Digital Equipment Corporation
Maynard, Massachusetts

digital

pdp11vo3 System Manual

EK-11V03-TM-002

PDP-11V03
System Manual

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PREFACE

This manual is intended to introduce the user to the PDP-11V03 system. A step-by-step turn on procedure is presented in Chapter 1, and basic troubleshooting procedures are covered in Chapter 2. Those familiar with computer hardware may wish to go directly to Paragraph 1.6 for an overview of the software. Diagnostic software is described further in Chapter 3.

The user is advised not to unpack the system if installation arrangements have been made with DIGITAL Field Service. However, if the system is to be installed by the user instead of by DIGITAL Field Service, Appendix A contains installation instructions.

CHAPTER 1
BASIC SUMMARY OF SYSTEM OPERATION

1.1 GENERAL

The PDP-11V03 is a complete system, containing all the hardware and software necessary for the user to develop and run programs in assembly language. Optional software allows programming with BASIC, Multiuser BASIC, FORTRAN IV, FOCAL and APL. The PDP-11V03 is shown in Figure 1-1 and will have one of the two terminals shown.

This chapter assists the user in establishing communication with the system. Once the PDP-11V03 is responding to commands typed on the keyboard, it is ready for the user's application. If the system has been installed by DIGITAL Field Service it will be ready to use. If not, refer to Appendix A for installation instructions. When the system has been installed, it may be powered up and loaded by the procedures given in the following paragraphs.

1.2 TURNING ON THE PDP-11V03

The recommended power-up sequence is listed below. The numbers in parentheses are index numbers, keyed to Figures 1-2 through 1-6. If the system does not respond as noted, refer to Chapter 2 for further instructions.

1. On the front panel of the PDP-11V03 (Figure 1-2) ensure the control switches are set as follows.

   a. DC ON/OFF switch (1) to OFF
   b. ENABLE/HALT switch (2) to ENABLE
   c. LTC ON/OFF switch (3) to OFF

2. On the rear of the computer cabinet (Figure 1-3) switch the circuit breaker (4) to ON. The ac monitor lamp (5) should light.

3. If the system has a DECwriter II hard copy terminal (Figure 1-4), set the switches as follows.

   a. POWER ON/OFF switch (6) to ON
   b. LINE/LOC switch (7) to LINE
   c. FDX/HDX switch (8) to FDX
   d. BAUD RATE switches (9) to 300
   e. CAPS LOCK key (10) depressed

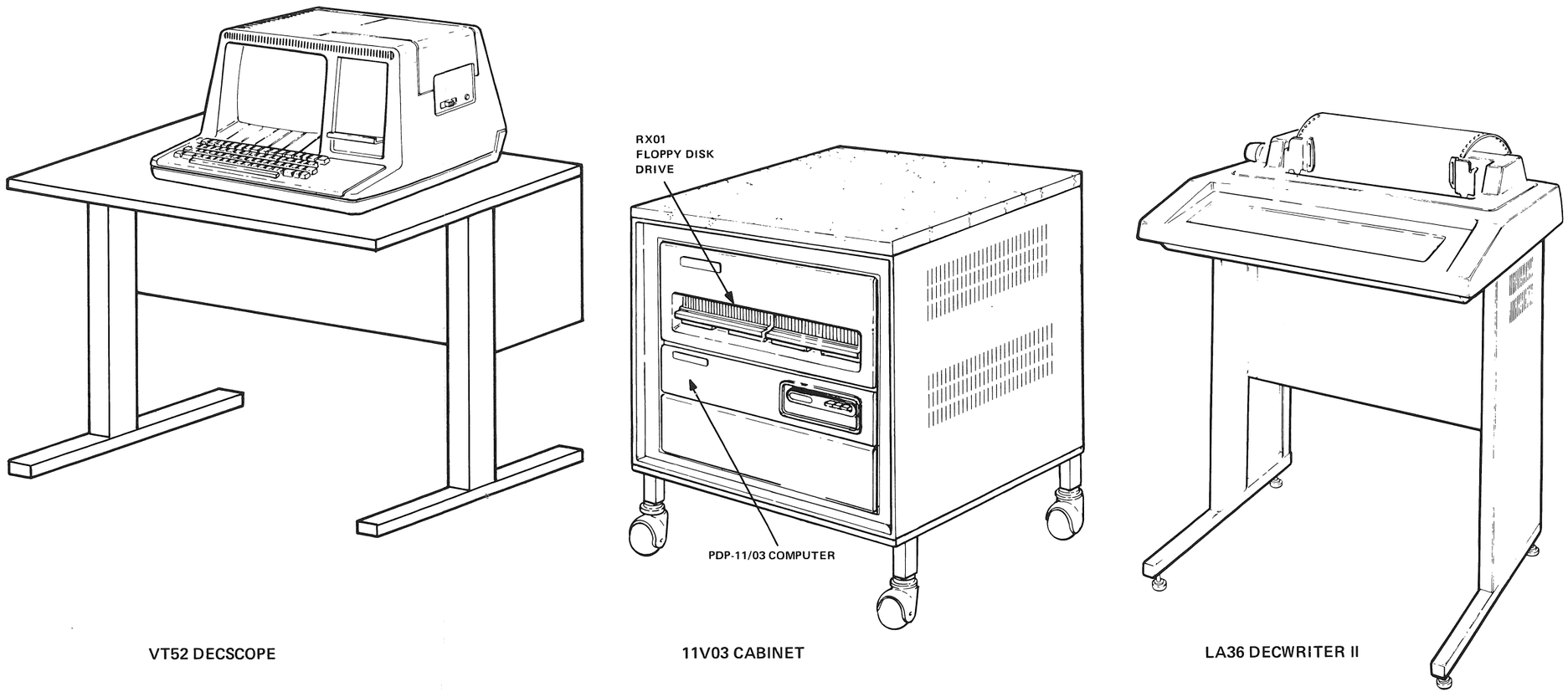
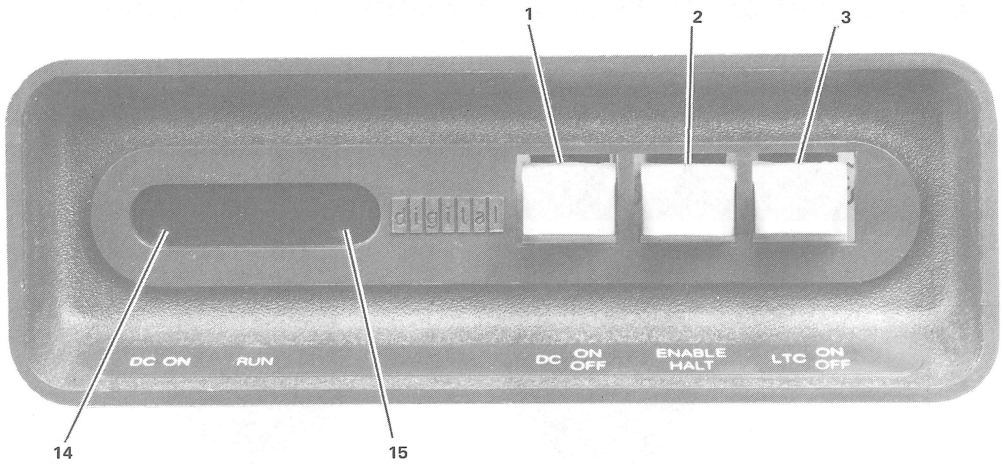


Figure 1-1 PDP-11V03 System



1. DC ON/OFF (UP = ON; DOWN = OFF)
2. ENABLE/HALT (UP = ENABLE; DOWN = HALT)
3. LTC ON/OFF (LINE TIME CLOCK) (UP = ON; DOWN = OFF)
14. DC ON Indicator
15. RUN Indicator

Figure 1-2 Computer Control Console

4. AC BREAKER
5. AC MONITOR LAMP

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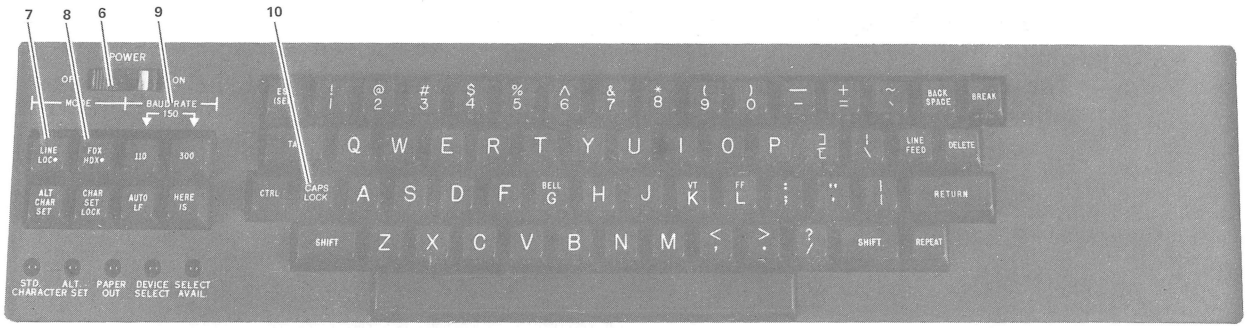
Figure 1-3 Computer Cabinet, Rear View



(a) Keypad Type

7622-28

(b) Rocker Switch Type

6. POWER ON/OFF
7. LINE/LOCAL (ON KEYPAD TYPE, DEPRESSED = LOCAL
NOT DEPRESSED = LINE)
8. FDX/HDX (DEPRESSED = HALF DUPLEX
NOT DEPRESSED = FULL DUPLEX)
9. BAUD RATE (ON KEYPAD: 110 DEPRESSED = 110 BAUD
300 DEPRESSED = 300 BAUD
BOTH DEPRESSED = 150 BAUD)
10. CAPS LOCK (SHIFT LOCK)

6934-8

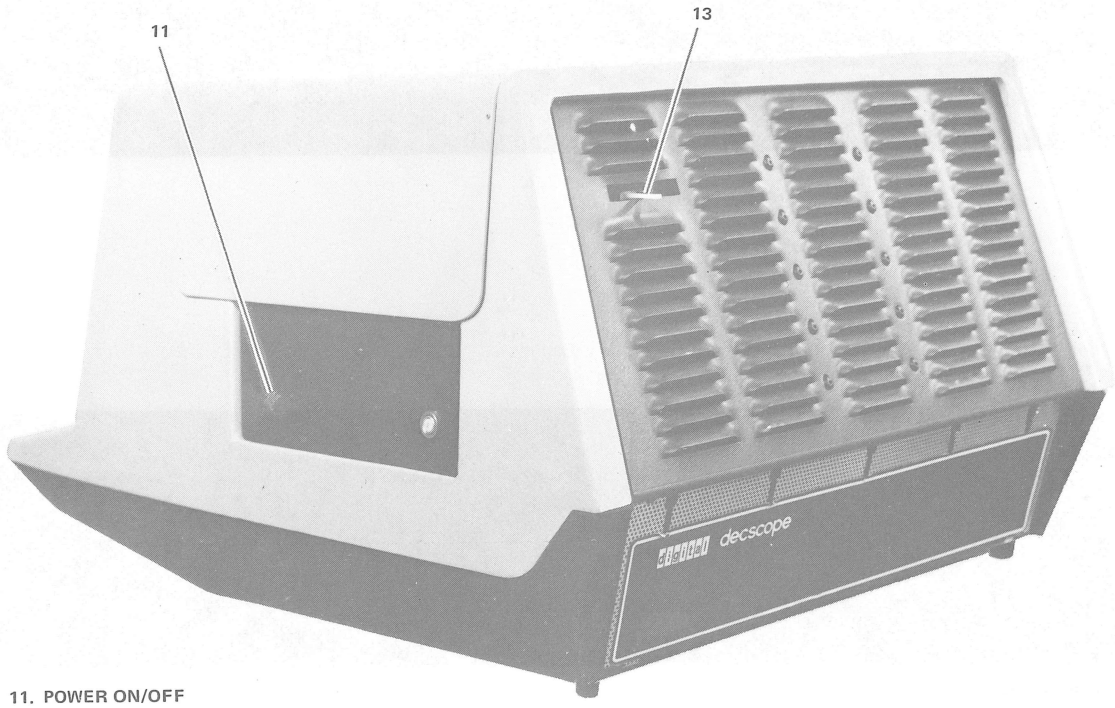
Figure 1-4 DECwriter II Control Switches

4. If the system has a DECscope video terminal, set the control switches as follows.

   a. POWER ON/OFF switch (11) to ON (Figure 1-5)

   b. CAPS LOCK key (12) depressed. (Figure 1-6)

   c. The DECscope warms up in about 30 seconds. The intensity of the display may be adjusted by a control (13) on the rear of the cabinet (Figure 1-5).



11. POWER ON/OFF
13. INTENSITY CONTROL

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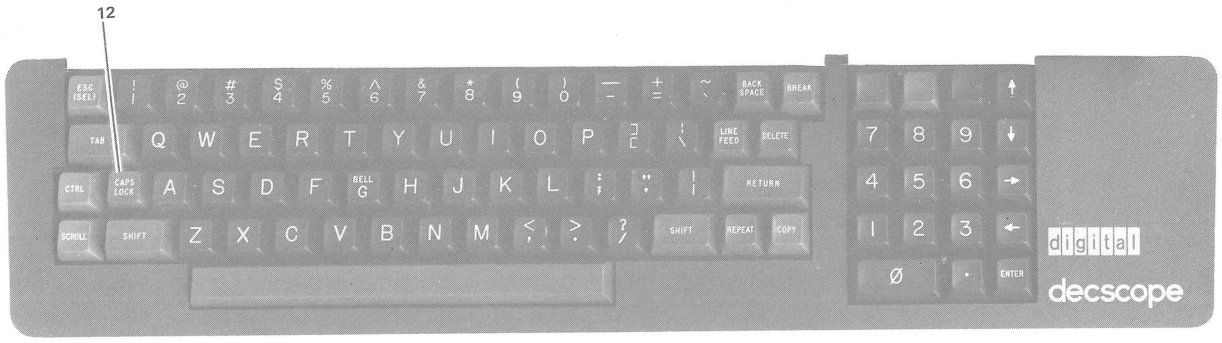
Figure 1-5 DECscope Controls



12. CAPS LOCK

7966-3

Figure 1-6 DECscope Keyboard

5. On the PDP-11V03 (Figure 1-2) switch the DC ON/OFF switch (1) to ON. The DC ON and RUN indicators (14) (15) should light. Also, the system should respond by printing (or displaying) a dollar sign ($). The "$" is a prompt character. This indicates that the system is waiting for a command from the operator. If the "$" does not appear upon power-up, refer to the instructions in Chapter 2.

The next step is to load the diskette into the floppy disk drive.

1.3 LOADING THE DISKETTE

The software distributed with the PDP-11V03 is the RT-11 operating system. This operating system is contained on two diskettes. Locate the diskette labeled "RT-11 V02C Disk 1 of 2" or "RT-11 V03-01 Disk 1 of 2." When handling the diskette observe the precautions listed in Table 1-1. Refer to Figures 1-7 and 1-8, and load the diskette as follows.

