modifications are destroyed. More specific examples of these procedures appear below.

CAUTION

When running diagnostics that test the XXDP monitor load device, be sure to write-protect the monitor volume or the drive that is holding it; otherwise, you may accidentally destroy the monitor on the medium. Also, if you need to test the particular drive or unit that holds the monitor volume, then remove the monitor volume from that drive and mount a "scratch" volume in its place.


LOAD THE XXDP MONITOR
See paragraph 7 1
MODIFY MEMORY?
NO
YES
START AT 200?
YES
NO
ISSUE XXDP "LOAD" COMMAND
See 7 4 2
ISSUE XXDP "LOAD" COMMAND
See 7 4 2
ISSUE XXDP "RUN" COMMAND
See 7 4 1
HALT CPU
MODIFY MEMORY AS NEEDED

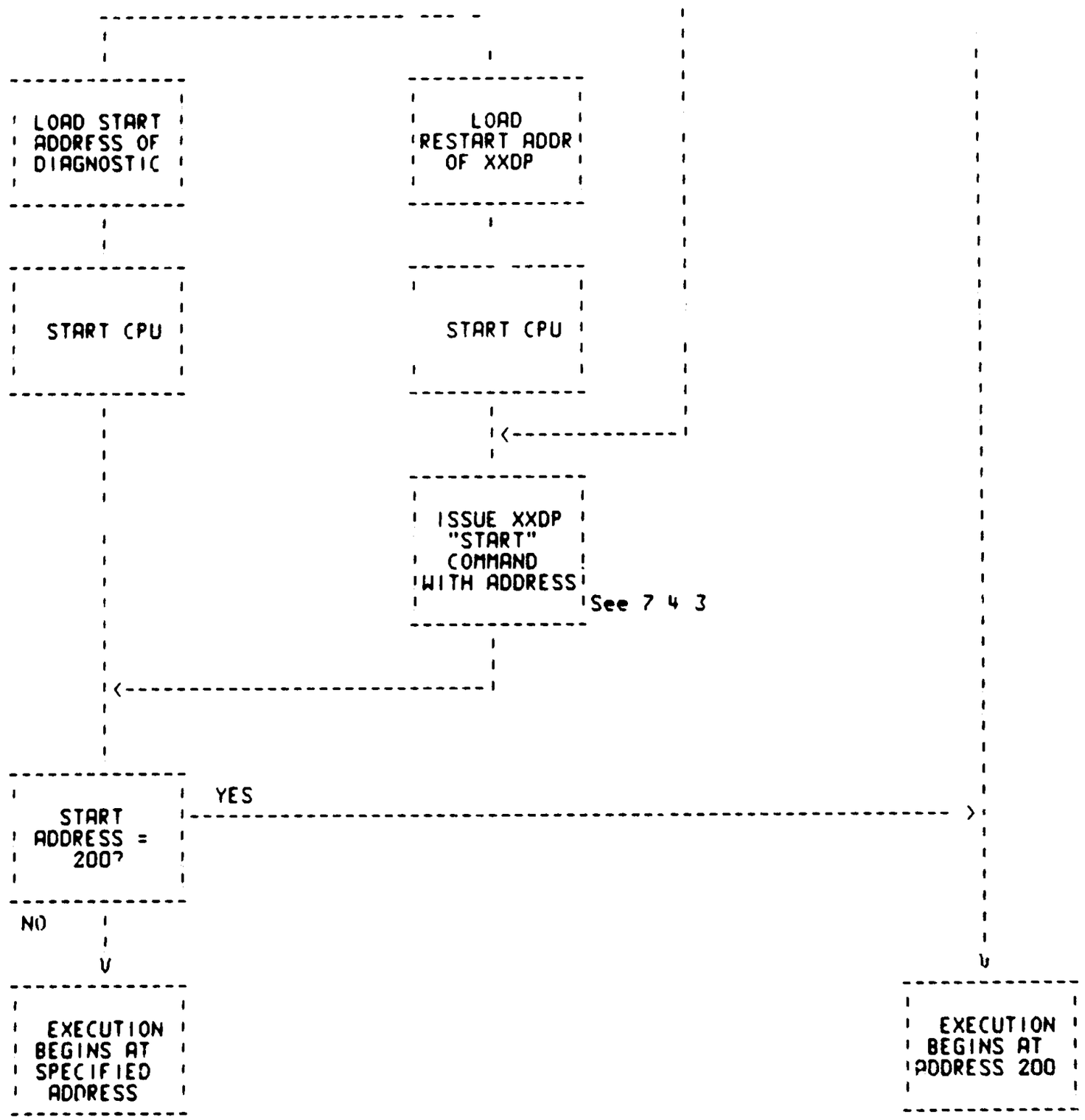


FIGURE 7-1 GENERAL PROCEDURE FOR RUNNING PROGRAMS UNDER XXDP

7.3 LOADING AND RUNNING PROCEDURES

There are two alternatives for loading and running programs under XXDP:

1. Load and start a program without modifying memory
2. Load a program, halt the CPU, modify memory, and start the CPU

Here is the general procedure, also illustrated in Figure 7-1. A more detailed example appears at paragraph 7.4.6.

7.3.1 RUNNING A DIAGNOSTIC WITHOUT MODIFYING MEMORY

1. Issue the XXDP run command, R (see paragraph 7.4.1)
2. Diagnostic execution begins at location 200, the standard diagnostic start address

OR,

1. Issue the XXDP load command, L (see paragraph 7.4.2)
2. Issue the XXDP start command, S, and specify an address (see paragraph 7.4.3). If you do not specify an address, XXDP starts execution at location 200.
3. Diagnostic execution begins at specified address

7.3.2 MODIFYING MEMORY AND THEN RUNNING A DIAGNOSTIC

1. Issue the XXDP load command, L (see paragraph 7.4.2)
2. Halt the CPU
3. Modify memory as needed. Set the SW/SWR, "patch" a program, etc. Then continue following procedure "a" or "b" below

4a Load the address at which you want to begin execution, location 200 is the standard starting address

5a Start the CPU

6a Diagnostic execution begins at address specified in step 4a

OR

4b Load the XXDP restart address given in the ready message

5b Start the CPU

6b Issue the XXDP start command, S If you do not specify an address, XXDP starts execution at location 200

7b Diagnostic execution begins at address specified in step 6b

7.4 XXDP COMMANDS

Here are the XXDP monitor commands They apply to all XXDP monitors In addition, the TADP monitor requires slightly modified operation Refer to paragraph 7.6 for this description.

