

VAX-11/730 Hardware User's Guide

VAX-11/730 Hardware User's Guide

Prepared by Educational Services
of
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CHAPTER 1 INTRODUCTION

1.1 SCOPE

The *VAX-11/730 Hardware User's Guide* contains the basic hardware operating information and customer care procedures. It provides an overview of the system and peripheral hardware and serves as a general reference document for the console operator. This manual consists of three chapters that provide the following information.

- Chapter 1 – An introduction to the system hardware and documentation.
- Chapter 2 – Descriptions of system controls and indicator functions, hardware operation, procedures for booting and starting the VMS operating system (VAX/VMS), and console commands.
- Chapter 3 – Describes procedures and precautions that must be followed to ensure that regular user-level maintenance is properly performed. Lists the problems that may occur in the system peripheral devices.

1.2 THE VAX-11/730 SYSTEMS

There are two main VAX-11/730 system configurations; VAX-11/730 System 1 and 2 (Figure 1-1) and VAX-11/730 SBB (system building block, Figure 1-2). The subsystems for these system configurations are listed below:

VAX-11/730 System 1 and 2

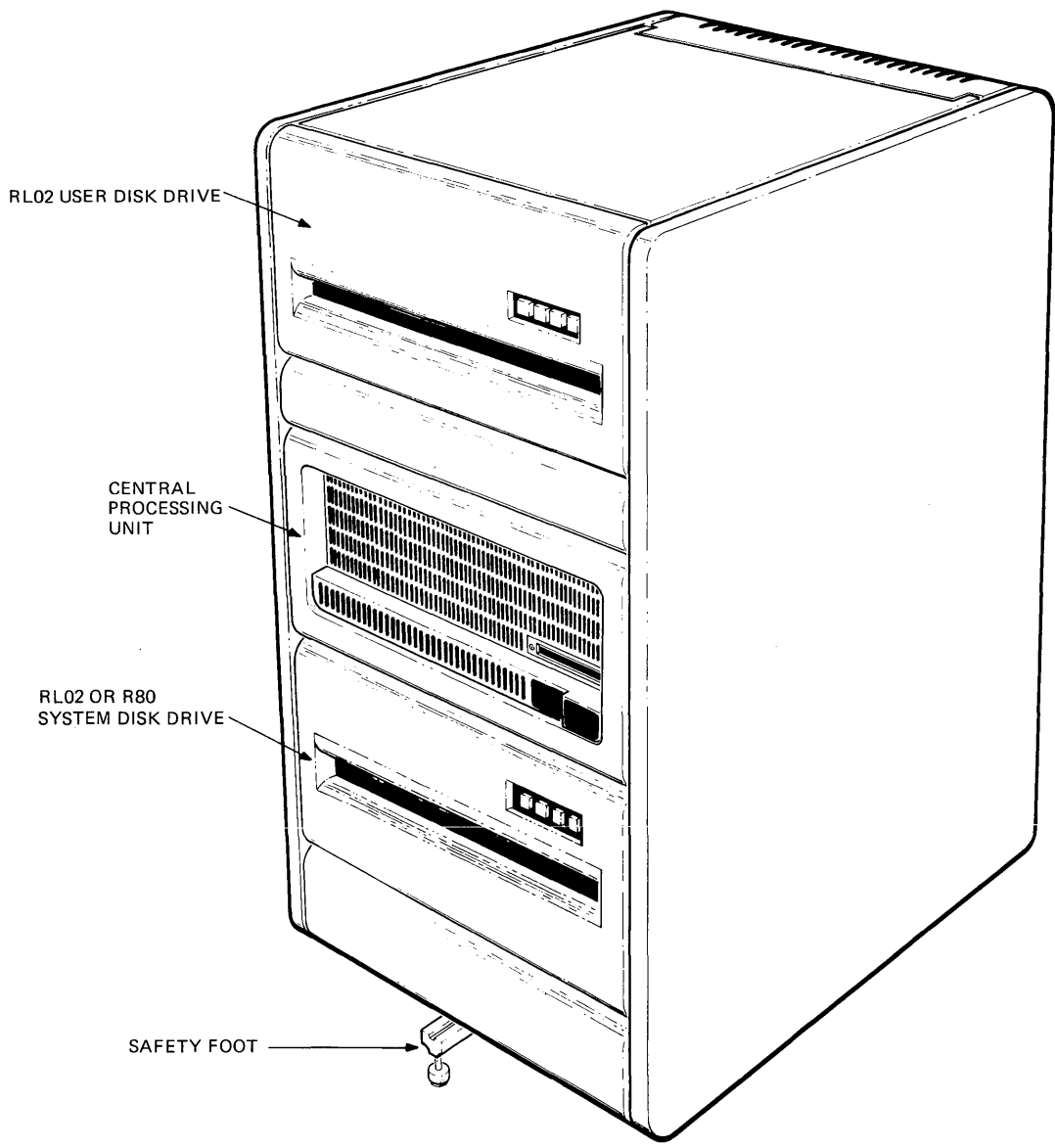
- The user drive device (RL02 disk drive)
- The central processing unit (CPU)
- The system drive device (RL02 and R80 disk drive)