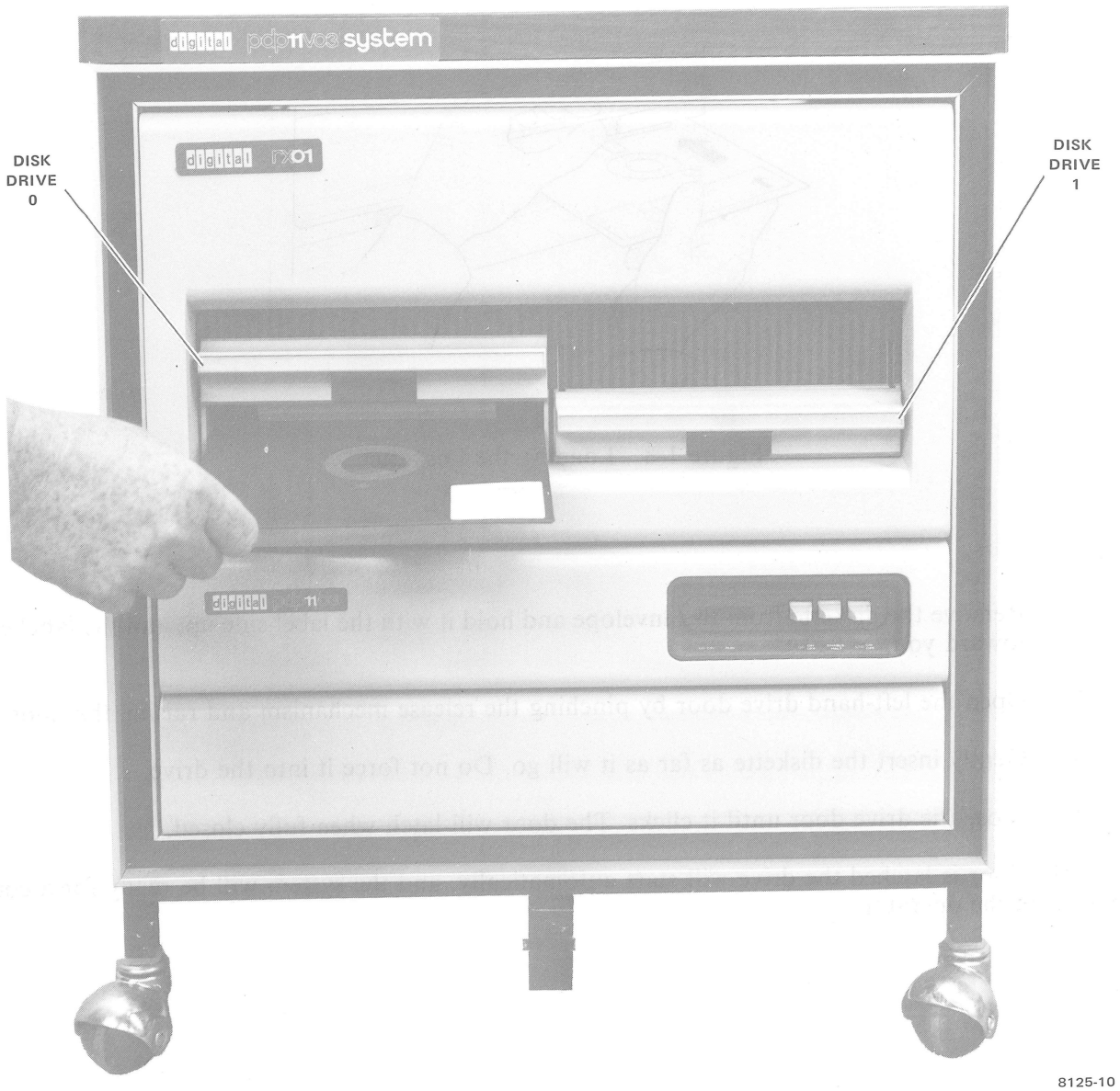


Figure 1-7 Disk Drives

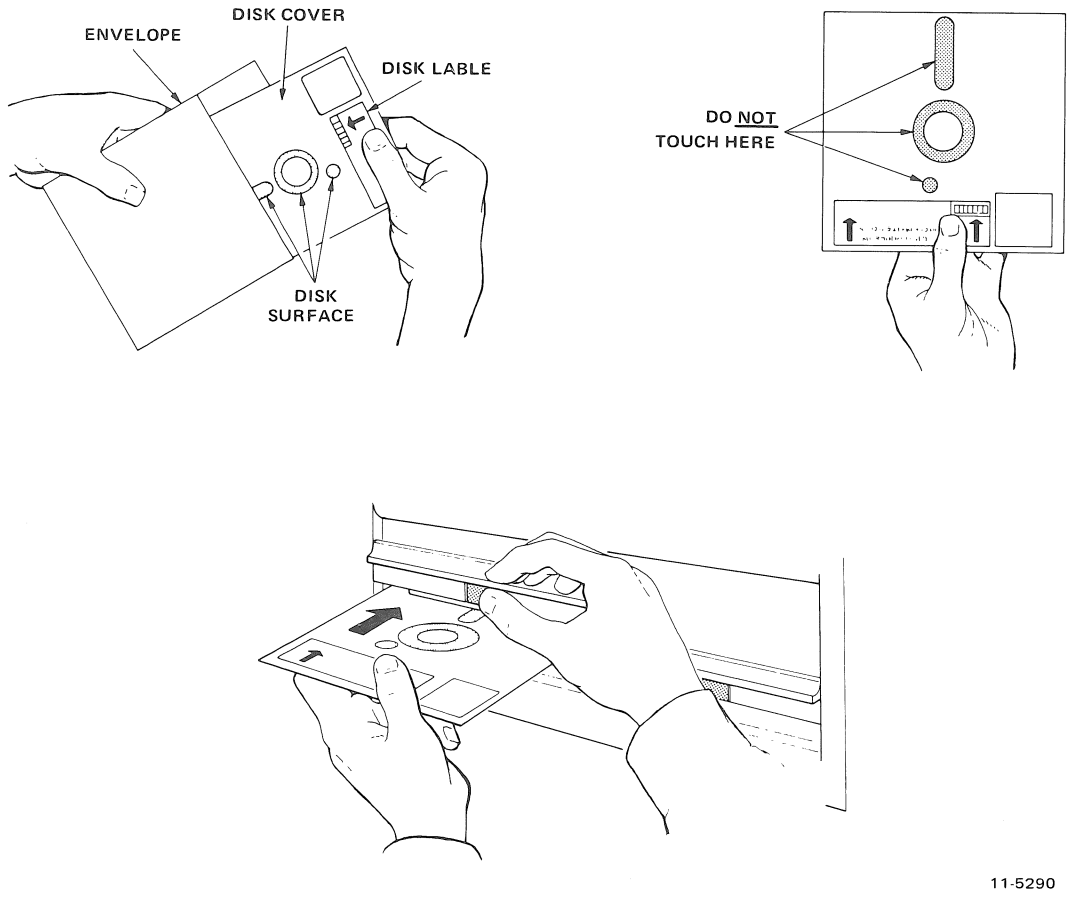


Figure 1-8 Loading the Diskette

1. Remove the diskette from the envelope and hold it with the label side up, and the label end toward you.
2. Open the left-hand drive door by pinching the release mechanism and raising the door.
3. Gently insert the diskette as far as it will go. Do not force it into the drive.
4. Close the drive door until it clicks. The door will latch when fully closed.

When the door is latched the drive will start automatically, and the system will be ready for a command from the operator.

Table 1-1 Diskette Handling Precautions

1. Do not write on the envelope containing the diskette. Write any information on a label prior to affixing it to the diskette.

2. Paper clips should not be used on the diskette.

3. Do not use writing instruments that leave flakes, such as lead or grease pencils, to label the envelope.

4. Do not touch the disk surface exposed in the diskette slot or index hole.

5. Do not clean the disk in any manner.

6. Keep the diskette away from magnets or tools that may have become magnetized. A diskette exposed to a magnetic field may lose information.

7. Do not expose the diskette to a heat source or prolonged sunlight.

8. Always return the diskette to the envelope supplied with it to protect it from dust and dirt. Diskettes not being used should be stored in a file box if possible.

9. When the diskette is in use, protect the empty envelope from liquids, dust, and metallic materials.

10. Do not place heavy items on the diskette.

11. Do not store diskettes on top of computer cabinets or in places where dirt can be blown by fans into the diskette interior. Store diskettes in their envelopes in horizontal stacks of ten diskettes or less. If vertical storage is necessary, the diskettes should be supported so that they do not lean or sag, but should not be subjected to compressive forces. Permanent deformation may result from improper storage.

12. If a diskette has been exposed to temperatures outside the range of the operating environment, allow 5 minutes for thermal stabilization before use. (The diskette must be removed from its shipping container during this time.)

1.4 LOADING THE OPERATING SYSTEM

Before the computer can read the programs on the diskette, the disk drive must first be bootstrapped. A bootstrap is a short program used to establish communication between the computer and a peripheral device. In this case, the peripheral device is the disk drive. Once the bootstrap program has been performed, the computer can interact with the disk drive to use the operating system programs contained on the diskette. To boot Disk Drive 0 (the left-hand drive) proceed as follows.

NOTES

When presenting examples of commands to be typed, this manual uses the convention of underlining all characters that are printed or displayed under the control of the computer. Characters typed by the operator are not underlined.

Characters enclosed by < > are nonprinting commands. For example, <CR> indicates carriage return, and operator is to press the RETURN key.

Type "DX" behind the "$" that is displayed when the system is started up.

$ DX <CR>

The computer reads the diskette and, after several seconds, prints the name of the operating system. For example:

$ DX <CR>

RT-11SJ V02C-xx

.

The "xx" in this example represents the letters which indicate the revision status of the operating system. The period (.) printed by the computer indicates that the operating system is now controlling the computer, and is monitoring the keyboard. RT-11 uses the period as a prompt character to signal that it is waiting for a command from the operator.

At this time the system is ready for the user's application. It is advisable to copy the RT-11 diskettes on to spare diskettes and store the originals for future use. This operation is presented briefly here, but it is recommended that the user become familiar with the following documents before proceeding.

For systems using RT-11 V02C:

Getting Started With RT-11(DEC-11-ORCPA-E)

RT-11 System Reference Manual(DEC-11-ORUGA-C and addendums)

For systems using RT-11 V03-01:

Introduction to RT-11(DEC-11-ORITA-A-D)

RT-11 Documentation Directory(DEC-11-ORDDB-A-D)

RT-11 System User's Guide(DEC-11-ORGDA-A-D)

These manuals are included with the PDP-11V03 system as part of the software documentation.

1.5 HOW TO COPY AN RT-11 DISKETTE

An RT-11 diskette may be copied by using a utility program called PIP. To copy the contents of one diskette onto a second diskette, proceed as follows.

1. Load the master diskette into disk drive 0 (the left side).

2. Load the diskette which is to receive the copy into disk drive 1 (the right side).

3. Boot disk drive 0:

   $ DX <CR>

   The computer will print the operating system name and the prompt character. For example:

   RT-11SJ V02-xx

   .

4. Next, call the PIP program:

   . R PIP <CR>

   The computer will respond by loading the program and by printing an *:

   *

5. Zero (erase) the contents of the new diskette:

   * DX1:/Z <CR>

   The computer will ask:

   DX1:/Z ARE YOU SURE?

   CAUTION

   When the operator responds with a Y to this question, the computer will erase the contents of the diskette in disk drive 1 (the right side). Ensure that the master diskette you are copying is in disk drive 0 (the left side).

6. Answer by typing Y for yes. The computer will zero diskette 1 and then print an *:

   DX1:/Z ARE YOU SURE? Y <CR>

   *

7. Next, type the copy command:

   * DX1:*.*=DX0:*.*/X/Y <CR>

   The computer will copy the contents of the diskette in disk drive 0 onto the diskette in disk drive 1. This is completed in about 5 minutes and the computer then types the * prompt character.

8. After the programs have been copied, it is necessary to build a "bootstrap block" on the diskette, so that it may be bootstrapped. To do this type the following command:

   *DX1:A=DX1:MONITR.SYS/U <CR>

   The computer will build a bootstrap on the diskette and then type an *.

9. Verify that the copying operation is complete by bootstrapping disk drive 1:

   *DX1:/O

   The computer will print the operating system name from the diskette in disk drive 1.

1.6 PROGRAM ORGANIZATION

1.6.1 General

The programs used by the PDP-11V03 can be grouped in two general categories: those intended for normal operation, and those intended for diagnosing problems. All normal operating programs are under control of the RT-11 software operating system. Diagnostic programs can be divided into hardware-implemented programs and software programs.

1.6.2 Normal Operating Software

The software used for normal operation consists of the RT-11 operating system, optional programming language processor programs, and the user's application programs.

The RT-11 operating system is a collection of programs that organizes the hardware components into an intelligent unit that is easy to use. Programs that are written and executed for a specific user-defined system requirement are referred to as "application programs." The RT-11 operating system programs serve as "software tools" for application program development, and provide the system environment in which the application programs run. The operating system interfaces between the operator and the computer hardware executing the application programs. (See Figure 1-9.)

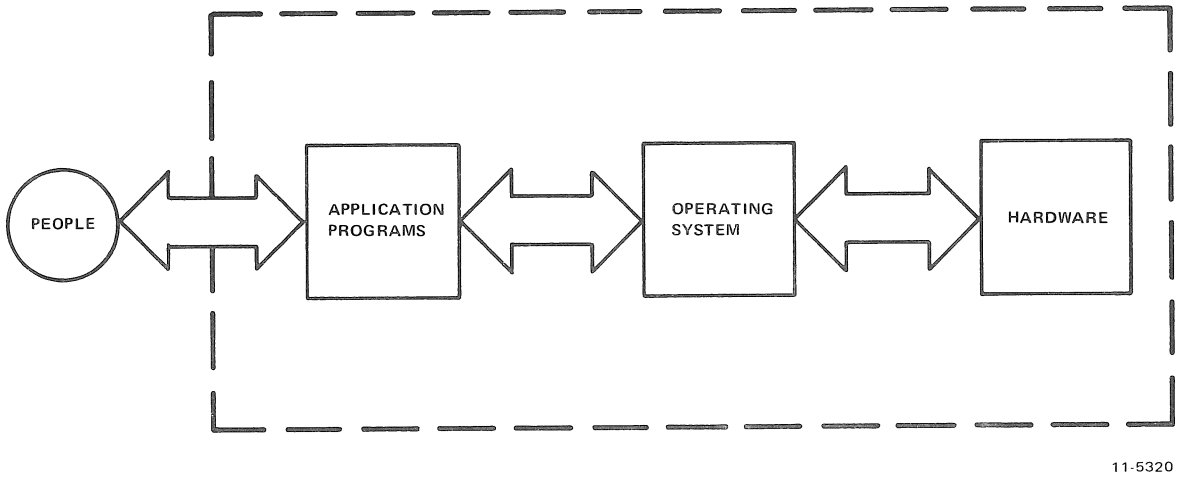


Figure 1-9 Computer System Components

To perform these functions the operating system uses two basic sets of software. It uses monitor (or executive) software to communicate with the operator and with the application programs, and it uses a set of system utility programs to provide the means for developing application programs. Both the monitor and the utility programs are explained in the RT-11 software documentation. This subject is also covered in Microcomputer Handbook in Section 4, Chapter 2.

The optional programming language processor programs translate easy-to-use "high-level" programming languages (FORTRAN IV, BASIC, FOCAL, and APL) into the machine language used by the computer hardware. Ordering information for these options is included in Appendix E.

1.6.3 Diagnostic Programs

Diagnostic programs are used to verify that the system is working correctly or to isolate malfunctions to the failing component. They are used for maintenance purposes and play no part in normal system operation (except automatically during the system turn-on sequence). There are three groups of diagnostic programs for the PDP-11V03: the DEC/X11 system exerciser software, the RXDP component diagnostic software, and the ODT and REV11-A hardware-implemented diagnostic programs.

The DEC/X11 software system consists of a collection of diagnostic programs plus the monitor and utility programs necessary to generate, run, control, and update these diagnostic programs. The DEC/X11 "run-time exerciser" is a combination of individual programs linked together to produce an interactive system that exercises the PDP-11V03 as a system. Its primary use is as a confidence check of the reliability of the PDP-11V03 functioning as an integrated system. Each PDP-11V03 system is shipped with a DEC/X11 run-time exerciser configured for the requirements of that individual system.

The RXDP diagnostic software system also consists of a collection of diagnostic programs plus monitor and utility programs. RXDP programs, however, are designed to diagnose individual system components, rather than to exercise the overall computer system.

The third group of diagnostic programs is built into the computer hardware, and does not have to be loaded from a diskette. There are three small diagnostic programs located on the REV11-A circuit card (M9400-YA module) inside the computer. One of these programs automatically checks non-memory modifying processor instruction execution during the power-on sequence. The remaining two programs check memory modifying processor instruction execution and system memory; the last two programs are automatically executed when "bootstrapping" the system, or they can be executed as directed by the operator.

The remaining diagnostic program is the hardware On-line Debugging Technique (ODT). This is built into the computer processor, and is the most basic means of communicating with the computer. It consists of a group of commands and routines for locating error conditions and for communicating with the computer in simple commands and responses. The diagnostic use of ODT commands allows the operator to use the terminal for functions normally available on a control panel containing an array of lights and switches.

DEC/X11, RXDP, REV11-A, and ODT programs are described further in Chapter 3.

CHAPTER 2
HARDWARE CHECKOUT

2.1 GENERAL

Frequently the cause of a problem can be traced to an incorrect switch position or a loose cable. The checks in this chapter are intended to identify such problems. If the procedures here do not solve the problem, the user should arrange for equipment servicing. There are several alternative servicing arrangements. Check the warranty and contact the local Digital Field Service representative.

This chapter addresses two basic symptoms: no "$" and no "." on the terminal. The checks here are mechanical and electrical. Electronic checks may be performed by the use of the diagnostic software; however, these require familiarity with the maintenance programs. Refer to Chapter 3 and to the diagnostic software documentation for further information.

2.2 NO "$" UPON POWER UP

If the "$" is not printed out when the computer's DC ON switch is switched on, refer to Table 2-1 and check the switch settings. Refer to Figures 1-2 through 1-6 to locate the switches. If no incorrect settings are found, follow the steps in the flowchart in Figure 2-1. If any loose cables or incorrect switch settings are discovered, proceed as follows.

1. Switch the DC ON/OFF switch to the OFF position.
2. Correct the condition.
3. Set the DC ON/OFF switch to the ON position.