NOTE

<cr> -- press "carriage return" key

CNTRL C -- press CNTRL-key and C-key simultaneously;
C puts you at XXDP command level ( ) at any time

DEL -- press key to delete erroneous
RUBOUT keyboard entry

Underlined characters in formats and examples are XXDP monitor output

7 4 1 RUN Command

Here is the format for the XXDP run command, R

_R filnam <cr>

The filnam is the filename of the program (up to six characters), without the extension. Do not type the extension XXDP will load and run the program

Example run the diagnostic program CHECKIT.BIN

1 Load the appropriate XXDP monitor as described under paragraph 7.1

2 Set the switch register (see Chapter 6 D) as required by CHECKIT BIN

3 Issue the run command, R, as follows

_R CHECKIT <cr>

4 XXDP will run CHECKIT.BIN.

5 To run another program, halt the CPU, load the XXDP restart address, and start the CPU. XXDP will accept commands if the previous diagnostic has not destroyed it in memory If you have lost the monitor then you must reload it, as described under paragraph 7.1.

7 4 2 The LOAD Command

Here is the format for the XXDP load command, L

_L filnam <cr>

The filnam is the filename of the program, without the extension Do not type the extension XXDP will load the program into memory

Example load the diagnostic program CHECKIT BIN

1 Load the appropriate XXDP monitor as described under 7 1

2 Issue the XXDP load command, L, as follows

_L CHECKIT <cr>

3 XXDP will load CHECKIT BIN from the XXDP volume into memory and await further commands

7 4 3 The START Command

Before starting a loaded program, you may want to set the switch register (see Chapter 6.0), you may also want to modify other memory locations (see paragraph 7.2)

Here is the format for the XXDP start command, S

_S <address> <cr>

The S command starts program execution at the address you specify If you do not specify an address execution begins at 200 When the diagnostic has finished, and provided it has not overlaid the XXDP monitor in memory, you can run another d agnostic by halting the CPU, loading the XXDP restart address, and starting the CPU again. If you have lost the monitor, then you must reload it as described under paragraph 7 1 Remember that you lose all your modifications when you reload the monitor

7 4 4 Directory Commands

The directory commands print or display directories of file-structured XXDP volumes either on the terminal device or the line printer A directory contains the following information

filnam ext -- the file name (up to six characters) and extension The only valid XXDP extensions are BIN for a binary file, BIC for a loadable binary file, SAV for a core image file, and .CCC for an ASCII chain file.

length -- a decimal number designating the number of blocks in a disc or tape file.

start -- an octal number designating the starting block number of a disc or tape file.

date -- the date of file creation

The directory commands have four forms:

D -- gives a directory on the terminal
D/F -- gives a fast directory on the terminal. (Does not include length, start, or date).
D/L -- gives a directory on the line printer.
D/L/F -- gives a fast directory on the line printer (Does not include length, start, or date)

NOTE

Line printer must be present; no check is made for it. The processor will trap to location 000004.

Example give a short directory on the line printer

_D/L/F <cr>

_

The directory will appear on the line printer

7 4 5 Set Fill Count

The "set-fill-count" command, F, allows you to change the number of fill characters inserted after a carriage return operation. The LA30S terminal requires fillers to operate properly, so the filler default value is octal 14 Other terminals do not require these fillers, and by issuing an F command, you can delete the annoying, time-consuming fill operations The F command displays the current fill count, and expects you to enter the new fill count

Example change the fill count to 0.

```
_F <cr>
000014 0 <cr>
_
```

7 4 6 Example Of Loading And Running A Program Using XXDP Commands

Run the diagnostic program CHECKIT.BIN. Before execution, take a short directory reading; put the value 17 into location 17530, and set the SW/SWR to 007100. Start execution at location 000214

1 Load the appropriate XXDP monitor as described in paragraph 7 1

2 Issue a "fast directory" command

```
_D/F <cr>
```

3 Issue the XXDP "load" command

```
_L CHECKIT <cr>
```

4 Halt the CPU.

5 Load address 017530

6 Deposit 000017

7 Load address 000176 (the address of the SW/SWR).

8 Deposit 007100

Continue following procedure "a" or "b" below

9a Load address 000214

10a Put the HALT/ENABLE switch to ENABLE

11a Start the CPU

12a CPU begins executing CHECKIT at address 000214

OR,

9b Load the restart address of the XXDP monitor, given in the ready message

10b Put the HALT/ENABLE switch to ENABLE

11b Start the CPU

12b Issue the XXDP "start" command

_S 000214 <cr>

13b XXDP transfers CPU control to CHECKIT program at address 000214

7 5 XXDP ERROR MESSAGES

INVCMD/SW	Invalid command and/or switch. Check command just given.
DEVERR	Device error on input device
EOM	End of medium Occurs during input operations when the program attempts to input and the file is at an end Serious problem. File in storage is probably wired out.
INVADR	Invalid address. Must be even and within existing memory limits Must not be within update program
CKSMER	Checksum error during "load" command
POFLO	Program too large to load within existing memory
INVNAM	Invalid character typed for file name
NEXFIL	Non-existent file. If in chain mode the program to be run does not have BIC extension

7.6 TADP MONITOR EXCEPTIONS

The TADP package cassettes are packaged according to the following schemes

1 One TADP cassette contains the TADP monitor and XXDP utilities (UPD1, UPD2, etc)

2 Several diagnostic cassettes containing the diagnostic programs

When using TADP, the TADP cassette must be mounted on drive 0 (left hand drive) of the TA11, the diagnostic cassette is mounted on drive 1 (right hand drive)

Because the TADP package is a two drive system, two additional commands are provided that control the drive that is to be accessed

```
E 0<cr>          ;Enables access to drive 0.

E 1<cr>          ;Enables access to drive 1.
```

When the TADP monitor is first loaded it defaults to drive 0. At that point all commands given to the monitor apply to drive 0 only

Typing E 1<cr> enables access to drive 1 with all monitor commands applying to drive 1 To return to access drive 0 the E 0<cr> command is given.