VAX-11/730 SBB

- The user drive device (RA60, RA80 or RA81 disk drive, or the TU80 tape drive)
- The central processing unit (CPU)
- The system drive device (RA60, RA80 or RA81 disk drive)

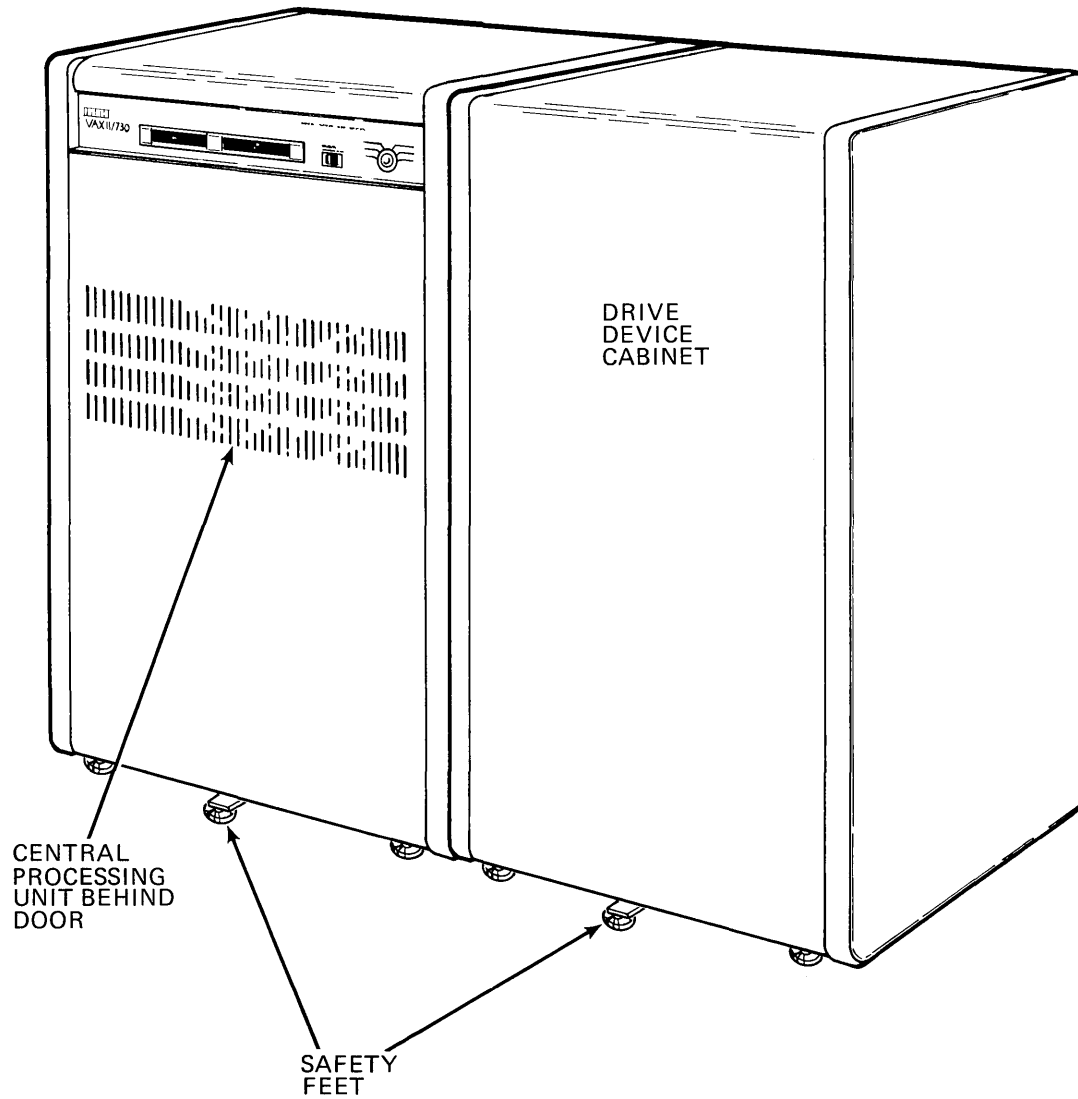
The VAX-11/730 System 1 and 2 is available in two standard configurations that provide a choice of two disk drives for the system drive.