Table 2-1 PDP11-V03 Switch Positions

Device	Switch	Set to	Function
11V03 Front Panel	DC ON/OFF	ON	Controls dc power to computer.
	ENABLE/HALT	ENABLE	Selects processor mode
	LTC ON/OFF	OFF	Controls Line Time Clock
DECwriter	Power ON/OFF	ON	Controls ac power
	LINE/LOCAL	LINE	Selects operating mode
	FDX/HDX	UP	Selects Full Duplex
	BAUD RATE	300	Selects baud rate
	CAPS LOCK	DOWN	Selects capital letters
DECscope	Power ON/OFF	ON	
	CAPS LOCK	DOWN	Selects capital letters

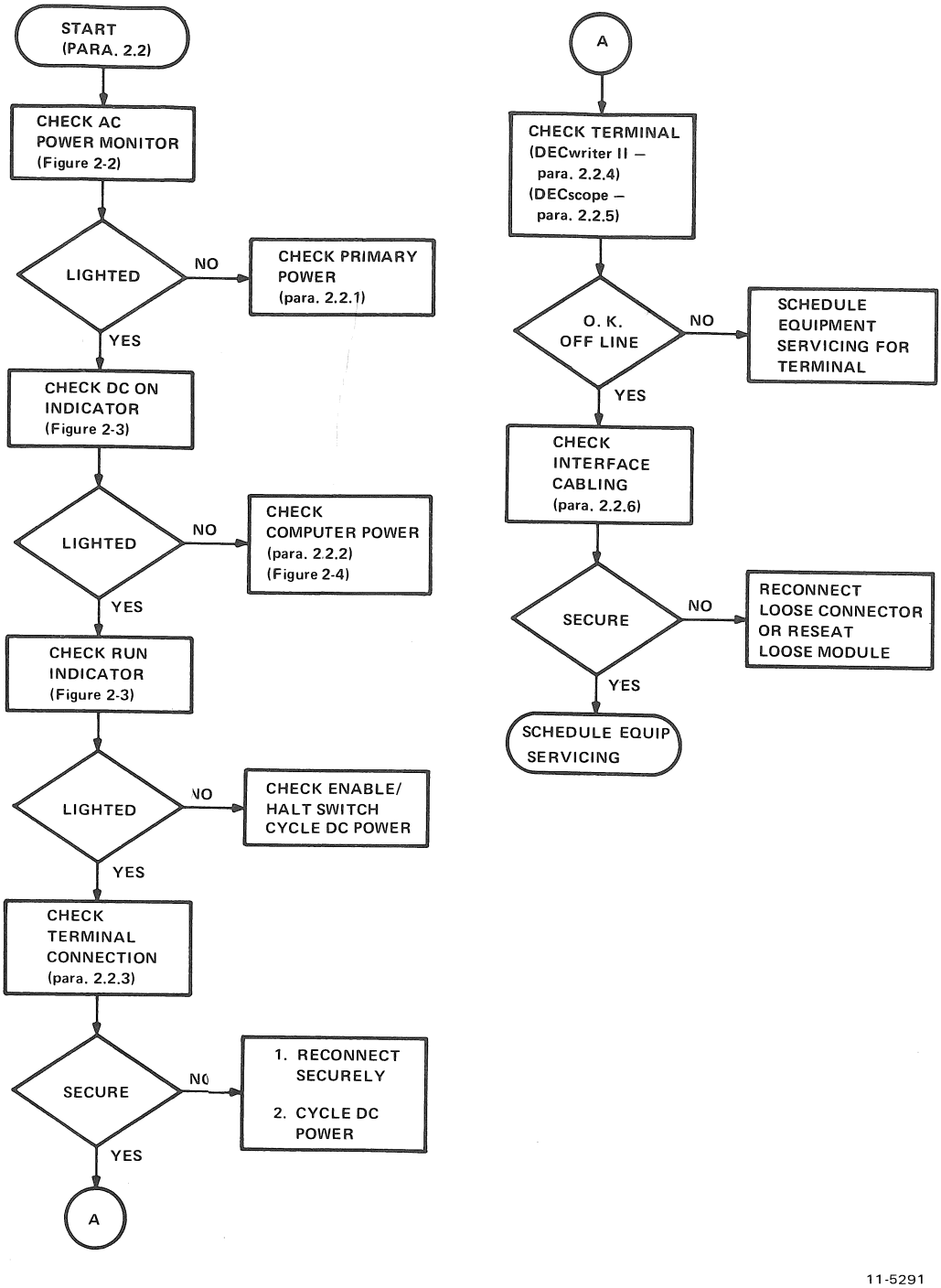


Figure 2-1 Flowchart For No $ Condition

Cycling the dc power off and on should result in the system printing or displaying the "$" character. If it does not, arrange for equipment servicing.

The troubleshooting steps in the sections that follow are referenced as necessary by the flowchart in Figure 2-1.

2.2.1 Check Primary Power

If the ac monitor lamp (Figure 2-2) does not light, check the ac line voltage at the power outlet where the PDP-11V03 system is plugged in. If the voltage is correct, reset the ac breaker on the rear of the computer cabinet. To do this, switch the breaker off and then back on again, making sure it is fully in the ON position.

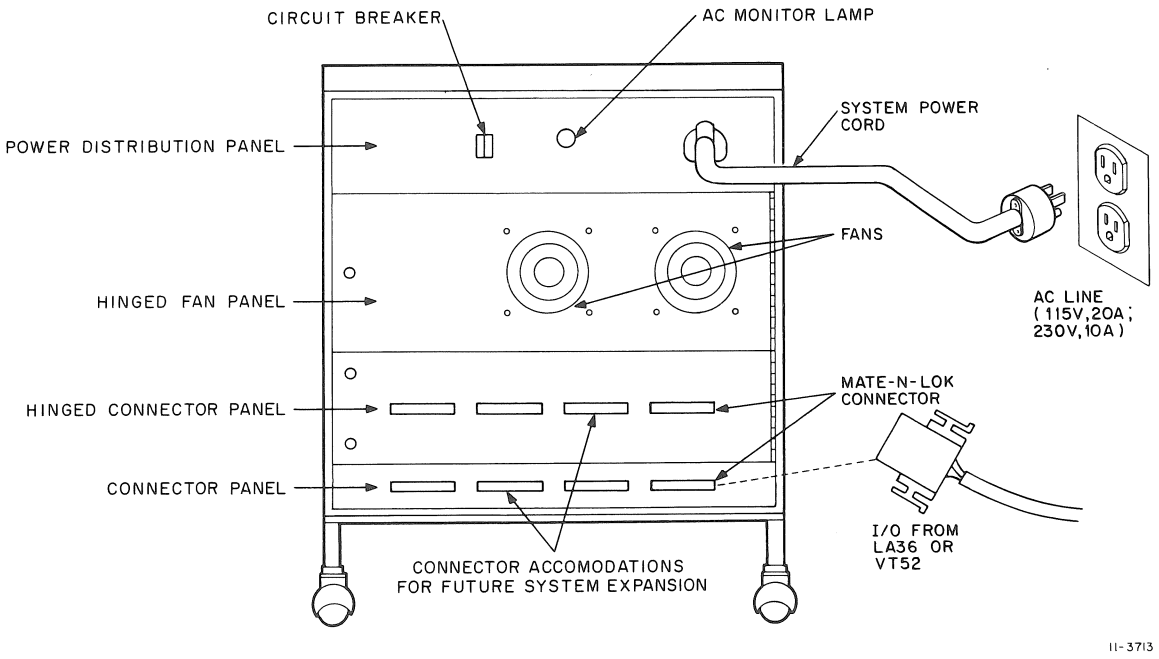


Figure 2-2 Rear View of Computer Cabinet

2.2.2 Check Computer Power

If the ac monitor lamp is lit but the DC ON indicator does not light when the DC ON/OFF switch is switched to ON, check the computer power as follows.

1. Switch off dc power at the DC ON/OFF switch (Figure 2-3) and switch off ac power at the circuit breaker (Figure 2-2).

2. Locate the hinged panel holding the fans (Figure 2-2). Remove the Phillips-head screw that secures it, and swing the fan panel open.

3. Check the fuse and switch on the rear of the computer (Figure 2-4). The switch should always be in the ON position.

4. Trace the ac power cable from the computer to the power distribution panel. Ensure it is plugged in securely.

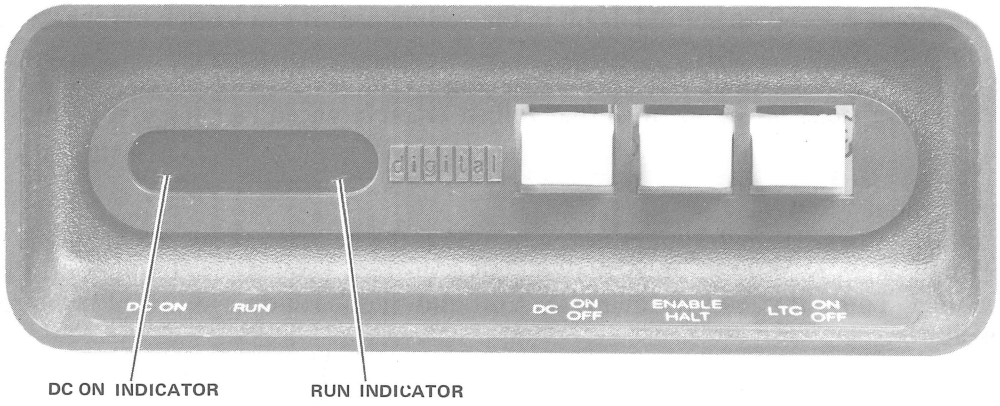


Figure 2-3 DC ON and RUN Indicators

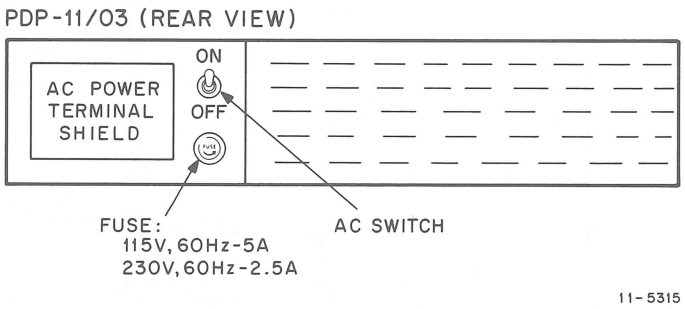


Figure 2-4 Computer ac Power Switch and Fuse

2.2.3 Check Terminal Cable Connection

Refer to Figure 2-2. Check the connector on the cable from the terminal. It should be secure and latched into the connector on the computer cabinet.

2.2.4 DECwriter II Checks

Switch the LINE/LOC switch to the LOC (local) position (Figure 1-4). This disconnects the terminal from the computer. In this "off-line" setting the DECwriter II should perform as an electric typewriter, printing what the operator types. If it does, the problem is probably in the computer. If it does not, the problem is in the terminal. Check the ac line power outlet to verify that the DECwriter is getting primary power. If the machine is receiving power, the internal cooling fans should be running. Also, there should be a movement of the print head when power is cycled off and on. If this movement does not occur, check the fuses. These are located in the front of the supporting pedestal (see Figure 2-5).

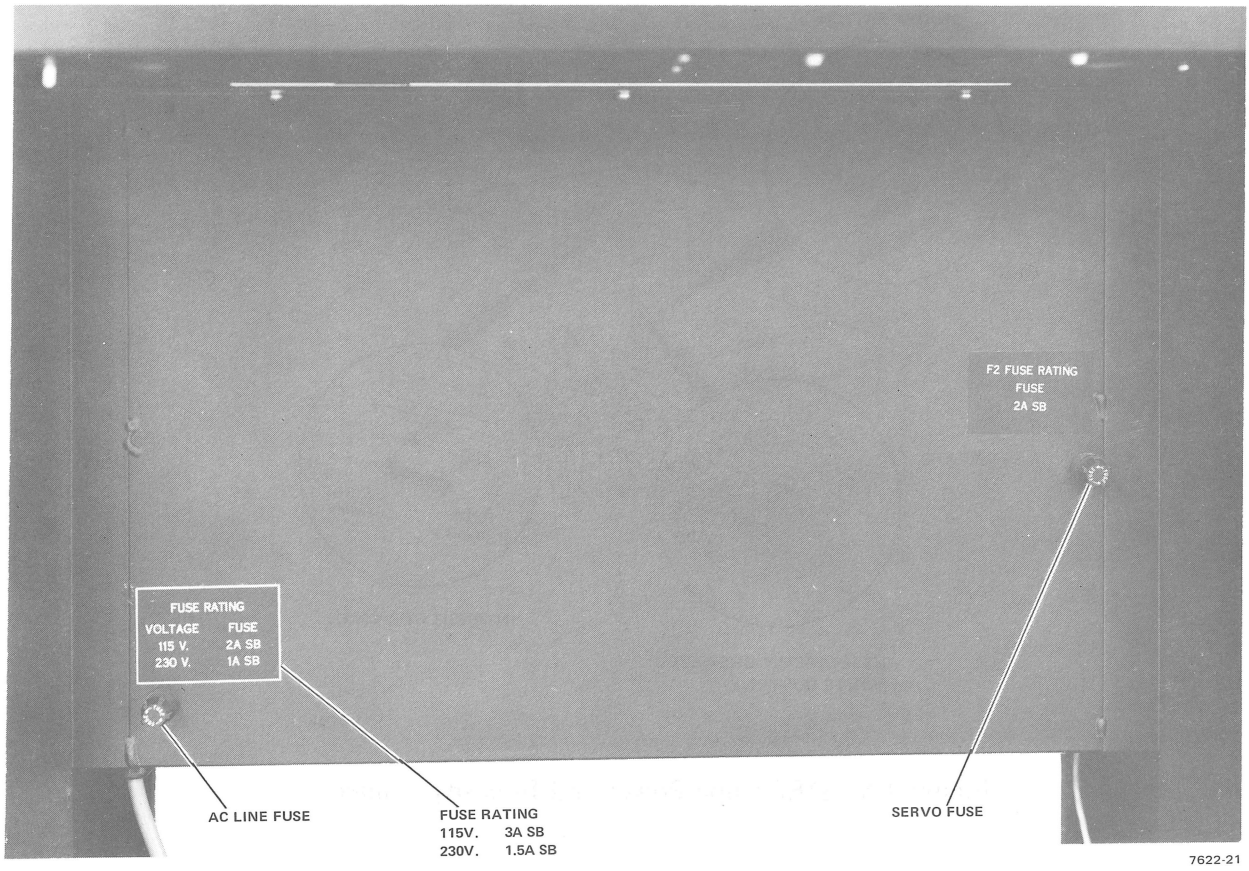


Figure 2-5 DECwriter II Fuse Locations

2.2.5 DECscope Checks

The DECscope should display a flashing cursor in the upper left-hand corner of the screen. This should appear within 30 seconds of turn on. If it is not visible, refer to Figure 2-6 and check the following.

1. Check the circuit breaker. If it is tripped (protruding), switch off the ac power and reset the breaker by pressing it in. Switch the power back on.

2. Check the intensity control. Movement of the lever should control the brightness of the cursor.

3. If the cursor is still not visible, check the ac power line at the outlet the DECscope is using.

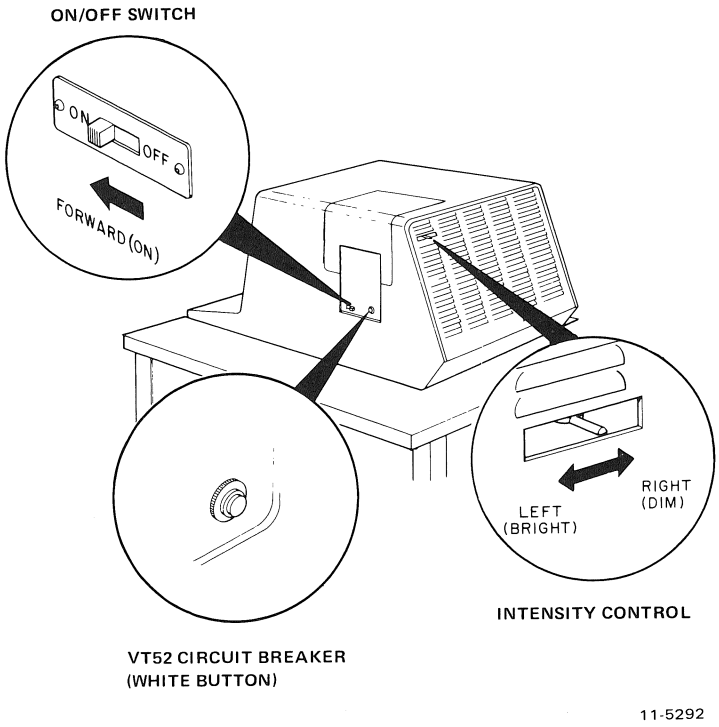


Figure 2-6 DECscope Power and Intensity Controls

If the cursor is present, but the "$" is not, check the baud rate control switches as follows.

1. Tip the DECscope up on its back side (Figure 2-7) and locate switches S1 and S2 (Figure 2-8).

2. Check to ensure that switch S1 is in position 3 and S2 is in position G. The position of these switches may be checked as follows.

   a. Switch off the ac power.

   b. Using a screwdriver, set the shaft of S1 fully counterclockwise (position 1) and then turn it two positions clockwise (position 3).

   c. Ensure that S2 is turned to its fully clockwise position (position G). The circuits that interface the DECscope to the computer are configured to operate at 9600 Baud. A placard on the bottom of the DECscope explains the switch settings.