Examples,

```
E 0<cr>              ;Enables drive 0 access
D<cr>                ;Obtains drive 0 directory
R UPD2               ;Runs UPD2 after loading from drive 0

E 1<cr>              ;Enables drive 1 access.
D/F<cr>              ;Fast directory from drive 1
L ZTCAA0<cr>         ;Loads ZTCAA0 from drive 1.
S 200<cr>            ;Starts ZTCA50.
E 0<cr>              ;Reenables drive 0 access.
```

When the "D" (directory) command is given and drive 1 is enabled drive 0 will be accessed first in order to load the non-resident directory routine from the TADP monitor on drive 0 Then drive 1 is accessed to obtain drive 1 directory

In chain mode (see 7 7) the chain file is always accessed from whatever drive was enabled when the "C" command was given, even if the chain file itself causes another drive to be assigned

Example,

```
E 0<cr>                 ,Drive 0 enabled
C CHAIN<cr>             ,Run chain from CHAIN CCC (drive 0)
```

ASSUME CHAIN CCC CONTAINS THE FOLLOWING·

```
E 1<cr>
                        ,Enable drive 1
R T1/10<cr>
                        ,Run T1 10 times
R T2/10<cr>
                        ,Run T2 10 times
R T3<cr>
                        ,Run T3
R T4<cr>
                        ,Run T4
R T5<cr>
                        ,Run T5
"
"
"
"
R T90<cr>
                        ,Run T90
E 0<cr>
                        ,Enable drive 0
```

NOTE

In ASCII chain files, comments may not appear on command lines

The CHAIN CCC file will be accessed from drive 0 All the test programs will be accessed from drive 1 At completion of chain drive 0 will be enabled

Note that with TADP, chain files do not have to be in the same cassette as the test programs

When in doubt as to what drive is available the user just has to give the command that enables the drive he/she wishes to use

7 7 CHAIN MODE OPERATION

Chain mode operation consists of the sequential execution of programs without operator intervention Only programs that have been modified to run in chain mode can be chained Chainable programs are identified in the directory by the extension BIC.

To run chain mode, the XXDP monitor requires a file indicating the programs to run, and the number of times each program must execute before going on to the next program in the table. (A chain file may be generated by using the XTECO text editor, and the user must put a CCC extension on the chain file Refer to the XXDP USERS MANUAL for information about XTECO text editor)

To Summarize

1 Chain mode runs chainable programs only (BIC extensions)

2 A chain file indicates the programs to run and their pass counts

3 Only programs resident on the same medium drive can be chained

4 The chain file must be on the same medium with a CCC extension

NOTE The CCC extension indicates a chain file

Chain mode is entered by typing

C filename<cr> (While in monitor mode)
Where
C is the "CHAIN" command
Filename is the name of the ASCII file that contains the monitor commands to be executed The file must have a " CCC" extension

7 7 1 Making A Chain ASCII File

The chain ASCII file may be created by running the XTECO program and using the text editor to create the ASCII chain file The chain file must contain only the commands supported under the XXDP monitor The commands in the ASCII file are executed in the order in which they are entered and run as a batch mode

NOTE

In ASCII chain files, comments may not appear on command lines

Example of a chain file. run T1 1000 times, run T2 1000 times, run T3 1000 times, run T4 1000 times, run T5 1000 times, run T6 1000 times, run T7 1000 times; run T8 1000 times, run T9 1000 times, run T10 1000 times; run T11 1000 times, run T12 1000 times, load T13, start it and run 1000 times, resubmit the chain file again

```
.CPU CCC
.This chain file exercises the XYZ processor with T1-T13
.
R DOAA/1000
R DOBA/1000
R DOCA/1000
R DODA/1000
R DOEA/1000
R DOFA/1000
R DOGA/1000
R DOHA/1000
R DOJA/1000
R DOKA/1000
R DOLA/1000
R DOMA/1000
L DONA
S/1000<cr>
C CPU
```

7 7 2 Running A Chain

To execute a chain file the user types

C filnam<cr> or C filnam/QV<cr>

The pass count specified in the chain file determines the number of times XXDP will execute each program The optional /QV switch provides a "quick verify" operation by execut ng each diagnostic program in the chain only once, despite the pass count specified

The chain file to be executed must have an extensin of CCC

The chain file and the objective programs to be run must reside in the same XXDP medium and must be mounted on drive 0 of XXDP device

When in chain mode switch register or software switch register should be set to 000000

The XXDP monitor will type each command that it evaluates and then proceed to execute it

If the monitor encounters a program that does not have a .BIC extension it types "NEXFIL" Then if the error resulted from a R (RUN COMMAND) only, it will continue with the chain file command, otherwise it terminates the chain operation.

When the last command other than another "C" command has been executed the XXDP monitor terminates chain mode and types a DOT( ), ready to accept another command from the console.

If the user wishes to terminate chain mode before its normal termination he may do so by repeatedly typing CTL C (C) at the console until the monitor accepts it at the end of a program pass

7 8 UPD1 AND UPD2

Each XXDP package contains two update programs, called UPD1 BIN and UPD2 BIN These programs are used to add, delete, rename, and patch programs in the XXDP packages, and also to provide general file maintenance services

This section describes three update commands For more information on UPD1 and UPD2 consult the XXDP Users Manual

WARNING

Do not use the XXDP UPDATE utility to load diagnostics UPDATE does not write-protect the monitor volume You may inadvertantly destroy the monitor Instead use the XXDP load command, L, or the run command, R

You run UPD1 and UPD2 by issuing the XXDP run command, R, as follows

_R UPD1 <cr> or _R UPD2 <cr>

Update responds and asks for the date, formatted dd-mmm-yy Then it gives it relocation and restart addresses and issues a ready signal, * Update will now accept commands

NOTE

Running an update program destroys the XXDP monitor in memory If you need the monitor, you must reload it Use the BOOT command for this (See 7 8 3 below)

7 8 1 The Load Command

The Load command loads files from a device to memory The format of the load command follows

*LOAD ddn filnam ext <cr>

dd -- the load device name from Table 7-1
n -- the unit or drive number for that device, does not apply to paper tape devices
filnam ext -- the name of the file on the device, omit if the load medium is paper tape.