1. System 1 – Contains two RL02 removable-media disk drive units, one for the user disk and one for the system drive.
2. System 2 – Contains one R80 fixed-media disk drive for the system disk and one RL02 disk drive for the user drive.



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Figure 1-1 The VAX-11/730 System 1 and 2



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Figure 1-2 The VAX-11/730 SBB

The VAX-11/730 SBB is available in six standard configurations that provide a choice of three disk drives for the user drive, and one tape drive or one disk drive for the system drive.

1. One RA80 fixed-media disk drive for the system drive and either one TU80 tape drive or one RA60 removable-media disk drive for the user drive.
2. One RA81 fixed-media disk drive for the system drive and either one TU80 tape drive or one RA60 removable-media disk drive for the user drive.
3. One RA60 removable-media disk drive for the system drive and either one TU80 tape drive or one RA60 disk drive for the user drive.

Table 1-1 is a list of VAX-11/730 system hardware manuals and related reference handbooks. Table 1-2 lists manuals that are available for the standard peripheral subsystems.

Table 1-1 VAX-11/730 System Hardware Manuals

Title	Document Number
<i>VAX-11/730 Central Processing Unit Technical Description</i>	EK-KA730-TD
<i>VAX-11/730 Memory System Technical Description</i>	EK-MS730-TD
<i>VAX-11/730 FP730 Floating-Point Accelerator Technical Description</i>	EK-FP730-TD
<i>VAX-11/730 Integrated Disk Controller Technical Description</i>	EK-RB730-TD
<i>VAX Diagnostic System User's Guide</i>	EK-VX11D-UG
<i>VAX-11/730 Installation Guide</i>	EK-SI730-IN
<i>VAX-11/730 Diagnostic System Overview Manual</i>	EK-DS730-UG
<i>DIGITAL Site Preparation Guide</i>	EK-OCORP-SP
<i>H7202B Power Supply Technical Description</i>	EK-PS730-TD
<i>VAX Architecture Handbook</i>	EB-21811
<i>VAX Hardware Handbook</i>	EB-21711
<i>DMF32 Multi-Function Communications User's Guide</i>	EK-DMF32-UG
<i>BA11 Mounting Box and Power System Technical Description</i>	EK-BA11-A-TM
<i>UDA50 User's Guide</i>	EK-UDA50-UG
<i>UDA50 Service Manual</i>	EK-UDA50-SV
<i>KC730 Remote Diagnostics Option Technical Manual</i>	EK-KC730-TM