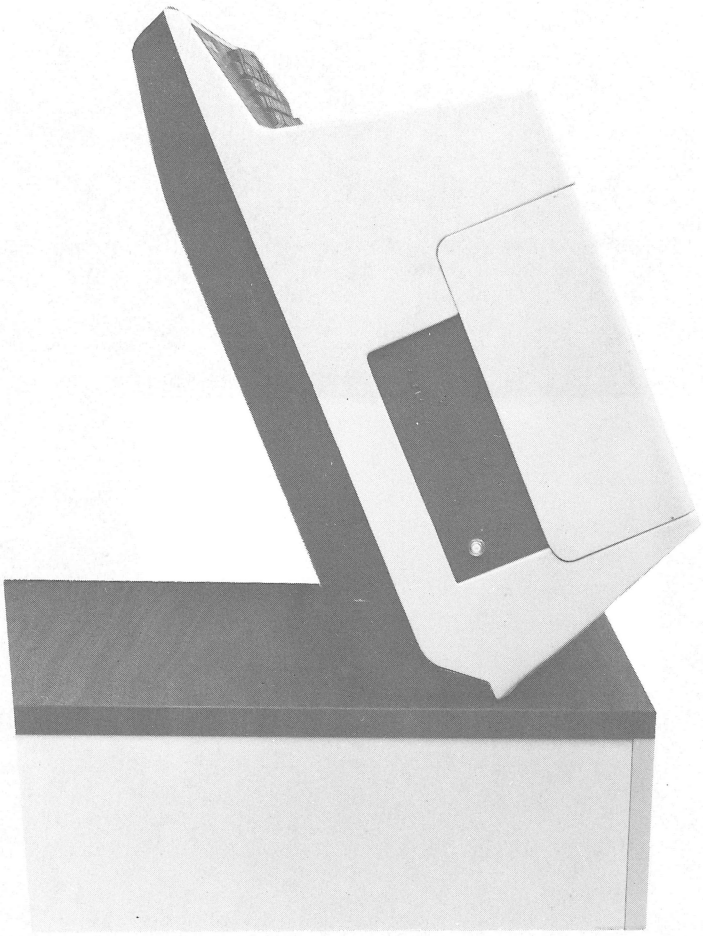


Figure 2-7 Tipping the DECscope

Figure 2-8 Bottom View of DECscope

If either switch S1 or S2 was not in the correct position, this could be the cause of the problem. If they were in the correct positions, check the terminal off-line as follows.

1. Turn S1 counterclockwise to position 1. This disconnects the DECscope from the computer, placing it off-line.

2. Tip the terminal back down to its normal position and switch on the power.

3. After warmup (about half a minute), the flashing cursor should appear at the top left of the screen (HOME position). Type characters on the keyboard and observe that they are displayed on the screen. If they are not, the problem is in the DECscope. If they are, the problem may be in the computer. Turn off the power and return S1 to position 3.

2.2.6 Check Interface Cabling

The terminal is interfaced to the computer by an interface circuit located on a circuit card which plugs into the computer. This circuit card (the M7940 serial line unit module) is connected by a cable to the connector in the rear of the computer cabinet. If this cable is loosened during shipping, the terminal will not respond to the computer. Check the cable connection as follows.

1. Switch the DC ON/OFF switch to the off position.

2. Grasp the front panel of the computer (Figure 2-9) and pull it off. It is designed to pop off; there are no screws to remove.

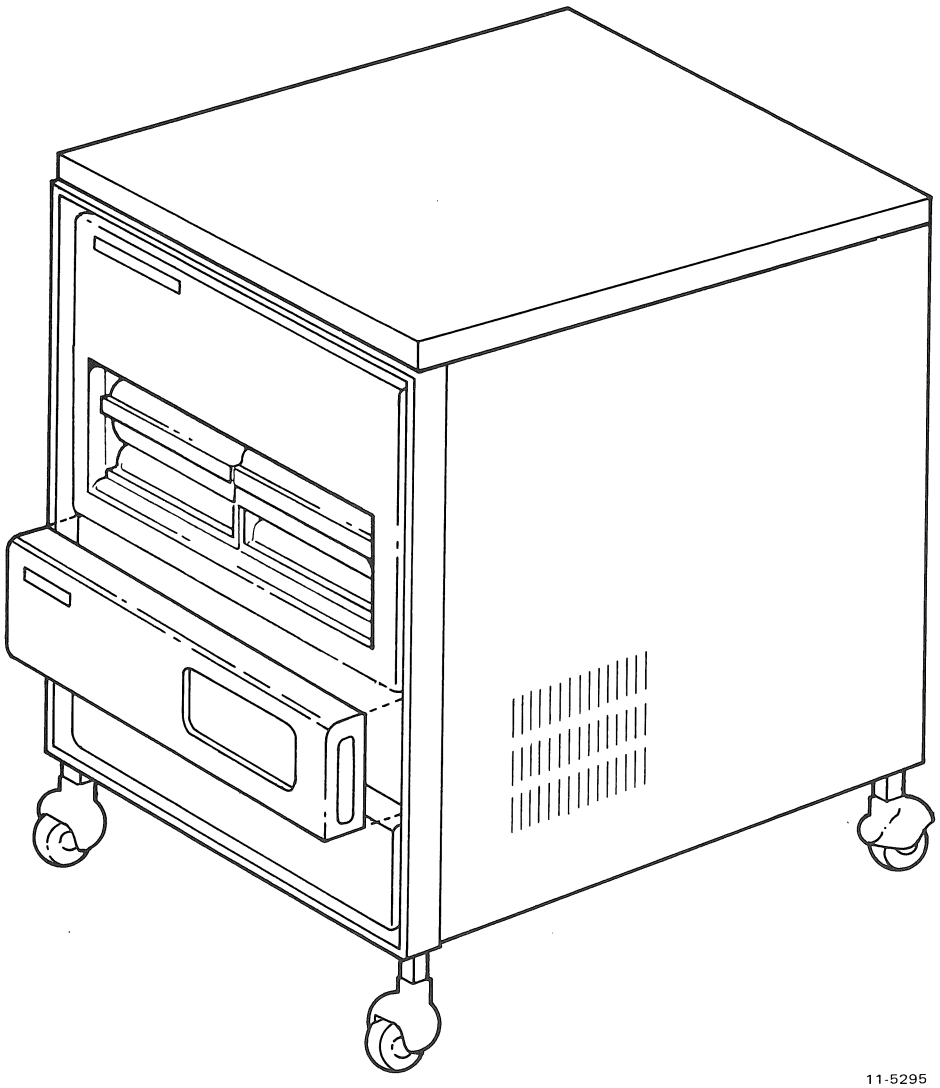


Figure 2-9 Removing Snap-off Panel

3. Refer to Figures 2-10 and 2-11, and locate the M7940 serial line unit.

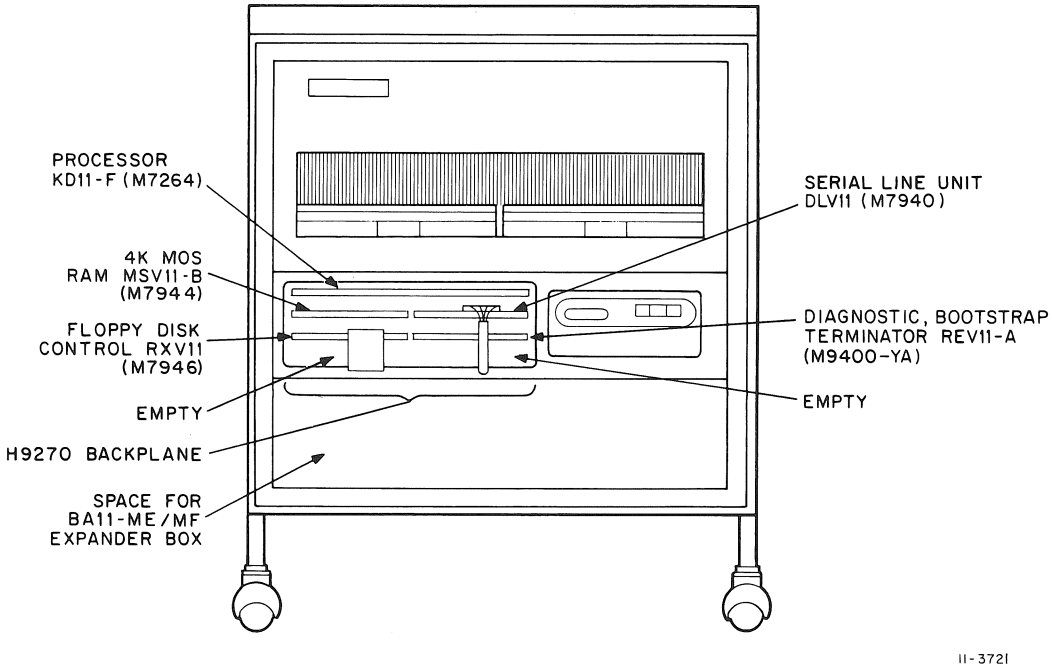


Figure 2-10 PDP-11V03 A/E Module Locations

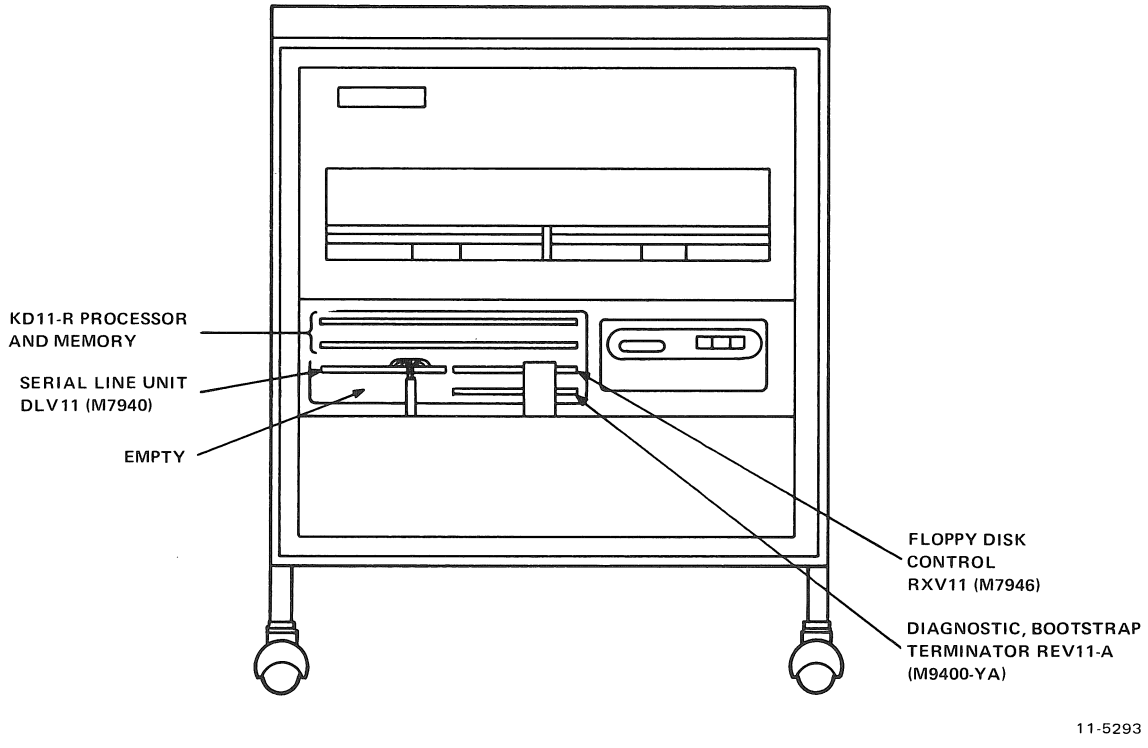


Figure 2-11 PDP-11V03 F/H Module Locations

4. Ensure that the cable connector is secure in its socket, and that the module is plugged into the computer backplane all the way. The "THIS SIDE UP" label should be up.

5. Reinstall the front panel of the computer by lining it up with the cabinet and pressing it on.

6. Switch dc power on.

2.3 NO "." RESPONSE AFTER BOOTSTRAPPING

If the "$" prompt character is printed when dc power is switched on, the problem is likely to be either the disk drive or the computer. Figure 2-12 is a flowchart for checking first the computer and then the disk drive system. The flowchart refers to the following paragraphs, which explain the steps in the flowchart. If this sequence of checks locates the problem, cycle the dc power off and on and then try again to bootstrap the disk drive. If the problem is not located, arrange for equipment servicing.

2.3.1 Perform XM and XC

The computer has two small diagnostic programs built into the REV11-A hardware module. One is a memory test called XM. The other is a processor test called XC. The computer may be checked by running these two tests as follows.

1. Cycle dc power off and then back on to get the "$" prompt character.

2. Run the memory diagnostic by typing XM after the "$" prompt character:

   $XM <CR>

   The computer should run the test, then print another $.

3. Run the processor diagnostic by typing XC after the "$" prompt character:

   $XC <CR>

   The computer should run the test, then print another $.

If either of these tests fails, the computer will not print the $. In this case call Digital Field Service. If the tests pass, the computer is probably working properly. Proceed with the steps in Figure 2-12 to check the disk drive system.

2.3.2 Check the Diskette Label

Open the door on disk drive 0 and pull out the diskette (Figure 2-13). The diskette should be labeled "RT-11 V02C Disk 1 of 2" or "RT-11 V03-01 Disk 1 of 2." If it is not, locate the correct diskette and load it into the left-hand disk drive.

2.3.3 Check Disk Drive Controller Cabling

The disk drive system is controlled by circuitry on a card that plugs into the computer. This card (the M7946 Floppy Disk Control module) is connected to the disk drive system by a cable. To check the controller connections, proceed as follows.

1. Switch off dc power at the DC ON/OFF switch (Figure 2-3) and switch off ac power at the circuit breaker (Figure 2-2).

2. Grasp the front panel of the computer and pull it off (see Figure 2-9). It is designed to pop off; there are no screws to remove.

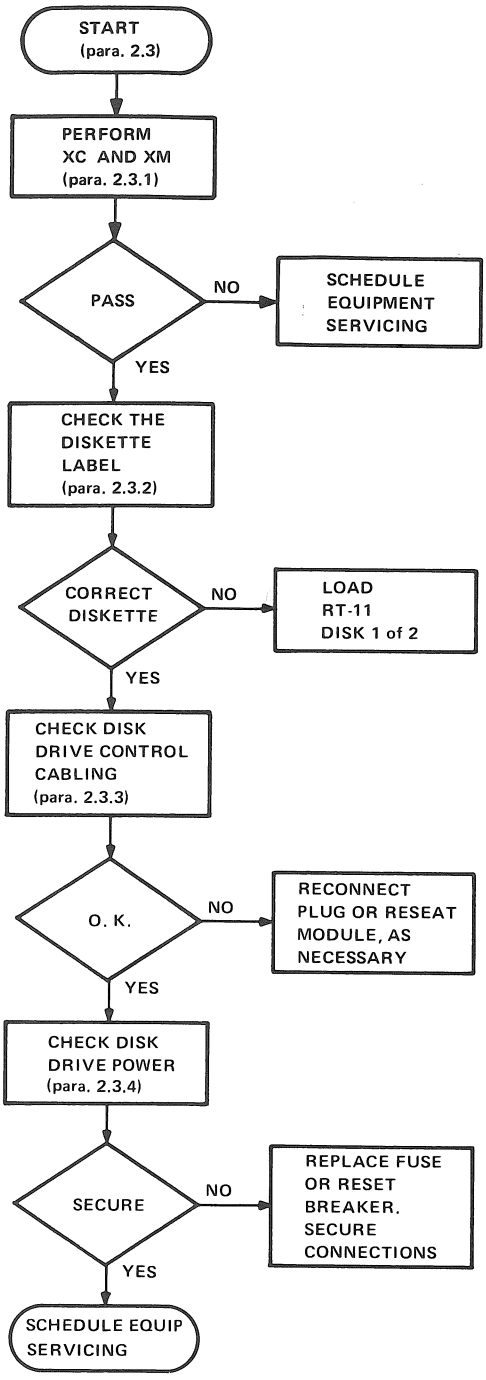


Figure 2-12 Flowchart for No "." Condition

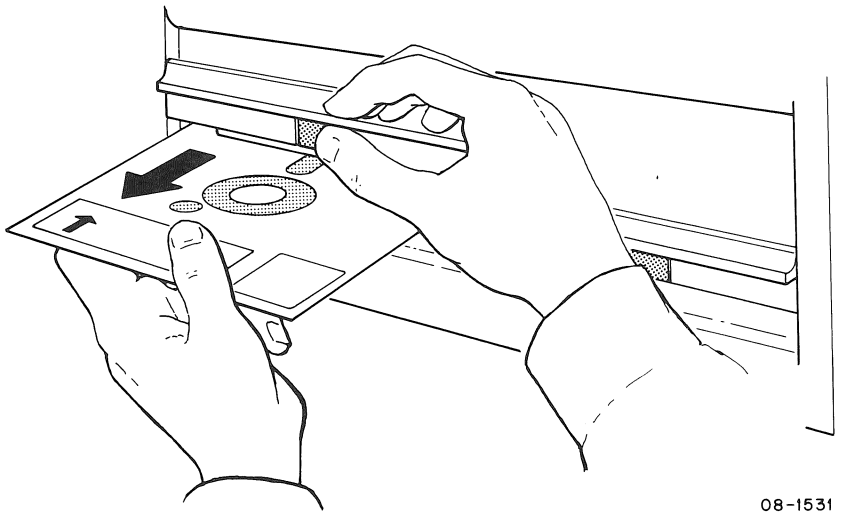


Figure 2-13 Removing the Diskette

3. Refer to Figures 2-10 and 2-11, and locate the floppy disk control module.

4. Ensure that the cable connector is secure in its socket, and that the module is plugged into the computer all the way.

5. Reinstall the front panel of the computer by lining it up with the cabinet and pressing it on.

6. Switch on the ac breaker and then switch on the dc power.

2.3.4 Check Disk Drive Power

The ac power to the disk drive can be checked as follows.