The load command gives the starting address of the program loaded and the memory limits of the program

Example Load a program from paper tape, using the high speed paper tape reader

```
*LOAD PR        <cr>
 XERROR  000050      CORE  000000- 012620
*
```

Example load a program from floppy disk drive 1 called MYFILE BIN

```
*LOAD DX1 MYFILE BIN      <cr>
 *ERROR_  000200     CORE_  000000_ 012522
*
```

7 8 2 The Dump Command

The dump command puts the contents of memory onto a specified device. The format of the dump command follows:

```
*DUMP   ddn filnam ext    <cr>
```

dd -- the name of the device on which you want to dump memory; see Table 7-1.

filnam ext -- the name you want to give the file, omit if you are dumping to paper tape.

Example dump a file from memory to RK05 disk drive 0, call the file MYFILE BIN.

```
*DUMP DK0 MYFILE BIN      <cr>
```

Example dump a file from memory to paper tape, using the high-speed paper tape punch.

```
*DUMP PP      <cr>
```

7 8 3 The Boot Command

The boot command allows you to return CPU control to the XXDP monitor. The command format follows:

```
*BOOT ddn     <cr>
```

dd -- the name of the device from which you are bootstrapping XXDP, see Table 7-1

n -- the unit or drive number of the device

Example bootstrap the TADP monitor from cassette drive 0

```
*BOOT CT0    <cr>
```

Bootstrap RKDP monitor from disk drive 0

```
*BOOT DK0     <cr>
```

Table 7-1 PERIPHERALS SUPPORTED BY UPDATE PROGRAMS

DEVICE CODE	DEVICE NAME	REMARKS
PR	PC11 HIGH SPEED PAPER TAPE READER	(UPD1, UPD2)
PP	PC11 HIGH SPEED PAPER TAPE PUNCH	(UPD1, UPD2)
KB	TTY KEYBOARD, OR LOW SPEED READER	(UPD1, UPD2)
PT	TTY PRINTER AND PUNCH	(UPD1, UPD2)
DTN	TC11 DECTAPE	(UPD1 N=0 OR 1), (UPD2, N=0-3)
DKN	RK11/RK05 DISK	(UPD1 N=0 OR 1), (UPD2, N=0-3)
MTN	TM11/TU10 MAGTAPE 7/9 TRACK	(UPD2, ONLY, N=0-3)
CTN	TA11 CASSETTE	(UPD1, N=0 OR 1), (UPD2, N=0 OR 1)
DXN	RX11/RX01 FLOPPY DISK	(UPD1 N=0 OR 1) (UPD2, N=0 OR 1)
MMN	TM02/TU16 MAGTAPE	(UPD2 ONLY, N=0-3)
DPN	RP11C/RP02/RP03	(UPD2 ONLY, N=0 OR 1,
DBN	RH11, RH70/RP04, RP05, RP06 DISK	(UPD2 ONLY, N=0 OR 1)
DSN	RH11, RH70/RS03, RS04 DISK	(UPD2 ONLY, N=0 OR 1)
RMN	RK611/RK06 DISK	(UPD2 ONLY, N=0-3)

CHAPTER 8

DIAGNOSTIC PROGRAM ERROR REPORTING

In most cases an error will be reported via a message output on the console (TTY, etc)

The standard format for an error message is

MESSAGE

TEST P C H/W (OPTIONAL)

Where

MESSAGE is a description of the type of error

P C. is the address in the diagnostic where the failure was detected.

H/W is the status of the hardware under test when the failure was detected. This is optional

If an output console is unavailable, the error information will be stored in a location in memory. This address may be examined after the processor is halted

Each appendix should be consulted for a description of the following:

1 Error messages.

2 Error types

3 Information contained in error message.

4 Location of error message.

5 Error numbers.

For each diagnostic, the listings and cross references should be consulted for the address of the error information

CHAPTER 9

DEVICE ADDRESSES

All options have standard device addresses, interrupt vector addresses, and interrupt priority (BR) levels Many options can e configured, by means of jumpers, to have addresses and BR levels that are different from these standards However, most diagnostics are written assuming the standara addresses and BR levels

For example, the LP11 line printer has the following addresses ord BR level

```
PRINTER STATUS REGISTER      - 777514
PRINTER DATA BUFFER REGISTER - 777516
INTERRUPT VECTOR ADDRESS     -    200
PRIORITY LEVEL               -    BR4
```

Usually the diagnostic will reference these values by referencing a label, i e

```
LPS        177514  ,  STATUS
LPB     A  177516  ,  BUFFER
INTVEC        200  ,  VECTOR ADDRESS
PRLUL           4  ,  PRIORITY
```

Should the device be configured for values other than these, the locations indicated by the labels must be changed to the proper values The location of these labels will be found in the cross reference table that accompanies the diagnostic's list ng

NOTE

These locations must be changed after the diagnostic has been loaded into memory Failure to change these locations will result in a trap to location 000004 whei the diagnostic executes and references the registers

CHAPTER 10

AUTOMATED PRODUCT TEST SYSTEM (APT)

The automated product test system, APT, loads and monitors one or more PDP-11 diagnostics into a PDP-11 computer known as the unit under test, or UUT The mechanism for loading the diagnostic into the UUT memory is a specialized I/O controller designed by test engineering.

A diagnostic executing under APT runs pass after pass until halted, either externally by the operator, or by APT when running a script file On an error condition, the diagnostic may either loop or halt; it is the diagnostic's job to indicate the error and then take the appropriate path of execution.