Table 1-2 VAX-11/730 Peripheral Manuals

Title	Document Number
<i>LA120 Technical Manual</i>	EK-LA120-TM
<i>LA120 User Guide</i>	EK-LA120-UG
<i>LA120 Operator Reference Card</i>	EK-LA120-RG
<i>Letterwriter 100 Installation Guide</i>	EK-LW100-IN
<i>Letterwriter 100 Operator Guide</i>	EK-LW100-OP
<i>LA100 Programmer Reference Manual</i>	EK-LA100-RM
<i>LA100 Series Pocket Service Guide</i>	EK-LA100-PS
<i>LA100 Series Technical Manual</i>	EK-LA100-TM
<i>TU58 DECTape II Technical Manual</i>	EK-0TU58-TM
<i>TU58 DECTape User's Guide</i>	EK-0TU58-UG
<i>RL01/RL02 Disk Drive Technical Manual</i>	EK-RL012-TM
<i>RL01/RL02 Disk Drive User's Guide</i>	EK-RL012-UG
<i>R80 Disk Drive Technical Description</i>	EK-00R80-TD
<i>R80 Disk Drive User's Guide</i>	EK-00R80-UG
<i>R80 Disk Drive Service Manual</i>	EK-00R80-SV
<i>R80 Pocket Service Guide</i>	EK-00R80-PS
<i>RA80 Disk Drive User's Guide</i>	EK-0RA80-UG
<i>RA80 Disk Drive Service Manual</i>	EK-0RA80-SV
<i>RA81 Disk Drive User's Guide</i>	EK-0RA81-UG
<i>RA81 Disk Drive Service Manual</i>	EK-0RA81-SV
<i>RA60 Disk Drive User's Guide</i>	EK-0RA60-UG
<i>TU80 Tape Subsystem Technical Manual</i>	EK-0TU80-TM
<i>TU80 Pocket Service Guide</i>	EK-0TU80-PS
<i>TU80 Pathfinder User's Guide</i>	EK-0TU80-SV
<i>TU80 Subsystem User's Guide</i>	EK-0TU80-UG

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CHAPTER 2 OPERATION

2.1 GENERAL

This chapter describes system indicators, control switch functions, and how to boot the VMS operating system from the console terminal. It also provides procedures for setting up and operating the following subsystems:

- LA120 and LA100 console terminals
- RL02, R80, RA80, RA81 and RA60 disk drives
- TU80 tape drive.

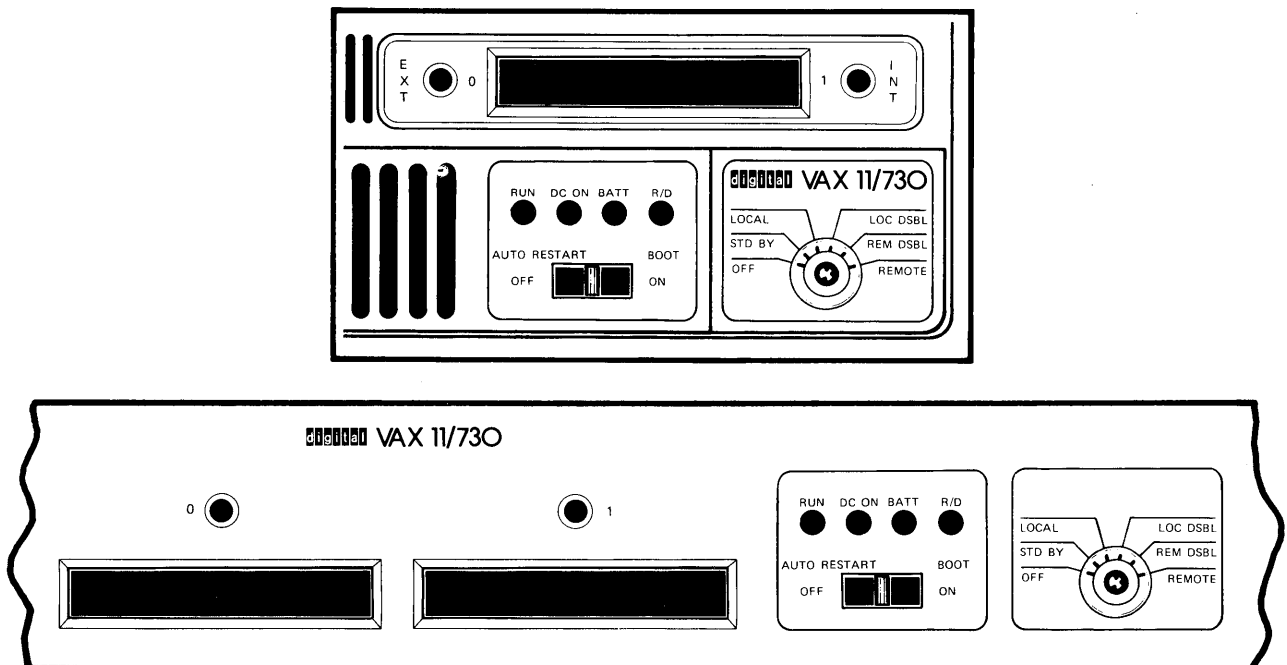
2.2 CPU CONTROL AND INDICATORS

Figure 2-1 shows both VAX-11/730 system CPU controls and indicators and the TU58 tape drive cartridge slots. The VAX-11/730 System 1 and 2 control panel contains only one TU58 tape drive cartridge slot. The second cartridge slot is located on the right side of the CPU and is accessed when the CPU drawer is slightly extended from the cabinet. This slot normally contains the console tape cartridge.