1. Switch off dc power at the DC ON/OFF switch (Figure 2-3) and switch off ac power at the circuit breaker (Figure 2-2).

2. Locate the hinged fan panel. Remove the Phillips-head screw that secures it and swing the panel open.

3. Refer to Figure 2-14. Check the fuse (or circuit breaker) on the rear of the disk drive unit.

4. Check the connectors at P1, P2, and P3. They should be plugged in securely.

5. Trace the ac power cable from the disk drive to the outlet inside the rear of the computer cabinet. Ensure that it is plugged in securely.

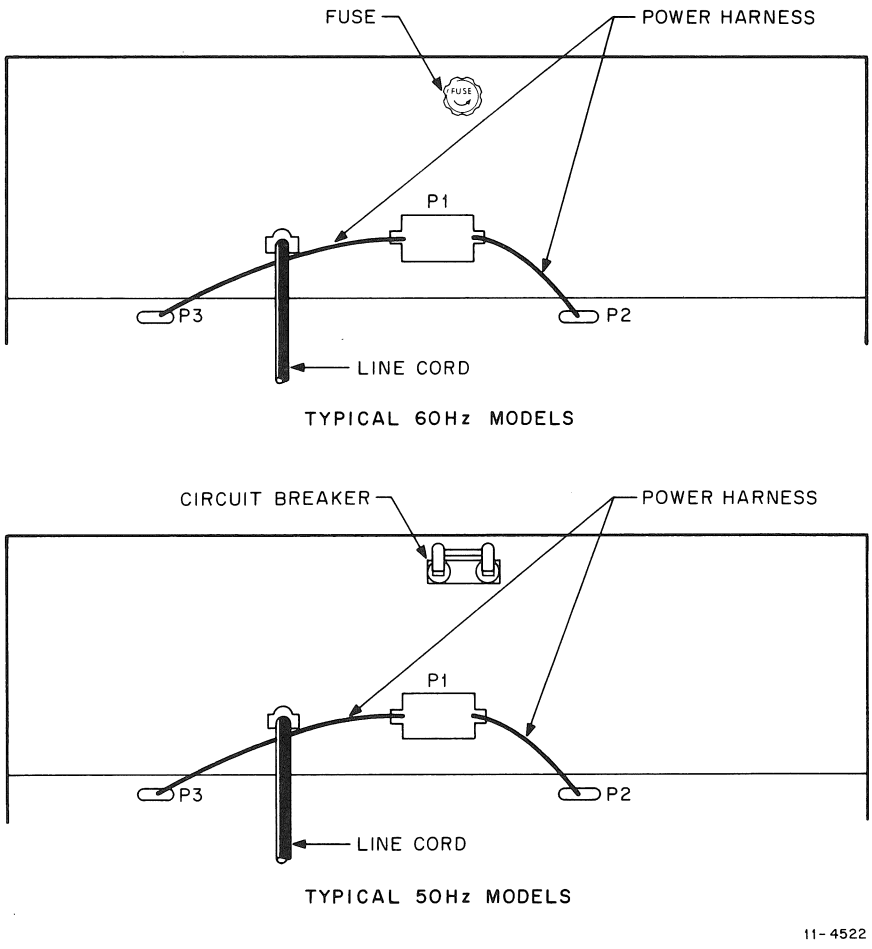


Figure 2-14 Rear View of Floppy Disk Drives

CHAPTER 3
DIAGNOSTIC PROGRAMS

3.1 GENERAL

The diagnostic programs for the PDP-11V03 include two software systems plus several small programs that are implemented in hardware. The RXDP and DEX/X11 software systems are described briefly in Paragraph 3.3 of this chapter, and are described in detail in *XXDP User's Manual* (part number MAINDEC-11-DZQXA-I-D and *DEC/X11 User's Documentation and Reference Guide*(part number MAINDEC-11-DXQBA-U-D). The hardware routines include the REV11-A programs and On-line Debugging Technique (ODT) commands. These are described briefly in Paragraph 3.2 of this chapter and are explained in more detail in *Microcomputer Handbook* (part number EB-065831 76 090/53).

3.2 HARDWARE-IMPLEMENTED DIAGNOSTICS

The ODT and REV11-A programs do not require the loading of any software. They are built into the computer hardware, and are available upon power up.

3.2.1 ODT

The most basic way of communicating with the computer is through the hardware ODT. The commands in this program are a subset of the commands in the larger software ODT program (ODT.OBJ) which operates under the RT-11 operating system. The software ODT program is used for debugging software. The hardware-implemented ODT is primarily for hardware-oriented diagnosis of problems.

CAUTION

The hardware ODT can alter programs. Therefore the master diskettes should be copied and set aside before using ODT. Instructions for copying diskettes are presented in Paragraph 3.3.

The On-line Debugging Technique functions only when the computer is in the console emulator mode. This mode of operation is used instead of switches and lights on a console panel to communicate directly with the computer. In the console emulator mode, commands are typed on the keyboard instead of set in switches. Responses are displayed on the DECscope or printed by the DECwriter, instead of lighting lamps on a computer console. The computer enters the console emulator mode in any of the following ways.

1. Operator types the command OD after the "$" prompt character.
2. Operator presses the BREAK key.
3. Operator switches the ENABLE/HALT switch to the HALT position.
4. The program executes a HALT instruction.
5. An error condition is detected by the computer.

Upon entering the console emulator mode, the computer sends the following to the terminal.

<CR><LF>
nnnnnn <CR><LF>
@

Where CR is the carriage return command, LF is the line feed command, and nnnnnn is the location of the next instruction to be executed. The @ is the prompt character used by the ODT program.

Table 3-1 describes ODT commands. All ODT commands must be typed with the CAPS LOCK key depressed. Characters printed by the computer are shown underlined. Characters typed by the operator are not underlined.

Note also that all commands and characters are echoed by the computer and that illegal commands will be echoed and followed by ?, followed by CR, followed by LF, followed by @. Lower case letters are not legal for ODT commands. If a valid command character is received when no location is open (e.g., when having just entered the console emulator mode), the valid command character will be echoed and followed by a ?, CR, LF, @. Opening nonexistent locations will have the same response. The computer always prints six numeric characters. However, the user is not required to type leading zeros for either addresses or data.

NOTE

If the command L <CR> is typed, the computer will hang up. To get out of this condition toggle dc power off and on.

3.2.2 REV11-A

The REV11-A programs are stored in read-only memories on a module in the computer. The REV11-A module contains diagnostic programs and the bootstrap program for the floppy disk drive system. Each time the PDP-11V03 is switched on, the REV11-A hardware automatically performs a short routine to check out the computer. When it passes this quick check it prints the "$" prompt character. At this time the operator may enter any of the commands listed in Table 3-2. The DX commands bootstrap the disk drive. The XC and XM commands perform checks on the processor and the memory. If one of the programs fails to function properly, the computer will print an error message in the form:

nnnnnn
@

The @ sign indicates that the computer has halted and control has passed from the REV11-A program to the console emulator mode, which simulates some of the software ODT commands. The number (nnnnnn) indicates why. If the system prints an error message in response to an REV11-A command, arrange for equipment servicing. For more information about the meanings of the error messages, refer to the sections on ODT and REV11-A in *Microcomputer Handbook* (DIGITAL number EB-065831 76 090/53) or to volume one of the *REV11 Field Maintenance Print Set* (part number MP00073).

If an invalid command is entered following the "$" prompt character, the system will respond with a ? after the command. It will then advance a line and issue a new $. For example:

$ XJ ?
$

Table 3-1 ODT Program Commands

NOTE

Examples presented in this table use the following conventions:

1. Characters printed or displayed under the control of the computer are underlined. Characters typed by the operator are not underlined.

2. Characters enclosed by < > are non-printing commands. For examples, < CR > indicates that the operator types carriage return, and < CR > indicates that the computer performs a carriage return.

Command	Function
/ (slash)	Opens a location (memory or general purpose register). The / command is normally preceded by a numeric location identifier. Before the contents are printed, the console will issue a space character. Example: @1000/021525 where: @ = ODT prompt character 1000 = octal location in address space to be opened / = command to open and exhibit contents of location 012525 = contents of octal location 1000 NOTE If / is used without a preceding location identifier, the address of the last opened location will be used. This feature can be used to verify data just entered into a location.
CR (carriage return)	This command is used to close an open location. If the contents of a location are to be changed, CR should be preceded by the new value. If no change to the location is necessary, then CR will not alter contents. Example: @1000/012525 <CR> <LF> @/012525 OR

Table 3-1 ODT Program Commands (Cont)

Command	Function
CR (carriage return) (Cont)	Example: @1000/012525 15126421 <CR> <LF> @/126421 where: CR is used to close location 1000 in both examples. Note that in the second example the contents of location 1000 was changed and that only the last 6 digits entered were actually placed in location 1000.
LF (line feed)	This command is also used to close an open location or GPR (general-purpose register). If entered after a location has been opened, it will close the open location or GPR and open the location + 2 or the GPR + 1. If the contents of the open location or GPR are to be modified, the new contents should precede the LF operator. Example: @ 1000/ 012525 < LF > < CR > 001002/ 005252 < CR > < LF > @ where: LF is used to close location 1000 and open location 1002.
^ (up arrow)	The "^" command is also used to close an open location or GPR (general-purpose register). If entered after a location or GPR has been opened, it will close the current location or GPR and will open the previous location (current location - 2, or GPR - 1). If the contents of the open location or GPR are to be modified, the new contents should precede the "^" command. Example: @ 1000/ 012525 ^ < CR > < LF > 000776/ 010101 < CR > < LF > @ where: "^" used to close location 1000 and open location 776.

Table 3-1 ODT Program Commands (Cont)

Command	Function
@ (at sign)	Once a location has been opened, the @ command is used to close that location and open a second location, using the contents of the first location as an indirect address to the second location. That is, the contents of the first location points to the second location to be opened. The contents of the first location can be modified before the @ command is used. This command is useful for stack operations. Example: @ 1000/ 000200 @ <CR> <LF> 000200/ 000137 <CR> <LF> @ where: @ is used to close location 1000 and open location 200. Note that the @ command may be used with either GPRs or memory contents.
_ (underline)	This command is used to close one location and open a second location. The address of the second location is the sum of the following: 1. The address of the first location 2. The contents of the first location 3. 2 This is useful for relative instructions where it is desired to determine the effective address. Example: @1000/ 00200 _ <CR><LF> 001202/ 002525 <CR> LF @ where: _ is used to close location 1000 and open location 1202. 1202 is the sum of 1000 (the address of the first location) + 200 (the contents of the first location) + 2. This command cannot be used if the open location is a general-purpose register.

Table 3-1 ODT Program Commands (Cont)

Command	Function
$ or R	These commands are used to designate the internal registers. Either command can be followed by a register value (0 through 7) which will allow that specific general-purpose register to be opened or changed. The register value must be followed by the / command. Example: @ $ n / 012345 <CR> LF @ where: $ = register designator. This could also be R. n = octal register 0 - 7. 012345 = contents of GPR n. Note that the GPRs once opened can be closed with either the CR, LF, ^ , or @ commands. The ___ command will also close a GPR, but will not perform relative addressing.
$ S	By replacing "n" in the above example with the letter S the processor status word will be opened. Again either $ or R is a legal command. Example: @ $ S / 000200 <CR> LF @ where: $ = GPR or processor status word (PSW) designator S = specifies processor status register and differentiates it from the GPRs. 000200 = eight bit contents of PSW; bit 7 = 1, all other bits = 0. Note that the contents of the PSW can be changed using the CR command but bit 4 (the T bit) cannot be modified using any of the ODT commands.
G (go)	The "G" (GO) command is used to start execution of a program at the memory location typed immediately before the "G". Example: @ 100G or @ 100;G

Table 3-1 ODT Program Commands (Cont)

Command	Function
P (proceed)	The "Proceed" command is used to continue, or resume, execution at the location pointed to by the current contents of the Program Counter (R7). Example: @P
M (maintenance)	The "Maintenance" command prints data that indicates how the computer entered the HALT mode. This command is used for hardware maintenance, and requires interpretation. Refer to Microcomputer Handbook (Digital part number EB-065831 76 090/53) for further information.
DELETE Key	While DELETE is not actually an ODT command, the computer does support this character. When typing in either address or data, the user can type DELETE to erase a previously typed character. The computer will respond by printing a " \ " (backslash) for every DELETE typed. Example: @000100/ 077777 123457 <DELETE> \ 6 <CR> LF @000100/ 123456 In the above example, the user typed a "7" while entering new data and then typed DELETE. The console responded with a " \ " and then the user typed a "6" and CR. Then the user opens the same location and the new data reflects the DELETE. Note that if DELETE is issued repeatedly, only numerical characters are erased and it is not possible to terminate the present console mode. CAUTION **If more than six DELETE's are consecutively typed, and then a valid location closing command is typed, the open location will be modified with all zeros.** **The DELETE command cannot be used while entering a register number. R2 \ 4 / 012345 will not open register R4; however, the DELETE command will cause ODT to revert to memory mode and open location.4.**

Table 3-1 ODT Program Commands (Cont)

Command	Function
L (bootstrap	The "L" (Bootstrap Loader) command is typically used with paper tape. The command will cause the processor to determine the amount of memory available and then load a program, making the most efficient use of memory. The program on the device specified for loading must be in bootstrap loader format (e.g., the Absolute Loader program). The device is specified by typing the address of its input control and status register (RCSR) immediately before the "L" command. Example: @177560L @ **CAUTION** **Incorrect use of the "L" command can hang up the system. If this occurs, cycle dc power off and on.**

Table 3-2 REV11-A Commands

Command	Function
OD	ODT. This command places the computer into the console emulator mode, and thereby transfers control to the ODT program. This enables the operator to examine and/or modify memory and register locations. If the operator does not alter the Program Counter (PC) while using the ODT program, control may be returned to the REV11 program by entering the ODT "P" (Proceed) command. The computer will respond by displaying the "$" prompt character. If the PC has been altered, the operator can start program execution by entering the starting address 165006 and the "G" (Go) commands as follows @165006G $ The computer responds by displaying the "$" prompt character on a new line, signifying that another REV11 command can be entered.
XM <CR>	Memory Diagnostic Program. After successfully completing this program the computer displays the prompt character $. If the test fails, the computer will enter the console emulator mode and print out an error message. The memory test consists of an address test and a data test. After the tests the memory is left with the vector page set to halt on interrupts or traps, and the rest of memory set to all 1s.

Table 3-2 REV11 Commands (Cont)

Command	Function
XC <CR>	Processor Diagnostic Program. This is a memory-modifying instruction test. Successful execution of the diagnostic program results in the "$" prompt character being displayed on the console device. If the test fails, the computer will enter the console emulator mode and print an error message.
DX <CR> or DX0<CR>	Floppy Disk System Bootstrap. Typing either of these commands causes the REV11-A to boot disk drive 0. This assumes that the drive has been loaded with a diskette formatted for use with the PDP-11V03 system. When the command is entered the computer first performs the XC and XM diagnostic programs and then, upon successful completion of these, executes the bootstrap program for the disk drive. If any errors are detected, the computer will enter the console emulator mode and display an error message. If the sequence is successful, the REV11-A program will transfer control to the system program on the diskette. Normally this will be a monitor program, and the computer will issue a "." prompt character.
DX1 <CR>	Floppy Disk System Bootstrap. This command is similar to the DX or DX0, with the exception that it bootstraps disk drive 1 instead of disk drive 0.

3.3 DIAGNOSTIC SOFTWARE

The PDP-11V03 system includes two separate diagnostic software packages: RXDP and DEC/X11. The equipment uses only one of these systems at a time. The RXDP package is a subset of the larger XXDP family of diagnostic programs used for the PDP-11 family of computers. RXDP programs are configured for use on an RX01 floppy diskette-based system. They are loaded individually and run one at a time to diagnose problems in system components. DEC/X11 programs, by contrast, are run as a group to verify the interaction of system components.

3.3.1 RXDP

The RXDP package includes several diskettes. In each diskette envelope is a small sheet that lists the contents of the diskette. The contents of a diskette can also be found by looking up its number in the *XXDP User Manual* (part number MAINDEC-11-DZQXA-I-D). That manual also describes in detail how to use the monitor and utility programs. Explanations of the individual maintenance diagnostic programs are presented in the individual program listings. The following paragraphs gives examples of a few basic operations.

3.3.1.1 How to Copy an XXDP Diskette (RXDP) - It is advisable to copy the original diskettes distributed with the system and then store the masters for future reference. A diskette can be copied from disk drive 0 to disk drive 1 or from disk drive 1 to disk drive 0. It is therefore important to give careful attention to which way the transfer is going. Transposing the source and destination commands will cause a blank diskette to be "copied" onto the master, thereby destroying the information on the master.

To copy a master diskette which is in disk drive 0 (left side) onto a blank diskette which is in disk drive 1 (right side) proceed as follows.

1. Boot disk drive 0:

   $ DX<CR>

   The system will print the program heading, a restart address, and a help message (see Figure 3-1). After the help message it will print the RXDP prompt character ".".