APT must communicate with the UUT diagnostic to ensure that the diagnostic is executing correctly APT uses a polling mechanism to do this. APT periodically reads an eight-word block of memory called the mailbox. Based on the values it finds there, APT performs particular services, such as verifying the proper execution of a diagnostic, or ensuring that no error conditions exist When it completes these services, APT sends to the mailbox, indicating to the diagnostic that the requested services are complete

10.1 LOG IN PROCEDURE

1 Log into APT on an APT system control terminal by typing

HELLO <cr>

2 APT gives a message and prompts you for an account number with a #

a Enter account 1,10 (or 1/10) if you want to create or edit a program or a script file

OR,

o Enter account 3,0 (or 3/0) if you want to load and execute a program or a script file

Complete the account number prompt with a carriage return, <cr>

3 APT asks for a password, to which you respond APT

PASSWORD <cr>

The APT password is not visible at the terminal

4 APT issues messages describing current system usage and any new operating features You can cancel these messages by typing CNTRL-C (C) Then APT issues a ready message

READY

Now you can proceed to the paragraph that discusses the operations you want to perform under APT. paragraph 10 2 for creating program and script files, or paragraph 10 3 for loading and running program and script files.

5 You log off the APT system with the following command.

BYE/F <cr> (for "fast good-bye")

10 2 CREATING AND EDITING FILES UNDER TSP

The test software package utility, TSP, allows you to create and edit files for use by the APT system If you have logged into APT under account 1,10, then you need only give the following command after the APT ready signal

RUN TSP <cr>

APT will transfer control to TSP, or else give the message "TSP IN USE" Note that TSP is available to only one user at a time, you may have to wait to use it

NOTE

If you have logged into APT under account 3,0 and you want to run TSP, then specify TST for the AREA? prompt in the AINT program dialogue This action logs you out of account 3,0. Then you must log in again under account 1,10 and issue RUN TSP when you get a ready message See paragraph 10 3

When you have succeeded in calling TSP, you will receive this message

TEST SOFTWARE PACKAGE/ TSP REV

COMMAND <HE>

The characters following the word COMMAND indicate the current TSP command in use, in this case, the HELP command, abbreviated HE

NOTE

Throughout the operation of TSP, any characters contained within < >'s are the default value If you issue a carriage return without giving a value, then TSP uses the string contained by the < >

All TSP commands use interactive dialogue to obtain information For a detailed explanation of the command dialogues, consult the APT General Specification and the APT System Manager's Guide

10 2 1 TSP Command, CREATE

The CREATE command lets you build an APT file. This may be a program or a script or a master script

NOTE

In these examples, do not confuse <cr> (which means carriage return) with <CR> (which is TSP's abbreviated default notation for the CREATE command)

Type in CREATE at TSP command level after the colon

COMMAND <HE> CREATE <cr>

This will begin a dialogue that asks you for information concerning the file you are building See paragraph 10 2 3 for a sample of this dialogue

10 2 2 Returning Control To APT

When you want to leave TSP, issue the OFF command

COMMAND (xx) OFF (cr)

This puts you back to APT ready level You can log-off using BYE/F

10 2 3 Sample TSP Dialogue

Here is an example in which a user logs into APT, calls TSP, builds a file called MEZZ, then leaves TSP and logs off APT All user-supplied information in this example is underlined This differs from the usual format used throughout this manual Text contained in *'s is explanatory, and not part of the control terminal printout

```
HELLO (cr)          *APT log in command*

RSTS V06A-02 APT-D-RB-03NOV  JOB 34  KB3  05-JAN-78  09.23
#1,10 (cr)          *account number prompt*
PASSWORD.      (cr) *enter password APT, will not appear
                     at terminal*
JOB(S) 12 ARE DETACHED UNDER THIS ACCOUNT
JOB NUMBER TO ATTACH TO? (cr) *do not specify a job
                              number*
4 OTHER USER(S) ARE LOGGED IN UNDER THIS ACCOUNT


READY

RUN ISP (cr) *first attempt to run TSP utility*
TSP IN USE        *TSP not available*

READY

RUN ISP (cr) *try again*

                  *this try successful*

TEST SOFTWARE PACKAGE/ TSP        REV 07
```

```
        COMMAND (HE)      (cr) *issuing (cr) gives default command,
                               HELP*

        COMMANDS ARE            *HELP command output*

        CREATE
        EDIT
        LIST
        RENAME
        LOCATE
        DELETE
        UPDATE
        PATCH
        COPY
        HELP
        OFF

        COMMAND (HE)   CREATE (cr)  *issue TSP command CREATE*
        COMPUTER TYPE (8,10,11,VS)  (11)  11 (cr)  *since 11 was
                                                    default value,
        SOFTWARE TYPE (P,S,M) (P).  (cr)            user could
                                                    have issued
                                                    just (cr)*
        APT,ACT,PRE-ACT,SPVR-DIAG PROGRAM (APT)  PRE-ACT (cr)
        LOAD DEVICE (PR,RK,MT,DT,MM,DM,MC) (PR).   (cr)
        PR UNIT NUMBER (0-7) (0)   (cr)
        IS PATCHING REQUIRED (Y/N)   (N)    (cr)
        PROGRAM NAME    MEZZ (cr)

        LOAD AND READY THE PAPER TAPE READER
        TYPE (CR) WHEN READY    (cr)  *both (CR) and (cr) here mean
                                      carriage return*
        WORKING

        REVISION ( )  A (cr)
        MCO ( )  0    (cr)
        TITLE ( )  MEZZ  (cr)

        COMMAND (CR)  QEE (cr)  *leave TSP, note default
                                 command is now CREATE
                                 (abbreviated CR), the
                                 last command used*

        READY

        BYE/E  (cr)      * og off APT*
```

10 3 LOADING AND RUNNING PROGRAMS UNDER APT

You must log into APT under account 3,0 (or 3/0) in order to load and run program files and script files under APT. See paragraph 10 1.

When you receive the APT ready message, issue the following command to run the APT initialization utility, AINT:

```
RUN AINT <cr>
```

This will start a dialogue. After each response you give during the dialogue, press the carriage return key to enter the information. Use the following values:

```
BADGE NO? = 1
    AREA? = MLE  (or TST, see NOTE and
            paragraph 10 3 1)
    UNIT? = <cr>
```

An example of this dialogue appears in paragraph 10 3 2.