The VAX-11/730 SBB control panel contains both TU38 tape drive cartridge slots. The slot marked "1" normally contains the console tape cartridge.

CAUTION

The safety foot **MUST** be extended before any slide-mounted devices are extended.



TK 11211

Figure 2-1 CPU Control Panels

2.2.1 The Console Subsystem

The VAX-11/730 CPU features a console subsystem that allows the CPU to be controlled from the console terminal. The console terminal serves as the local input device to the system and takes the place of most of the switches and indicators normally found on a CPU front panel.

2.2.2 CPU Indicators

Four LED indicators display the CPU operating conditions described in Table 2-1.

Table 2-1 CPU Indicators

Indicator	Function
RUN	ON – The CPU is in program mode and is running the main memory program. OFF – The main memory program is halted and the CPU is in console mode. The console subsystem responds to console commands typed on the console keyboard.
DC ON	ON – All dc power supply voltages are within specified limits. Blinking – One or more dc supply voltages is out of tolerance.
BATT	Indicates condition of battery backup unit (BBU). <ul style="list-style-type: none">• Constantly lit: BBU fully charged.• Blinking slowly: BBU charging.• Blinking fast: BBU discharging.• Off: BBU not present or not active.
R/D	Blinking – The CPU key switch is in the REMOTE position to establish communication with the remote diagnostic operator. This indicator works only when the system is equipped with the remote diagnostic option. ON – The CPU is under the control of the remote diagnostic operator. Local control may then be reenabled by commands from the remote operator. OFF – Normal operation.

2.2.3 CPU Power and Control Switch

The key-operated power switch has six positions that have the functions described in Table 2-2.

2.2.4 AUTO RESTART Switch

The console subsystem tests the ON and OFF state of the switch following a system power-up sequence or a program halt condition. A general description of the functions is provided in Table 2-3.

2.2.5 TU58 Cassette Tape Drives

There are two tape motion indicators, one on either side of the external tape cartridge slot shown in Figure 2-1.

Table 2-2 CPU Power Switch Functions

Position	Function
OFF	Switched ac power is turned off inside the system cabinet (unswitched power is still applied).
STANDBY (STDBY)	Minimum CPU power is applied to maintain all data in the console, writeable control store (WCS), main memory, and time-of-year clock.
LOCAL	<p>This is the normal ON position. All power is applied and the operator controls the system from the console terminal as follows.</p> <p>Console mode – The operator performs console commands.</p> <p>Program mode – The operator communicates with the system program. A CTRL/P character is not passed to the program, but halts the program and returns the CPU to the console mode.</p>
LOCAL DISABLE (LOC DSBL)	<p>CPU functions are the same as for the LOCAL position except as follows.</p> <p>Console mode – Inputs from the console keyboard are ignored. The momentary BOOT position of the Auto Restart switch is also ignored.</p> <p>Program mode – A CTRL/P character is passed to the program and does not halt the CPU.</p>
REMOTE	<p>REMOTE is used to establish and hold communications with a remote operator at a DIGITAL diagnostic center (DDC). The local operator has control of the system until the remote operator takes control. The local keyboard may then be reenabled by the remote operator to allow the local operator to have different levels of access.</p> <p>CPU functions for the local operator are the same as for the LOCAL position depending on the level of access granted by the remote operator.</p> <p>Console mode – The local operator may perform console commands.</p> <p>Program mode – A CTRL/P halts the program and returns the CPU to the console mode.</p>
REMOTE DISABLE (REM DSBL)	<p>CPU functions are the same as for the REMOTE position, depending on the level of access granted by the remote operator.</p> <p>Console mode – Inputs from the local keyboard are ignored. The momentary BOOT position of the Auto Restart switch is also ignored.</p> <p>Program mode – A CTRL/P character is passed to the program and does not halt the CPU.</p>