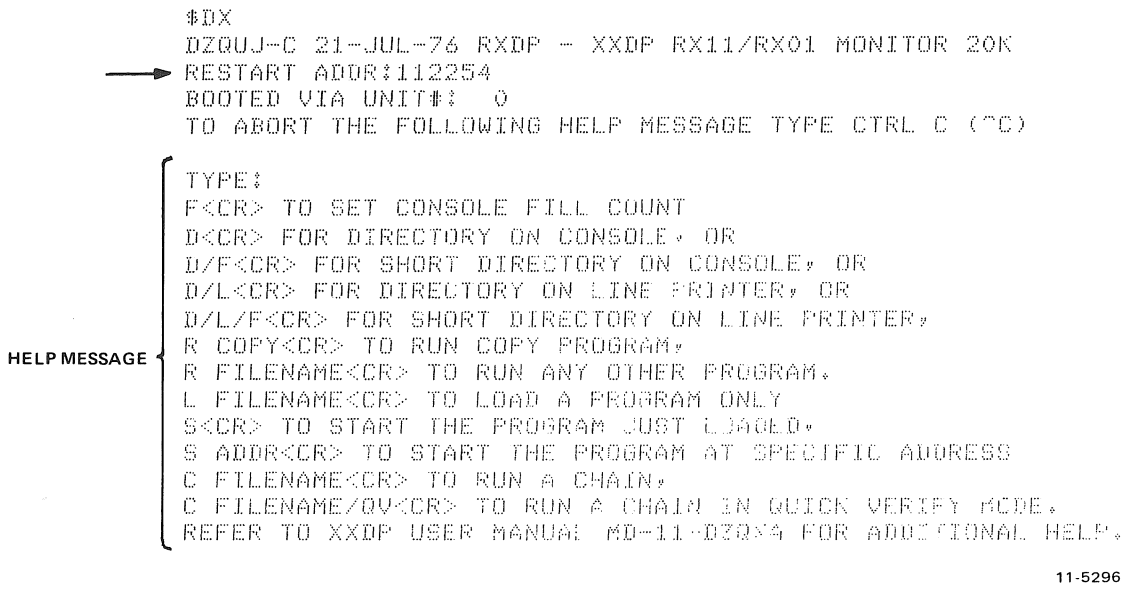


Figure 3-1 Restart Address and Help Message

2. Call the copy program in from the diskette by typing:

   .R COPY <CR>

   The system will print the copy program heading, location and restart address information, and an "*" prompt character.

3. Type source and destination information:

   *COPY DX1:=DX0: <CR>

   This will indicate that the DX0 diskette is to be copied onto the DX1 diskette. This will delete whatever is on DX1. At this point the computer will print:

   MAKE OUTPUT READY. TYPE <CR> WHEN READY.

4. Ensure that the master is in drive 0 and a blank is in drive 1. Check to ensure that the entry in step 3 is correct. After verifying this, strike the carriage return.

5. The transfer takes approximately 20 minutes. After approximately 15 minutes the system prints: START VERIFICATION. When it is complete the copy program will print the asterisk prompt character. To return to the RXDP monitor program, type:

   *BOOT DX0: <CR>

6. Remove the original diskette from disk drive 0 and store it in a safe place.

3.3.1.2 How To Find A Diagnostic Program – The contents of a diskette can be ascertained by typing "D" and a carriage return in response to the "." prompt character.

.D <CR>

This command will cause a directory of the diskette contents to be printed. Figure 3-2 is an example of a directory listing. The mnemonics in the FILNAM column (file names) correspond to product codes of the programs.

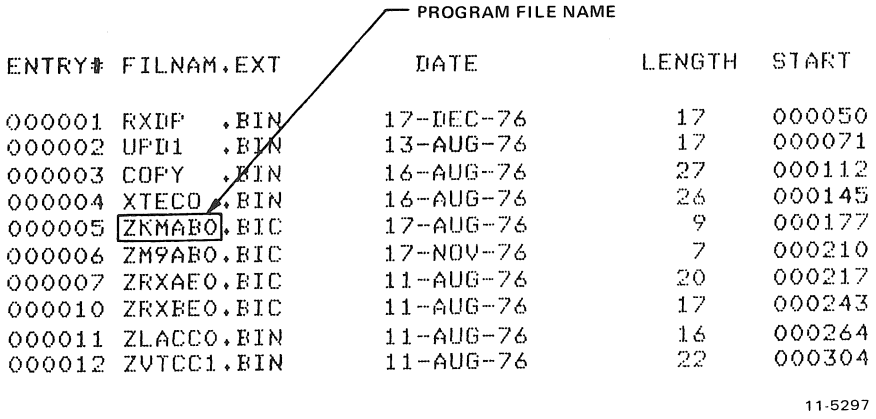


Figure 3-2 Typical Directory Listing

For example, the product code for the memory exerciser program is MAINDEC-11-DZKMA-B, and the file name is ZKMAB0. The product code printed on the program listing and the file name printed on the diskette directory listing correspond as follows.

MAINDEC-11-DZKMA-B (product code)
ZKMAB0 (file name)

Note that the last character in the file name is a number (0, 1, etc.), not the letter O. All file names (ZKMAB0, VKAAA0, etc.) are prefaced by MAINDEC-11-D on the title page of their program listings. Refer to Appendix E for program titles.

3.3.1.3 Running a Diagnostic Program – An individual RXDP diagnostic program is normally run by typing "R" and the program filename. For example, typing:

```
. R ZKMAB0 <CR>
```

will run the memory exerciser program. If there are no faults, the program will run until all tests are completed (3 seconds to 10 minutes, depending on the particular program). At that time the system will print out END PASS and will begin another cycle of the program. This will continue until the operator terminates the program by either pressing the BREAK key or toggling the ENABLE/HALT switch. Either of these actions halts the computer, and passes control to the ODT program. The ODT program then prints the "@" prompt character.

Some diagnostic programs, such as the memory exerciser, destroy the RXDP monitor program. After these programs are run it is necessary to reboot the diskette. Most programs, however, do not overwrite the monitor. After these programs the operator can return to the RXDP monitor program by typing in the monitor restart address and the ODT GO command "G".

```
@nnnnnnG
```

where nnnnnn is the restart address. This address is printed out under the monitor's program name whenever the RXDP diskette is bootstrapped (Figure 3-1).

3.3.1.4 Modifying a Diagnostic Program – Diagnostic programs often can be modified to perform specialized diagnostic functions. The program listing explains what to modify for what purpose. The modification is accomplished by using the ODT program to change the contents of certain locations. As an example, assume it is desired to alter the memory exerciser program so that it performs a "long loop" instead of a "short loop." The program listing directs the user to change software switch register 176 to 1000. This can be done as follows.

1. Load the program with the "L" command instead of the "R" command.

   ```
   . L ZKMAB0 <CR>
   ```

   The computer will load the program into memory and return the "." prompt character. The program is not executed at this time.

2. Toggle the ENABLE/HALT switch to the HALT position and back to the ENABLE position. This places the computer into the console emulator mode and gives control to the ODT program. The system responds by printing the "@" prompt character.

3. Open location 176 by typing "176" and the slash command. The computer responds by printing the present contents of that location.

   ```
   @176/000000
   ```

4. Behind the zeros printed by the computer, type the number specified by the program listing.

   ```
   @176/000000 1000 <CR>
   @
   ```

5. Verify that the change has been made by typing the 176/ again and examining what is printed. If the contents are correct, strike the carriage return.

   ```
   @176/001000 <CR>
   @
   ```

6. Start the program at location 200 with the ODT GO command.

   @200G

7. The computer will print the program name and execute the program. When the testing is complete, the system will print "END PASS" and will begin another pass.

8. To terminate the program, toggle the ENABLE/HALT switch or press the BREAK key. This returns control to the ODT program. To return to the RXDP monitor program, toggle the DC ON/OFF switch to transfer control to the REV11-A program. When the "$" prompt character is printed, reboot disk drive 0.

   $ DX <CR>

Modifying the program by this method affects only the computer memory, and not the program on the diskette. It is therefore unnecessary to change the location back.

3.3.2 DEC/X11

The DEC/X11 software provided with the PDP-11V03 system includes libraries of many separate program "modules", each intended for a specific system component. Information necessary for linking program modules together to build an interactive system exerciser program is contained in *DEC/X11 User's Documentation and Reference Guide.* The DEC/X11 package also contains a system "run-time exerciser." This is a group of program modules that have been configured to perform a confidence check on the reliability of the PDP-11V03 components interacting as an integrated system. The group includes programs selected to exercise the particular system with which it is shipped. These programs are configured to run continuously, rather than to halt on errors. The run-time exerciser sequences through each program module and records any errors which have occurred along the way. When the operator stops the exerciser it prints a summary of the programs run, the number of times they were run (pass count), and the number of errors (error count).

The run-time exerciser is completely contained on one diskette. The diskette is labeled in one of two ways, depending on how it is configured. The first labeling method uses the DEC number from the purchase order. This number is on the order form enclosed with the system shipping documents. The second labeling method uses the system serial number. This is located on a sticker on the rear of the computer cabinet. Either one or the other of these numbers is written on the label of the diskette containing the run-time exerciser. The exerciser may be run as follows.

1. Load the diskette into disk drive 0 and boot the disk drive ($DX <CR>). The system will print the DEC/X11 monitor program name and other information, and then print the "." prompt character.

2. Call the run-time exerciser program by typing "R" and the program file name. The file name is either the DEC order number or the system serial number, whichever is written on the diskette label. For example, if the diskette label bears the system serial number "MR688", the program is started as follows.

   . R MR688 <CR>

3. The system prints out the program name and status. It also prints the following instruction.

   TO EXERCISE LOAD MEDIUM YOU MUST CLEAR LOC 40

   —

4. At this time remove the DEC/X11 system exerciser diskette from disk drive 0. Load blank or "scratch" diskettes into both disk drives 0 and 1. (This is necessary to exercise the disk drive system without destroying the DEC/X11 diskette.)

5. Change the contents of location 40 to zero as follows.

```
.MOD 40
000040 004000 0 <CR>
.
```

6. Type "RUN" after the prompt character.

```
.RUN <CR>
```

The exerciser will now run until stopped by the operator. The run time for the basic PDP-11V03 system is 1 hour.

7. To stop the exerciser type "CONTROL C." (This is done by holding down the CTRL key and striking the C key.) The program will stop and print a run summary.

APPENDIX A
INSTALLATION

A.1 GENERAL

The system should not be unpacked by the user if arrangements have been made for Digital Field Service support. If the user is to unpack and install the system, it is important to first examine the shipping containers for any evidence of damage during shipment. As each container is unpacked it should be inspected for damaged or missing parts. Model numbers should be verified before power is applied. Report any problems to Digital Field Service.

A.2 UNPACKING THE COMPUTER CABINET

Figure A-1 shows how the cabinet is packaged. It may be unpacked as follows.

1. Cut and remove the strapping that holds the cardboard shipping container on the skid.
2. Lift the cardboard tube and cap off the skid.
3. Cut and remove the three straps that hold the cabinet to the skid.
4. Remove the cardboard protector sheet and pieces.
5. Carefully lift the cabinet off the skid. It weighs approximately 82 Kg (180 lbs).

A.3 UNPACKING THE DECSCOPE

Figure A-2 illustrates the packaging of the VT52 DECscope. It is unpacked by simply lifting it out of the carton. It weighs approximately 20 Kg (44 lbs). The DECscope User's Manual contains instructions for inspection and checkout

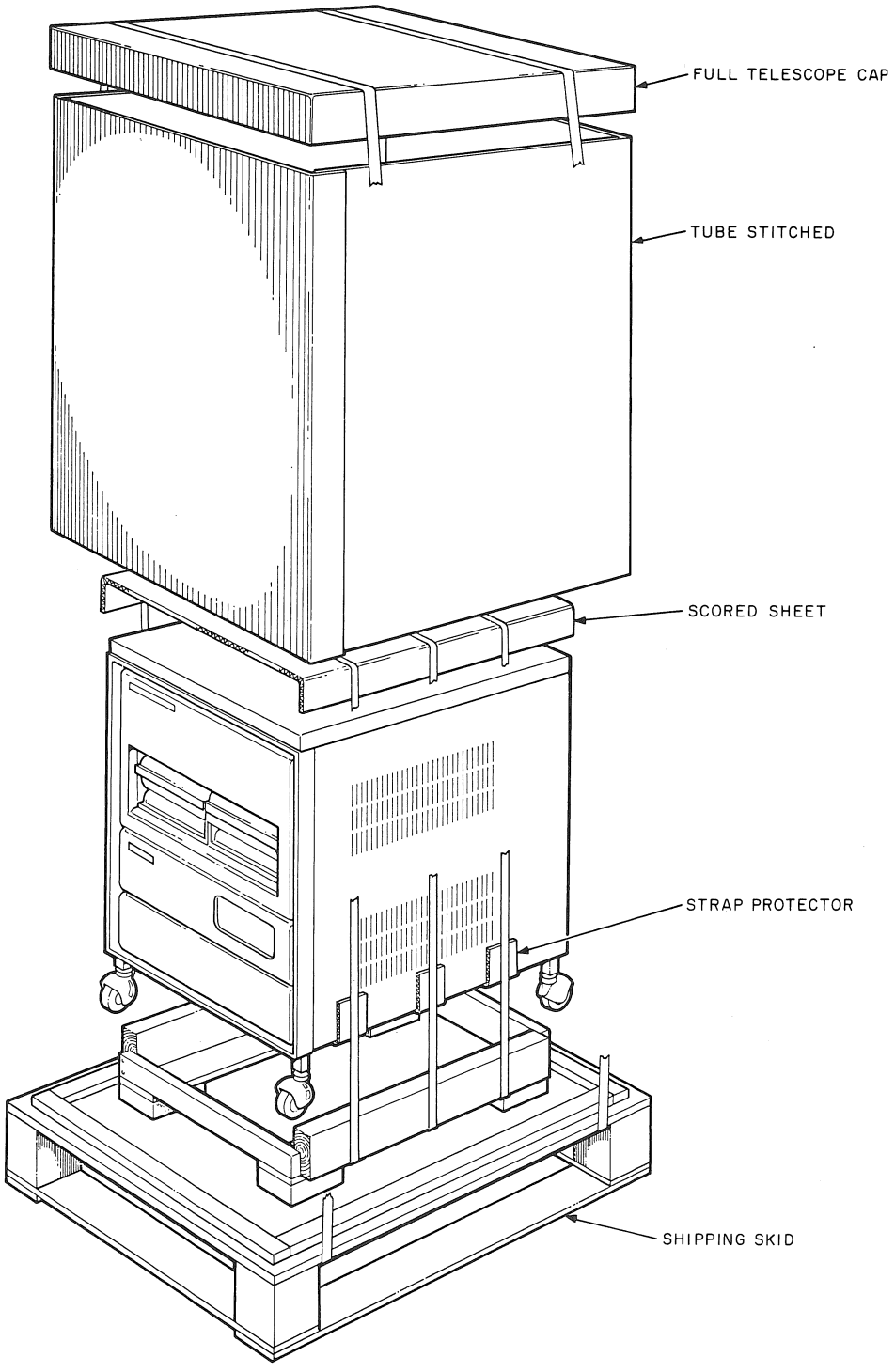


Figure A-1 PDP-11V03 Shipping Container

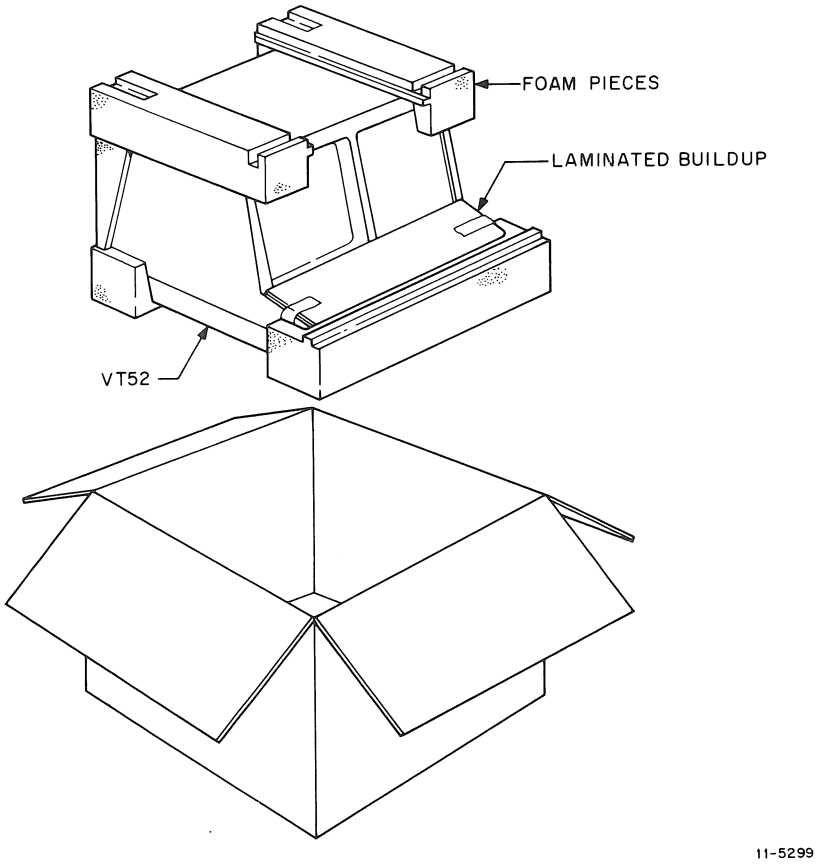


Figure A-2 DECscope Shipping Container

A.4 UNPACKING THE DECwriter II

Figure A-3 illustrates the packaging of the LA36 DECwriter II. It may be unpacked as follows.