NOTE

If you are on line under account 3,0 and you want to run TSP (which requires account 1,10), then specify TST for the AREA? prompt. Then log in under account 1,10 as described in paragraph 10 1.

10 3 1 Returning Control To APT

Issue the OFF command in response to a dialogue prompt. This will put APT back on line. The only way to log off from here is to specify TST for the AREA? prompt, then give the BYE/F command after the ready signal.

10 3 2 Sample MLE Dialogue

In the following example, a user logs into APT account 3,0, unsuccessfully runs two program files (MEZZ, created in paragraph 10 2 3, and ACM15, created another time) and a script file (RONU), and then logs off. All user-supplied information in this example is underlined. This differs from other example formats used in this manual. Text contained in *'s is explanatory and not part of the control terminal printout.

```
HELLO 320 (cr)  *quick log  n   give account number with
                        HELLO*
PASSWORD   (cr)  *password APT does not appear at terminal*
18 OTHER USER(S) ARE LOGGED IN UNDER THIS ACCOUNT

READY

RUN APNI (cr) *APT initialization necessary to run programs*
APT ON LINE

05-JAN-78   09 54

BADGE NO?  1 (cr)

AREA?  MLE (cr)

UNIT?  (cr)
APT READY
UUT LINE #?  1392 (cr) *this number obtained from listings in
                        APT machine room*
COMPUTER?  1105 (cr) *computer type you are testing*
INTERFACE?  G50888 (cr) *varies according to interface you are
                        using*
PROGRAM NAME    MEZZ (cr)
RCVD       09 55
HUNG-LOAD     UUT LINE#   1397      TIME. 10 13    DATE
05-JAN-78
SCRIPT        PROGRAM  MEZZ    ERROR  00000 00000  ET
0 00 00
PROGRAM NAME   RONU (cr) *this is a script file*
RCVD       09 58
UUT LINE #?  1362 (cr) *APT will accept only legitimate UUT
                        line #*
UUT LINE #?
MESSAGE(S) ARE PENDING FOR LINE(S)
1397
RESULTS NOW (N/ALL/LINE #)?  1392 (cr)
HUNG LOAD     UUT LINE #  1397    TIME  09 59   DATE 05-JAN-78
SCRIPT RONU    PROGRAM T01    ERROR  00000 00000  ET   0 00 00
DELETE MESSAGE(S) (Y/N)?   Y (cr)
UUT LINE #? OEE   (cr)  *put APT back on line*
APT ON LINE

05-JAN-78    10 02

BADGE NO? 1  (cr)

AREA? ISI (cr) *you must specify TST in order to log off*
THIS TERMINAL CAN BE USED FOR TIMESHARING

BYE/F   *this BYE/F issued by APT*

READY

BYE/E (cr)
```

10.4 APT ERROR MESSAGES

Most error messages printed on control terminals related to program loading problems. A few of these error messages are described below:

1. Request lost - this indicates that the last user's program load request hasn't been processed. It tells the operator to try again to load the program into the UUT.

2. Hung load - this indicates that there is some hardware malfunction between the interface and the UUT to be loaded.

3. Hung diagnostic - this indicates that when APT monitored the diagnostic it was not running correctly in the UUT.

NOTE

This error can be caused if the system manager specified "first pass run time", "maximum pass run time" or "longest test time" values that are too short.

4. Diagnostic error - this indicates that when the diagnostic was running in the UUT it detected a hardware error in the equipment being tested.

5. Line error - this indicates that a parity error was detected on the line connecting APT to the UUT.

NOTE

The line testing utility (LNTSTU) should be run on lines that frequently generate line errors.

CHAPTER 11

AUTOMATED COMPUTER TEST SYSTEM ACT

The automated computer test system, ACT, provides three basic services that aid DEC's manufacturing areas in testing PDP-11 computers

1 Load and run a diagnostic into a unit under test, UUT, as if it were loaded and run manually, called ACT "dump" mode

2 Automatically load, run, and monitor a single diagnostic or sequence of diagnostics through one or more iterations, called ACT "auto-accept" mode, includes "quick verify" mode

3 Directly perform a variety of UUT memory tests, called ACT "station test" mode

An ACT system comprises a central computer and from one to thirty-two test stations. The central computer, also called "mother", consists of a PDP-11 CPU, one to eight RK disk drives, a high-speed paper tape reader, and a console terminal. (Additional peripherals supported by RKDP monitor are available). Each test station, also called a "daughter", consists of a station console, the UUT, and the UUT's console terminal You instruct "mother" by setting switches on the "daughters'" consoles. (Refer to the ACT Users' Guide for the exact settings of these switches when using ACT). The UNIBUS of the UUT is connected to the "daughter" station, and all control of the UUT is through the UNIBUS

11.1 LOADING AND STARTING THE ACT-11 MONITOR, OR "MOTHER"

1. ACT-11 resides only on Manufacturing RKDP disk volume #1 Mount this volume on RK drive 0
2. Bootstrap the RK drive as described in Chapter 4 of this guide
3. RKDP identifies itself and gives a ready signal, the period ( )
4. Call ACT-11 by issuing the following command:

   _R ACT<cr>

5. ACT-11 starts a dialogue to get information (restart? suppress messages? time-of-day?) and then issues a ready signal.

   READY

6. The ACT-11 monitor, or "mother", can now service the "daughter" stations

11.2 ACT-11 "DUMP" MODE

Operating ACT-11 in "dump" mode allows you to load and execute a single diagnostic into the UUT as if under manual control.

1. Ready the ACT-11 monitor See paragraph 11.1.
2. Ensure that the daughter station is powered-up and on-line (the "on-line" switch is up).
3. Determine the number of the diagnostic you are running, this will be either an ACT number or an RKDP number
4. Set the daughter station switch panel according to the diagnostic number and the load device. Refer to the ACT Users' Guide for the exact switch settings.
5. Set the daughter station control switches Refer again to the ACT Users' Guide for the control switch settings.
6. Activate the "initialize" switch on the daughter station console
7. ACT will load the diagnostic into the UUT and start its execution.