1. Cut and remove the strapping that holds the shipping container to the skid.
2. Lift the cardboard tube and cap off the skid.
3. Remove all shock-absorbing and packing material from around the DECwriter II.
4. Remove the hex head bolts that secure the leg brace to the skid.
5. Remove the wooden brace and the foam from the legs of the DECwriter II.
6. Lift the DECwriter II off the skid. It weighs approximately 46.4 Kg (102 lbs).
7. Lift the top cover assembly. Clip and remove the nylon cable tie that secures the print head assembly (Figure A-4). Remove the caution tag.
8. Adjust the leveling feet on the legs of the DECwriter II.

Refer to the DECwriter II User's Manual for information on checkout.

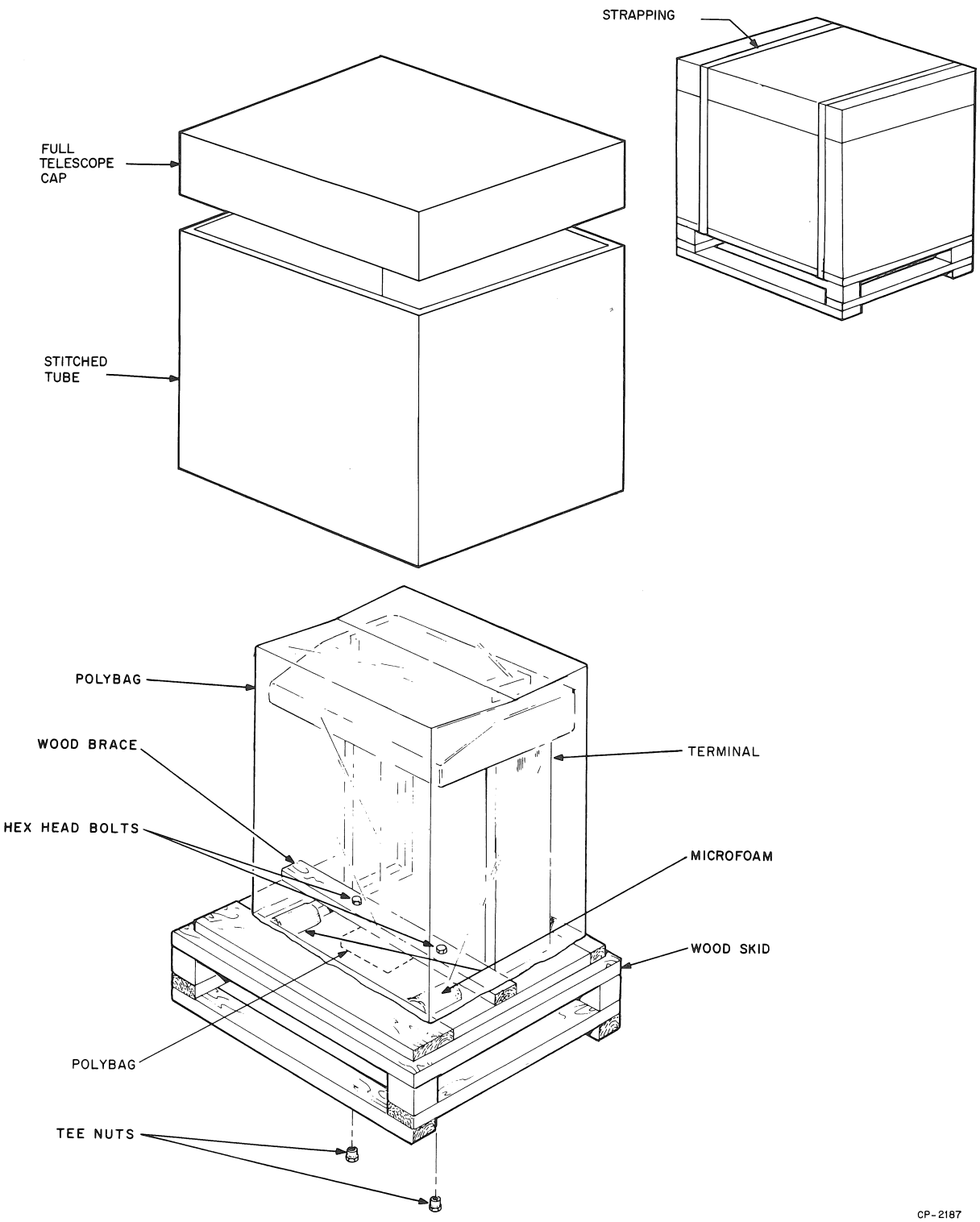


Figure A-3 DECwriter II Packaging

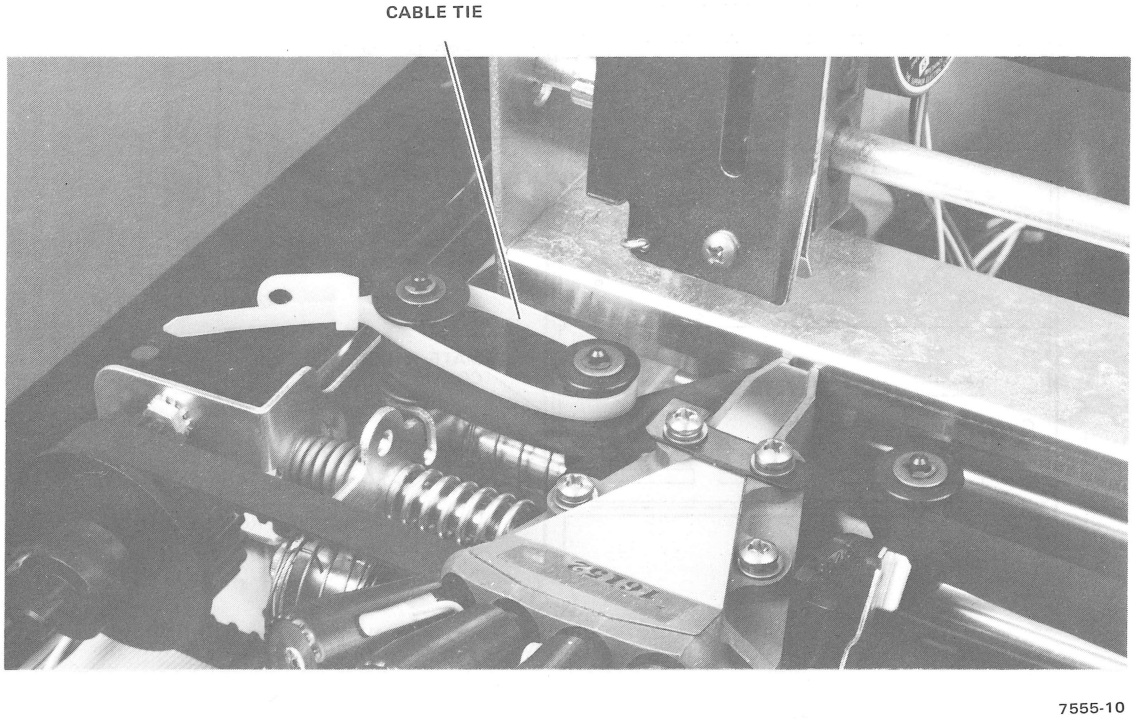


Figure A-4 Cable Tie Location

A.5 SYSTEM SET UP

When placing the computer cabinet at its operating location, allow at least 5 cm (2 inches) of space between the vented rear and right sides of the cabinet and any adjacent vertical surface. This is necessary for proper system cooling. The most critical elements in the system are the diskettes. These require an ambient operating temperature range of 15° to 32°C (59° to 90°F).

The VT52 DECscope requires air circulation through its louvers. Papers should not be allowed to block these louvers.

CAUTION

Do not place the DECscope on top of the computer cabinet with the keyboard extending beyond the front plane for operator knee room. The DECscope is deceptively light for its size and can be dislodged easily from this position. Serious equipment damage could result.

A.6 SYSTEM CONNECTIONS

The basic PDP-11V03 system is interconnected by a single cable from the terminal to the computer cabinet (Figure A-5). The only other connections to be made are the power cords from the computer cabinet and the terminal.

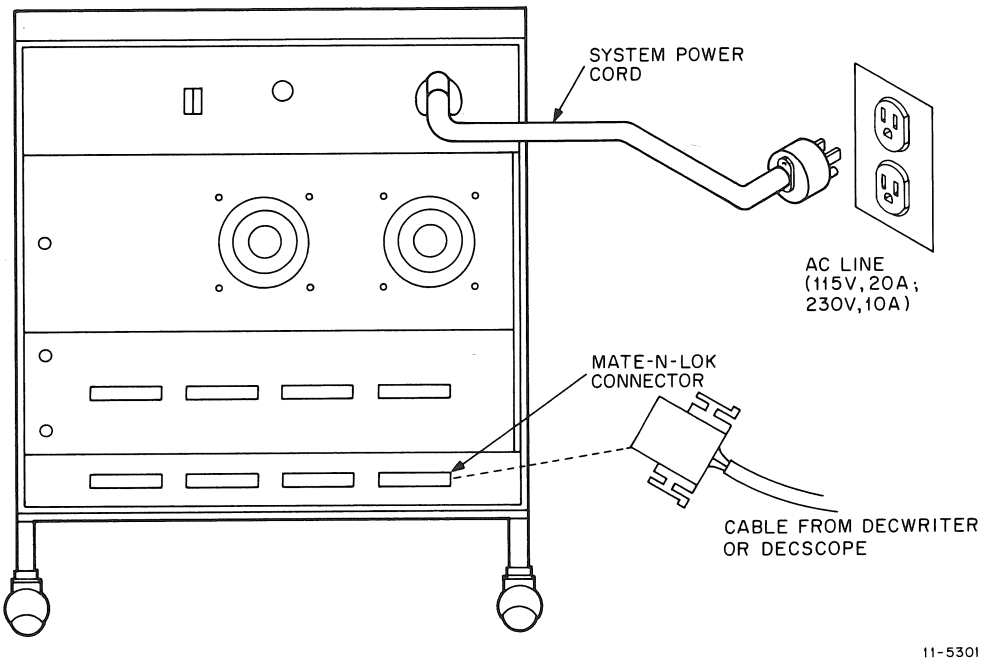


Figure A-5 System Interconnection

A.7 BAUD RATE SETTINGS

Systems ordered with a DECwriter II are configured at the factory to operate at 300 Baud. Systems ordered with a DECscope are configured to operate at 9600 Baud.

If it is desired to use a customer-supplied keyboard/printer with the system, ensure that the terminal (and its internal options, if applicable) are set for 300 Baud.

If a customer-supplied CRT terminal is used, ensure that it is set to 9600 Baud. The location of Baud rate selection switches for DECscopes is shown in Figure 2-8 and discussed in Paragraph 2.2.5.

Should it be necessary to change the Baud rate at which the system is intended to operate, refer to the DLV11 Serial Line Unit coverage in Microcomputer Handbook.

APPENDIX B
RELATED DOCUMENTS

B.1 HARDWARE DOCUMENTATION

RXV11 User's Manual EK-RXV11-OP-001
RX01/RX8/RX11 Floppy Disk System Maintenance Manual EK-RX01-MM-PRE2
Microcomputer Handbook EB 065831 76 090/53
MSV11-C User's Manual EK-MSV11-OP-001
LA36/35 DECwriter II User's Manual EK-LA365-OP
LA36 DECwriter II Maintenance Manual EK-OLA36-MM
DECscope User's Manual EK-VT5X-OP
VT52 DECscope Maintenance Manual EK-OVT52-MM
LSI-11 Programmer's Reference Card EK-04779-750200/53

B.2 OPERATING SYSTEM DOCUMENTATION

B.2.1 RT-11 Version 2

Getting Started With RT-11 (DEC-11-ORCPA-E)
RT11-System Reference Manual (DEC-11-ORUGA-C and addenda)
RT-11 System Generation Manual (DEC-11-ORGMA-A)
RT-11 Software Support Manual (DEC-11-ORPGA-B and addenda)
RT-11 System Message Manual (DEC-11-ORMEA-A)
RT-11 System Release Notes (DEC-11-ORNRA-A)
RT-11 System Reference Card (DEC-11-ORRCA-C-D)

B.2.2 RT-11 Version 3

Introduction to RT-11 (DEC-11-ORITA-A-D)
RT-11 System Message Manual (DEC-11-ORMEB-A-D)
RT-11 Documentation Directory (DEC-11-ORDDB-A-D)
RT-11 System Generation Manual (DEC-11-ORGMB-A-D)
RT-11 System Reference Card (DEC-11-ORRCB-A-D)
RT-11 System User's Guide (DEC-11-ORGDA-A-D)
RT-11 Advanced Programmer's Guide (DEC-11-ORAPA-A-D)
RT-11 System Release Notes (DEC-11-ORNRB-A-D)
RT-11 Software Support Manual (DEC-11-ORPGB-A-D)

B.3 OPTIONAL SOFTWARE DOCUMENTATION

Getting Started With BASIC/RT-11 (DEC-11-LBCLA-C)
BASIC/RT-11 Language Reference Manual (DEC-11-LBACA-D-D, DN1, DN2)
BASIC/RT-11 Release Notes (DEC-11-LBRNA-A-D)
Getting Started With RT-11 FORTRAN (DEC-11-LFGDA-B)
PDP-11 FORTRAN Language Reference Manual (DEC-11-LFLRA-C-D)
RT-11/RSTS/E FORTRAN IV User's Guide (DEC-11-LRRUA-A-D)
RT-11 FORTRAN Release Notes (DEC-11-LFRNA-A-D)
RT-11 FORTRAN Compiler (DEC-11-LRFPA-A)
FOCAL-11 User's Manual (DEC-11-LFOCA-F-D)
FOCAL-11 User's Manual Addendum (DEC-11-LFOCA-F-DN1)
BASIC Language Reference Manual (DEC-11-LIBBA-B-D)
MULTI-USER BASIC User's Manual (DEC-11-LSBRA-A-D)
MULTI-USER BASIC/RT-11 System Installation
Guide (DEC-11-LIBMA-A-D)
APL-11 Programmer's Reference Manual (DEC-11-LAPLA-A-D)
APL-11 Release Notes (DEC-11-LAPNA-A-D)

B.4 DIAGNOSTIC SOFTWARE DOCUMENTATION

XXDP User's Manual (MAINDEC-11 DZQXA-I-D)
DEC/X11 User's Documentation and Reference Guide (MAINDEC-11-DXQBA-U-D)

APPENDIX C
SYSTEM SPECIFICATIONS

C.1 MECHANICAL CHARACTERISTICS

Component	Height	Length	Width	Weight
H984-BA/B Computer Cabinet (including casters)	64 cm (25.5 in)	72 cm (28.1 in)	54 cm (21.5 in)	82 Kg (180 lbs) (with expander box fully loaded)
LA36 DECwriter II	85.1 cm (33.5 in)	60.7 cm (24.0 in)	69.9 cm (27.5 in)	46.4 Kg (102 lbs)
VT52 DECscope	36.0 cm (14.1 in)	69.0 cm (27.2 in)	53.0 cm (20.9 in)	20 Kg (44 lbs)

C.2 ELECTRICAL CHARACTERISTICS

Voltage:

104 – 126 Vac
or 209 – 254 Vac

Frequency:

50 Hz± 1 Hz
or
60 Hz± 1 Hz

Power Consumption:		Typical (or idle)	Maximum
Computer Cabinet	(115 V)	1100 W	1240 W
	(230 V)	1120 W	1265W
VT52 DECscope		110 W	110 W
LA36 DECwriter II		160 W	300 W

C.3 ENVIRONMENTAL CHARACTERISTICS

Temperature:

Operating	15° to 32° C (59° to 90° F) ambient; Maximum temperature gradient = 20° F/hr (11.1° C/hr)
Nonoperating	-35° to 52° C (-30° to +125° F)

NOTE

Diskette temperature must be within operating temperature range before use.

Relative Humidity:

Operating	25° C (77°F) maximum wet bulb 2° C (36° F) minimum dew point 20% to 80% relative humidity (no condensation)
Nonoperating	5% to 98% relative humidity (no condensation)
Diskettes, Nonoperating	10% to 80% relative humidity (no condensation)
Magnetic Field:	Diskettes exposed to a magnetic field strength of 50 Oersteds or greater may lose data.

C.4 Model Designations

System Model	Memory Size	Terminal Model	Input Power	PDP-11/03 Computer Model	RXV11 Disk Interface Model	System Cabinet
PDP-11V03-AA	8 K	VT52-AA	115 V/60 Hz	PDP-11/03-EA	RXV11-BA	H984-BA
PDP-11V03-AD	8 K	VT52-AB	230 V/50 Hz	PDP-11/03-EB	RXV11-BD	H984-BB
PDP-11V03-EA	8 K	LA36-DE	115 V/60 Hz	PDP-11/03-EA	RXV11-BA	H984-BA
PDP-11V03-ED	8 K	LA36-DJ	230 V/50 Hz	PDP-11/03-EB	RXV11-BD	H984-BB
PDP-11V03-FA	16 K	VT52-AA	115 V/60 Hz	PDP-11/03-KA	RXV11-BA	H984-BA
PDP-11V03-FB	16 K	VT52-AB	230 V/50 Hz	PDP-11/03-KB	RXV11-BD	H984-BB
PDP-11V03-FC	16 K	VT52-AC	115 V/50 Hz	PDP-11/03-KA	RXV11-BC	H984-BA
PDP-11V03-HA	16 K	LA36-DE	115 V/60 Hz	PDP-11/03-KA	RXV11-BA	H984-BA
PDP-11V03-HB	16 K	LA36-DJ	230 V/50 Hz	PDP-11/03-KB	RXV11-BD	H984-BB
PDP-11V03-HC	16 K	LA36-DH	115 V/50 Hz	PDP-11/03-KA	RXV11-BC	H984-BA

APPENDIX D
SYSTEM HARDWARE COMPONENTS

The basic PDP-11V03 System includes the following computer modules.

M7264	Processor	(KD11-F)
M7940	Serial Line Unit	(DLV11)
M7944	Memory	(MSV11-B)
or M7955	Memory	(MSV11-C)
M7946	Floppy Disk Control	(RXV11)
M9400-YA	Bootstrap and Terminator	(REV11-A)

The system can be expanded to increase the processor functions, enlarge the memory, and control more peripheral devices. Several optional modules are described in this section. For detailed information refer to Microcomputer Handbook or consult the Digital sales representative.

1. Processor Expansion – The KD11-F processor has a prewired 40-pin socket mounted on its printed circuit board that is reserved for the KEV11 option. This option increases the processor's capability to handle the Extended Instruction Set (EIS) and the Floating Point Instruction Set (FIS). The option is a 40-pin integrated circuit chip which is installed on the processor board and does not require any option position slots space on the backplane.

Option	Description
KEV11	Extended arithmetic option and includes fixed and floating point instructions.

2. Serial Line Unit – Each additional device that has serial data requires a DLV11 Serial Interface module and either a BC05M-04 cable or a BC03L-04 cable. The cable is connected from the module and mounted in a slot on the connector panel located on the back of the cabinet.

Option	Description
DLV11	An interface module for a 20mA current loop service or an EIA-compatible device. The DLV11 contains selectable baud rates from 50 to 9600 Baud.
BC05M-04	An interface cable to connect the DLV11 module through a Mate-N-Lok connector requiring a 20 mA current loop.
BC03L-04	An interface cable to connect the DLV11 module through an RS232-C male connector to a device requiring an EIA interface.

3. Parallel Line Units – Each additional device that has parallel data requires a DRV11 Parallel Interface module and two BC08R-XX (XX = 1, 3, 6, 10, 20, or 25 feet) cables assemblies.

Option	Description
DRV11	An interface with 16 input lines and 16 output lines for transferring 16-bit word or 8-bit byte programmed data transfers.
BC08R-XX	An interface cable with two 20-conductor ribbon cables and an H856 connector on each end. The cable connects between the DRV11 and the user device.

4. Memory – The basic 8K x 16 bit read/write memory system can be expanded up to a maximum of 28K x 16 bits of memory.

Option	Description
MSV11-B	A 4K x 16 bit MOS read/write memory module.
MRV11-AA	A module with sockets that allow the user to populate the board, using 512 x 4 bit PROM/ROM chips, up to 4K x 16 bit capacity.
MRV11-AC	The basic 512 x 4-bit PROM/ROM chip used to populate the MRV11-AA board.
MSV11-CD	A 16K x 16-bit MOS read/write memory that has self-refreshing circuits available on the module.

NOTE

If the MSV11-CD's internal refresh circuitry is used, the DMA refresh jumper on the REV11-A module must be removed. Refer to Microcomputer Handbook.

5. User-designed Expansion – A versatile wire wrap module is available for user-designed circuits. The module includes bus interface logic for operation with the LSI-11 processor and also provides adequate board area for custom circuitry.

Option	Description
DRV11-P	LSI-11 bus foundation module.

6. IEEE Instrument Bus Interface – This option interfaces the computer to instruments designed to IEEE Standard 488-1975 for Digital Interface for Programmable Instrumentation.

Option	Description
IBV11-A	An LSI-11 processor/IEEE Instrument Bus interface module.

7. Digital-to-Analog Converter – This D/A converter features a holding register for user control applications.

Option	Description
AAV11-A	A four-channel 12-bit digital-to-analog converter.

8. Analog-to-Digital Converter – This option can accommodate 16 single-ended or 8 quasi-differential inputs. Conversion is initiated by program control.

Option	Description
ADV11-A	A 12-bit successive approximation analog-to-digital converter.

9. Line Printer Option – Various models of the LA180 high-speed, low cost printer are available. The LA180 DECprinter is capable of printing from 60 to 400 lines per minute, depending on line length. It prints 180 characters per second.

Option	Description
LAV11	This option includes an LA180 DECprinter, a controller module, and an interface cable.

10. Expander Box – The basic system has two slot positions available for adding options. By adding an expander box the user has six additional slot positions available for a total of eight. The expander box is available in two versions, the BA11-ME is used with 115 Vac systems and the BA11-MF is used with 230 Vac systems. In addition to the expander box, a BCV1B-06 jumper cable/terminator assembly is required to connect the existing backplane to the backplane in the expander box. Some samples of an expanded system are shown in Appendix F.

Option	Description
BA11-ME	An expansion box that includes a backplane and a power supply for use in a 115 Vac system.
BA11-MF	An expansion box that includes a backplane and a power supply for use in a 230 Vac system.
BCV1B-06	The jumper cable/terminator assembly consists of two modules interconnected by a 6-foot, 40 conductor (H865-to-H856) connector cable.

APPENDIX E
SYSTEM SOFTWARE COMPONENTS

E.1 GENERAL

The major software components of the PDP-11V03 are the Operating System and Diagnostic System. The RT-11 software kit (QJ003-AY) includes programs for writing, editing, assembling, and de-bugging assembly language programs, disk-oriented file handling and maintenance routines, and device handlers for all options. The RXDP diagnostic and DEC/X11 exerciser programs (ZJ215-RY) provide the capability for separately checking the performance of all standard and/or optional PDP-11V03 devices as well as exercising the basic system and several file manipulating programs. The contents of these two software systems are listed in the sections that follow. For detailed information refer to:

RT-11 System Reference Manual (DEC-11-ORRUGA-C)

XXDP User Manual (MAINDEC-11-DZQXA-I-D)

DEC/X11 User's Documentation and Reference Guide (MAINDEC-11-DXQBA-U-D)

E.2 OPERATING SYSTEM SOFTWARE (QJ003-AY)

The RT-11 software is contained on two diskettes – DEC-11-ORTSA-E-YC1 and YC2.

E.2.1 DEC-11-ORTSA-E-YC1

Name	Description
(See RT-11 System Reference Manual for complete information)	
MONITR .SYS*	Disk Monitor (single job)
DXMNFB.SYS	Disk Monitor (foreground-background)
DP.SYS RK.SYS RF.SYS TT.SYS LP.SYS BA.SYS	Device handlers (See RT-11 System Reference Manual, Chapter 2 and Appendix H.)
BATCH.SAV*	Job control language for large and long-running programs
EDIT.SAV*	Text editor
MACRO.SAV*	Macro assembler (used with EXPAND)

*Designates items usable on basic 11V03 system

Name	Description
ASEMBL.SAV	Assembler without macro capability
EXPAND.SAV*	Processor for references in macro language source file
CREF.SAV	Used in conjunction with MACRO; produces listing with references to program symbols.
LINK.SAV	Converts object modules produced by assemblies into format suitable for loading and execution.
PIP.SAV*	File transfer program
PATCH.SAV	Permits modifying memory image (SAV) files
LIBR.SAV*	Permits creating, updating, modifying, listing, and maintaining library files
ODT.OBJ*	On-line Debugging Technique Program
VTHDLR.OBJ	Not applicable to 11V03 systems
DEMOFG.MAC	Demonstration foreground program
DEMOBG.MAC	Demonstration background program
SYSMAC.SML	Macro library file for 8K + systems
SYSMAC.8K*	Macro Library file for 8K systems

E.2.2 DEC-11-ORTSA-E-YC2

RKMNSJ.SYS RKMNFB.SYS RFMNSJ.SYS RFMNFB.SYS DPMNSJ.SYS DPMNFB.SYS DT.SYS	Monitors for non-11V03 systems
DX.SYS*	Device handler for RXV11 (used by MONITR)
CR.SYS MT.SYS MM.SYS PR.SYS PP.SYS CT.SYS DS.SYS	Device Handlers (See RT-11 Reference Manual, Chapter 2 and Appendix H.)

*Designates items usable on basic 11V03 system

Name	Description
FILEX.SAV	Permits converting files among file-formatted devices for various operating systems
SRCCOM.SAV*	Source compare program. Outputs difference between two ASCII files
DUMP.SAV*	Permits outputting Octal, ASCII, and RAD50 files on console device
PATCHO.SAV*	Permits modifying routines that are in OBJ format
SYSF4.OBJ	Concatenated set of object modules used to produce SYSLIB.OBJ
KB.MAC	General terminal driver

E.3 OPTIONAL SOFTWARE

Software Title	Option Number
BASIC/RT11	QJ920-AY
MULTI-USER BASIC/RT11	QJ921-AY
FORTRAN IV/RT11	QJ925-AY
SSP/11/RJ11	QJ960-AY
FOCAL/RT11	QJ922-AY
REMOTE-11/RT11	QJ945-AY
APL-11/RT11	QJ907-AY

E.4 DIAGNOSTIC SYSTEM SOFTWARE (ZJ215-RY)

Program Title	Program Code
AAV11 Diagnostic Test	MAINDEC-11-DVAAA-A-D
ADV11 Performance Test	MAINDEC-11-DVADA-A-D
DRV11B Diagnostic Test	MAINDEC-11-DVDRA-A-D
DRV11B Interprocessor Exerciser	MAINDEC-11-DVDRB-A-D
LSI-11 Basic Instruction Tests	MAINDEC-11-DVKAA-A-D
LSI-11 EIS Instruction Tests	MAINDEC-11-DVKAB-A-D
LSI-11 FIS Instruction Tests	MAINDEC-11-DVKAC-A-D

*Designates items usable on basic 11V03 system.

Program Title	Program Code
M.C. 0167	MAINDEC-11-DVAC-A1/01
LSI-11 Traps Test	MAINDEC-11-DVKAD-A-D
DLV11 Test	MAINDEC-11-DVKAE-B-D
DRV11 Test	MAINDEC-11-DVKAF-B-D
LSI-11 4K System Exerciser	MAINDEC-11-DVKAH-A-D
KWV11A Diagnostic	MAINDEC-11-DVKWA-A-D
DEC/X11 Monitor Module Library	MAINDEC-11-DXQLA-G-D
M.C. 0664	MAINDEC-11-DXQLA-G105
DEC/X11 General Products Module Library No. 1	MAINDEC-11-DXQLB-K-B
DEC/X11 General Products Module Library No. 2	MAINDEC-11-DXQLC-K-D
DEC/X11 Communication Option Module Library No. 1	MAINDEC-11-DXQLD-L-D
DEC/X11 Lab and Industrial Options Module Library No. 2	MAINDEC-11-DXQLG-1-D
DEC/X11 New Options Library No. 2	MAINDEC-11-DXQLI-E-D
MOS/Core Memory Exerciser For 0 to 124K with or without parity bits	MAINDEC-11-DZKMA-B-D
LA36 Terminal (DL11 and KL11 interface)	MAINDEC-11-DZLAC-C-D
M.C. 0236	MAINDEC-11-DZLAC-C1/01
PDP-11 ROM Bootstrap Terminator (M9301 M9400)	MAINDEC-11-DZM9A-A-D

Program Title	Program Code
RX11 System Reliability Test	MAINDEC-11-DZRXA-E-D
RX11 Interface Diagnostic	MAINDEC-11-DZRXB-E-D
VT50A, B, M 52 Acceptance Test	MAINDEC-11-DZVTC-C-D
M.C. 0243	MAINDEC-11-DZVTC-C1/02
M.C. 0377	MAINDEC-11-DZVTC-C2/03
RXDP No. 7 System Exerciser No. 1	MAINDEC-11-DZZGG-D-YB
RXDP No. 25 LSI Floppy 11V03	MAINDEC-11-DZZGY-C-YB
RXDP No. 31 LSI-11 Floppy No. 2	MAINDEC-11-DZZHE-A-YB

APPENDIX F
SYSTEM CONFIGURATION AND EXPANSION

F.1 PRIORITY CHAINING

Device priority is determined by the position of the module in the computer backplane. A signal passes through each module in turn forming a "daisy chain" through them. The closer a module is to the processor, the higher its hardware priority in the daisy chain. Figure F-1 shows the priority of the backplane slots, the numbers in circles indicating order. The priority chaining scheme requires that there be no empty slots between modules, as this would break the chain.

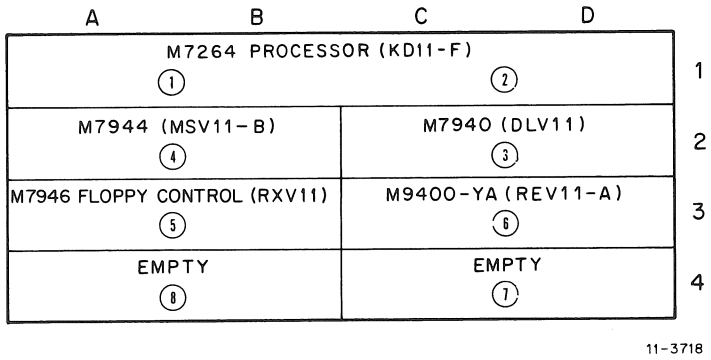


Figure F-1 PDP-11V03 Basic System Backplane – Module Side

F.2 BUS TERMINATION

The REV11-A bootstrap and terminator module must be the last module (lowest priority) after all options are installed. When installing optional modules the user must remove the REV11-A module (labeled M9400-YA), install the options in consecutive order of slot positions, and then install the REV11-A module in the next slot position available.

The REV11-A is a direct memory access (DMA) module. If an additional DMA module is to be installed, there are several constraints which must be observed. Refer to Microcomputer Handbook for the details of REV11-A installation.

F.3 EXPANSION

Figure F-2 shows two varieties of 16K PDP-11V03 systems. Models 11V03-A and 11V03-E use three 4K MSV11-B memory modules. These are refreshed by the REV11-A module. Models 11V03-F and 11V03-H use one 16K MSV11-CD memory module. This module has its own refresh circuitry.

M7264 PROCESSOR (KD11-F)	
M7944 4K MEMORY (MSV11-B)	M7944 4K MEMORY (MSV11-B)
M7944 4K MEMORY (MSV11-B)	M7940 SERIAL LINE UNIT (DLV11)
M9400-YA BOOT/TERMINATOR (REV11-A)	M7946 FLOPPY DISK CONTROLLER (RXV11)

(a.) 11V03-A/E 16K SYSTEM

KD11-R PROCESSOR (M7264-YA) + (M7955-YD)	
M7940 SERIAL LINE UNIT (DLV11)	M7946 FLOPPY DISK CONTROLLER (RXV11)
SPARE	M9400-YA BOOT/TERMINATOR (REV11-A)

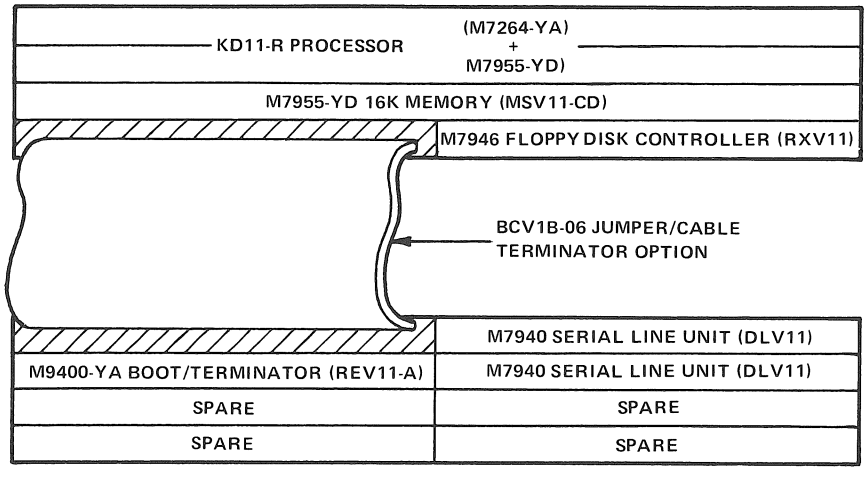
(b.) 11V03-F/H 16K SYSTEM

11-5302

Figure F-2 Examples of 16K x 16-Bit Systems

Either system can be expanded by using a BCV1B-06 expander cable and a BA11-ME or MF expander box. The BCV1B plugs into the last slot of the computer backplane and the first slot of the expander box backplane (Figure F-3). Two double-height slots are used, and should be subtracted from the total number of slots available.

MSV11-B memories should not be used as bank zero if it is desired to "power up" to an active program. If MSV11-B and MSV11-CD memories are mixed in the same system, the MSV11-CD's internal refresh circuit should be disabled. Refer to MSV11-C User's Manual (part number EK-MSV11-OP).



11-5303

Figure F-3 2K Two-User Expanded System

Reader's Comments

PDP-11V03 System Manual
EK-11V03-TM-002

Your comments and suggestions will help us in our continuous effort to improve the quality and usefulness of our publications.

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What faults do you find with the manual? _____

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Would you please indicate any factual errors you have found. _____

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