11 3 ACT-11 "AUTO-ACCEPT" MODE

ACT "auto-accept" mode automatically loads and executes a set of diagnostic programs in the UUT. ACT reads a list called the sequence table to determine which programs to run and in what order to run them. (Refer to the BCI System Managers Guide for instructions on building sequence tables). You can instruct ACT to complete only one run of the sequence table entries, also called a quick verify pass; or you can specify many repetitions of the table. When ACT has completed the list, it sends a message to the mother console and to the UUT console.

11 3 1 Running A List Of Diagnostics

1. Ready the ACT-11 monitor. See paragraph 11 1.
2. Ensure that the daughter station is powered-up and on-line ("on-line" switch is up).
3. Set the daughter station switch panel according to the UUT memory size, UUT options, and whether you want messages on the UUT terminal. Refer to the BCI Users' Guide for the exact switch panel settings.
4. Set the daughter station control switches; this includes specifying the sequence table number. See the BCI Users' Guide.
5. Activate the daughter station "initialize" switch.
6. ACT will load and execute the set of diagnostics as defined by the sequence table. ACT issues a "pass complete" message upon successful completion of all the diagnostics listed in the table.

11 3 2 Running A Single Diagnostic In "Quick-Verify" Mode

You can instruct ACT to load and run a single program automatically. One run of the program is called a "quick-verify" or Q/V pass.

1. Ready the ACT monitor. See paragraph 11 1.
2. Ensure that the daughter station is powered-up and on-line.
3. Determine the number of the diagnostic you are running. This will be either an ACT number or an RKDP number.

4 Set the daughter station switch panel to indicate the program number, and that you want a Q/V pass Refer to the ACI Users' Guide for exact switch settings

5 Set the daughter station control switches, this includes specifying the maximum run-time for the program See the ACI Users' Guide for Q/V mode control switch settings

6 Activate the daughter station "initialize" switch

7 ACT will load and execute the program defined on the switch panel ACT issues a "pass complete" message upon successful execution of the diagnostic

11.4 ACT-11 "STATION TEST" MODE

When running ACT-11 in station test mode, you can perform the following tests. Consult the ACI-11 Users' Guide for the step-by-step procedures

1 Lamp test -- verifies the operation of a daughter station's indicator lights

2 UUT word test -- verifies the read/write accuracy of any UUT memory word

3 UUT field test -- verifies the read/write accuracy of any 4K block of UUT memory

4 NPR interaction test -- verifies that "non-processor-request" transfers to and from the UUT are good

CHAPTER 12

DECX/11 UNIBUS EXERCISER

DECX/11 is the UNIBUS exerciser for the PDP-11 computer family UNIBUS exercising provides a means of testing the expected reliability of a particular system within a specified period of time Here are the basic components of a DECX/11 package

DECX/11 monitors (standard monitor, short monitor, and 11/70 monitor)

DECX/11 option/device test modules.

DECX/11 configurator/linker program.

DECX/11 documentation

You use the monitor, the test modules, and the configurator/linker program to create a UNIBUS exerciser This exerciser includes the monitor and those test modules required by the system you are testing. This chapter assumes that you have already created a UNIBUS exerciser, and provides an overview only for running it. For a complete description and instructions on creating a UNIBUS exerciser, consult the DECX/11 Reference Guide.

12 1 LOADING THE UNIBUS EXERCISER

If you are loading a UNIBUS exerciser from paper tape, use the absolute loader See Chapter 5 of this guide.

If you are loading a UNIBUS exerciser from other media, it must be a named file (with the extension BIN or BIC) on an XXDP monitor volume.

1 Load the XXDP monitor as described in Chapter 4.

2 Issue the XXDP load command, L, giving the filename of the UNIBUS exerciser Do not type the extension when giving the filename

Example load the UNIBUS exerciser DECX1 BIN

_L DECX1 <cr>

3 You have loaded the exerciser Proceed to paragraph 12 2

OR,

1a Load the XXDP monitor as described in Chapter 4.

2a Issue the XXDP run command, R, and the UNIBUS exerciser will self-start after loading Using the same exerciser DECX1 BIN

_R DECX1 <cr>

3a The exerciser will start at address 000200 It gives a message and a ready signal, the period ( ). Proceed to paragraph 12 3

WARNING

Do not use the XXDP UPDATE utility to load a UNIBUS exerciser UPDATE does not write-protect the monitor volume you may inadvertently destroy the monitor Instead use the XXDP load command, L, or the run command, R, as described above

12 2 STARTING THE UNIBUS EXERCISER

1 To start the exerciser issue the XXDP start command, S (see paragraph 7 4 3)

2 The monitor issues a message and a ready signal, the period ( ) Proceed to paragraph 12 3

OR,

1a Halt the processor

2a Load address 000200

3a Put the HALT/ENABLE switch to ENABLE

4a Start the processor.

5a The monitor issues a message and a ready signal, the period ( ) Proceed to paragraph 12 3

12 3 OPERATING THE UNIBUS EXERCISER

You control the exerciser by using the switch register (see also Chapter 6) and the DECX/11 commands, paragraph 12 3 2.

12 3 1 Switch Register Settings

The following switch register settings apply only when running a DECX/11 UNIBUS exerciser A switch is set when it equals one

Table 12-1 DECX/11 Switch Register Settings

PANEL SWITCH	SW/SWR SETTING (ALSO KEYPAD CPU SETTING)	OPTION
15	100 000	Drop module after error. the failing module stops executing, "MODULE DROPPED" message.
14	040 000	Inhibit module drop after error; if SW14=0, the failing module stops executing after 20 errors, "MODULE DROPPED" message.
13	020 000	Inhibit error and module messages
12	010 000	Enable "END OF PASS" message
10	002 000	Report all data errors, if SW10=0, report first three errors of any block transfers
9	001 000	Inhibit "RELOCATED TO" message

NOTE

The Keypad and SW/SWR settings are accumulative if you want more than one option, then add the SWR values and enter the sum as the SWR setting For example, if you want to designate the second and third options on the list (panel switches 13 and 14 up), then enter the value 060 000 as the SWR setting

If your CPU does not have a hardware switch register (for example, the PDP-11/04), then you must make the following patch before running the exerciser module

1 Find the address of the location labelled FAKESR in the DECX/11 cross-reference listing FAKESR is the DECX/11 software switch register

2 Using the DECX/11 MOD command (see Table 12-2), load the address number of FAKESR into the location labelled SR, also found in the DECX/11 cross-reference listing

3 The DECX/11 monitor will now read location FAKESR for switch register settings You load location FAKESR with the appropriate values from Table 12-1, depending on the options you select

12 3 2 DECX/11 Monitor Commands

You enter a command by terminating it with a carriage return, <cr> You can use the RUBOUT key to delete individual characters, and the combination CNTRL/C (or C) to delete a whole line

Table 12-2 DECX/11 Monitor Commands

COMMAND	DESCRIPTION
MAP	Types map of modules in the UNIBUS exerciser Indicates module starting address, and module status
SEL	Selects all modules for execution
DES	Deselects all modules
SEL modulename	Selects specified module
DES modulename	Deselects specified module
MOD addr	Types contents of address specified. Operator can enter new value if desired
MOD modulename addr	Types contents of address relative to starting address of module specified User can enter new value if desired
RUN addr	Starts execution of exerciser. Only selected modules run. If optional address is used and relocation is allowed, starts program at nearest (lower) 4K boundary
RUNL addr	Starts exerciser execution at specified address. Address must be on 4K boundary. (20000, 40000, etc) The program stays "locked" there It does not relocate.
KTON	Turns on memory management (KT11)
KTOFF	Turns off KT11
PON	Enables parity memory
POFF	Disables parity memory
FILL	Sets the fill count.

Table 12-2 (Continued)

COMMAND	DESCRIPTION
ROTON	Enables write buffer rotation and types range
ROTOFF	Disables write buffer rotation.
CON	Turns on the cache memory (PDP-11/70 only)
COFF	Turns off the cache memory (PDP-11/70 only).
MON	Enables the MAP box (PDP-11/70 only)
MOFF	Disables the MAP box (PDP-11/70 only)
LPON	Directs all TTY output to the line printer NOTE Cannot be used if line printer module is selected

12.4 DECX/11 ERROR MESSAGES

KBUF OFLO -- You entered too many characters at some point in a command line

INVALID COMMAND -- You have given an invalid command, or have entered a valid command incorrectly (Module names always have five characters)

MODULE NAME NOT FOUND -- You have specified a nonexistent module, or have entered the name of an existing one incorrectly (Module names always have five characters).

INVALID ADDR/DATA -- You have specified either an odd-numbered address, or a nonoctal address

CHAPTER 13

OUTLINE FOR DIAGNOSTIC OPTION APPENDICES

This chapter describes the type of information contained in the individual appendices for diagnostic options

Each option appendix is a procedural, step-by-step method of setting up an option to be tested, loading the diagnostic, and executing the diagnostic

Wherever possible, the appendix will reference the standard procedures described in this Users Guide. If the field service representative is unfamiliar with the standards, he/she should consult the appropriate sections of the guide

All appendices will contain the following sections

1 ABSTRACT--This section will state the options to be tested by the diagnostics

2 HARDWARE--This section will give the minimum hardware requirements necessary to run the diagnostics

   Central Processor Options

   Memory

   I/O Devices

   Interfaces

   Controllers

   Units

   Accessories

3 TEST SEQUENCE--This section will list the diagnostics available for the option and the order in which they must be run Running the diagnostics in the given order will isolate the hardware faults in the shortest possible time

4 TEST DESCRIPTION--This section will describe what each diagnostic tests The description will be by function and/or hardware as applicable

5 CAUTIONS--This section will describe all procedures necessary to prevent accidental erasure of system files and diagnostics

6 OPERATING PROCEDURE--This section will describe the detailed, step-by-step procedure for running the diagnostics There will be a separate operating procedure for each diagnostic

NOTE

These procedures assume the field service representative is familiar with the following

1 The hardware to be tested

2 The individual PDP-11 Processor

3 The Users' Guide

The operating procedure will be structured as follows

TITLE--The five-letter code for the diagnostic

SYSTEM INITIALIZATION--All procedures for the entire system that must be performed prior to running the diagnostic

LOADING PROCEDURE--Where applicable, reference will be made to the standard practices described in the Users' Guide If the diagnostic has its own unique method of loading, it will be described here

STARTING PROCEDURE--Where applicable, reference will be made to the standard practices described in the Users' Guide If the diagnostic has its own unique starting procedure, it will be described here.

SWITCHES--The switches used by the diagnostic will be described

INITIAL PRINTOUT--This will be the initial message the diagnostic outputs on the available I/O console. Output of this message indicates the successful loading and starting of the diagnostic

OPERATOR INTERROGATION--This section will describe the messages output by the diagnostic and the proper operator response

EXECUTION TIME--This is how long it takes the diagnostic to complete one pass successfully

END OF PASS INDICATOR--This will describe the method the diagnostic uses to signal a successful pass

ERROR REPORTS--This will describe types of messages the diagnostic will output on the available I/O Console when an error is detected The information contained in the error message will also be described Whenever possible, reference will be made to the standard practices described in the User's Guide

RESTART ADDRESSES--If the diagnostic has restart addresses they will be listed here The listings for the individual diagnostics must be consulted to determine the usefulness of a given restart address If the diagnostic has no restart address, the expression "Starting Address" will appear

NOTE

PART II, THE SET OF APPENDICES DESCRIBING THE DIAGNOSTIC OPTIONS, IS NOT INCLUDED IN THIS DOCUMENT THE APPENDICES ARE CURRENTLY IN PRODUCTION AND WILL BE RELEASED TO THE FIELD AS THEY ARE COMPLETED

Send all suggestions concerning this document to

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You should submit all software trouble reports via the AIDS problem reporting system