Table 2-3 Auto Restart Switch Functions

Position	Function
OFF	The CPU is placed in the console mode after the microcode is loaded from the TU58 on a power-up sequence or when a running program is halted. The operator may perform console commands or may bootstrap and run programs using the console terminal keyboard.
ON	<p>After the microcode is loaded on a power-up sequence, the console subsystem loads and executes the default bootstrap command file DEFBOO.COMD from the TU58.</p> <p>The first bootstrap command file then loads the main bootstrap program VMB.EXE from the TU58 to memory. VMB.EXE then loads and starts the VAX/VMS operating system.</p>
BOOT	<p>Moving the switch to the momentary BOOT position, when in the console mode idle state, loads the default bootstrap command file DEFBOO.COMD and begins the same sequence of events as for the ON position.</p> <p>Following the ON or BOOT sequence above, when the system is running in the program mode, the switch is left in the ON position to enable the warm restart facility if any of the following actions are desired.</p> <ul style="list-style-type: none">• A system reboot following a power loss• Program recovery following a program halt• A warm restart of the current program when the CPU power switch is turned from STD BY to LOCAL. (The current program remains intact if the CPU power switch is turned only to STD BY and not to OFF.)

The EXT (unit 0) indicator is lit when the external drive is in motion. The external drive allows the operator to:

- Load or store user-created programs or data
- Bootstrap, load, or update the software, diagnostics, or microcode
- Build the system disk.

The INT (unit 1) indicator is lit when the internal drive is in motion. The console tape normally remains inserted in the internal drive located on the right side of the CPU chassis. If system power has been completely removed, console and writeable control store (WCS) data is loaded from the console tape when system power is restored.

The console defaults to the internal drive if no drive is specified by the operator. It may also be used by the operator with, or as backup for, the external drive.

2.2.5.1 Cartridge Loading and Unloading – To insert a cartridge, hold it with the label side up and the baseplate down as shown in Figure 2-2. Align it with the grooves in the slot, slide it straight in, and seat it firmly. To remove the cartridge, pull it straight out. Be careful not to remove the cartridge while the tape motion indicator is on, or data may be lost.

2.2.5.2 RECORD Tab – Each cartridge has a movable RECORD tab as shown in Figure 2-2. The TU58 write circuitry is disabled when the tab is moved away from the edge of the cartridge. This prevents unintended write operations.

When the RECORD tab is moved toward the edge of the cartridge, it closes a switch in the drive that allows data to be written. The operator should be sure that system or program tapes have backup copies before loading them with the tab set in the RECORD position.

The RECORD tab may be removed for long-term write protection. On metal-base cartridges, lift the tab with a fingernail under the protruding end. Replace it by placing it in its slot and pressing it in until it snaps. On plastic-base cartridges, pry the tab from the back edge slightly, then lift it from the front. Replace it by placing it in the slot and pressing forward and down.

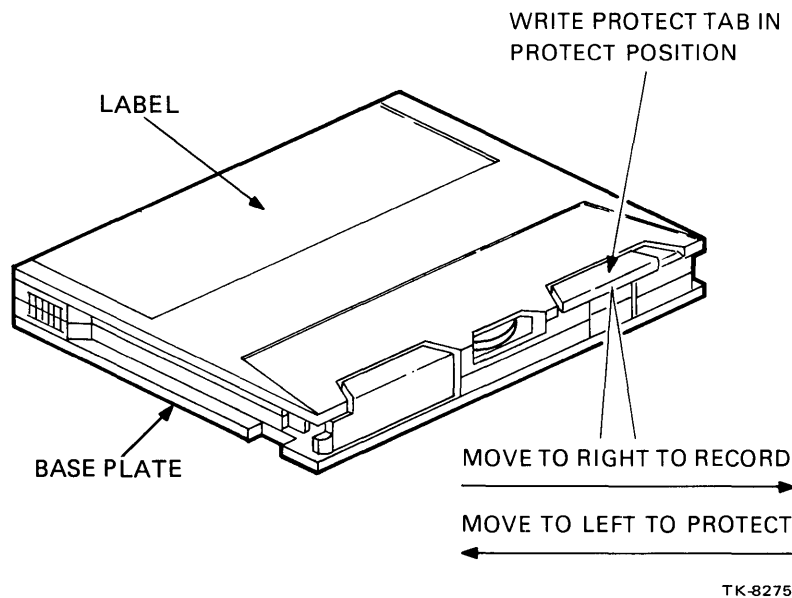
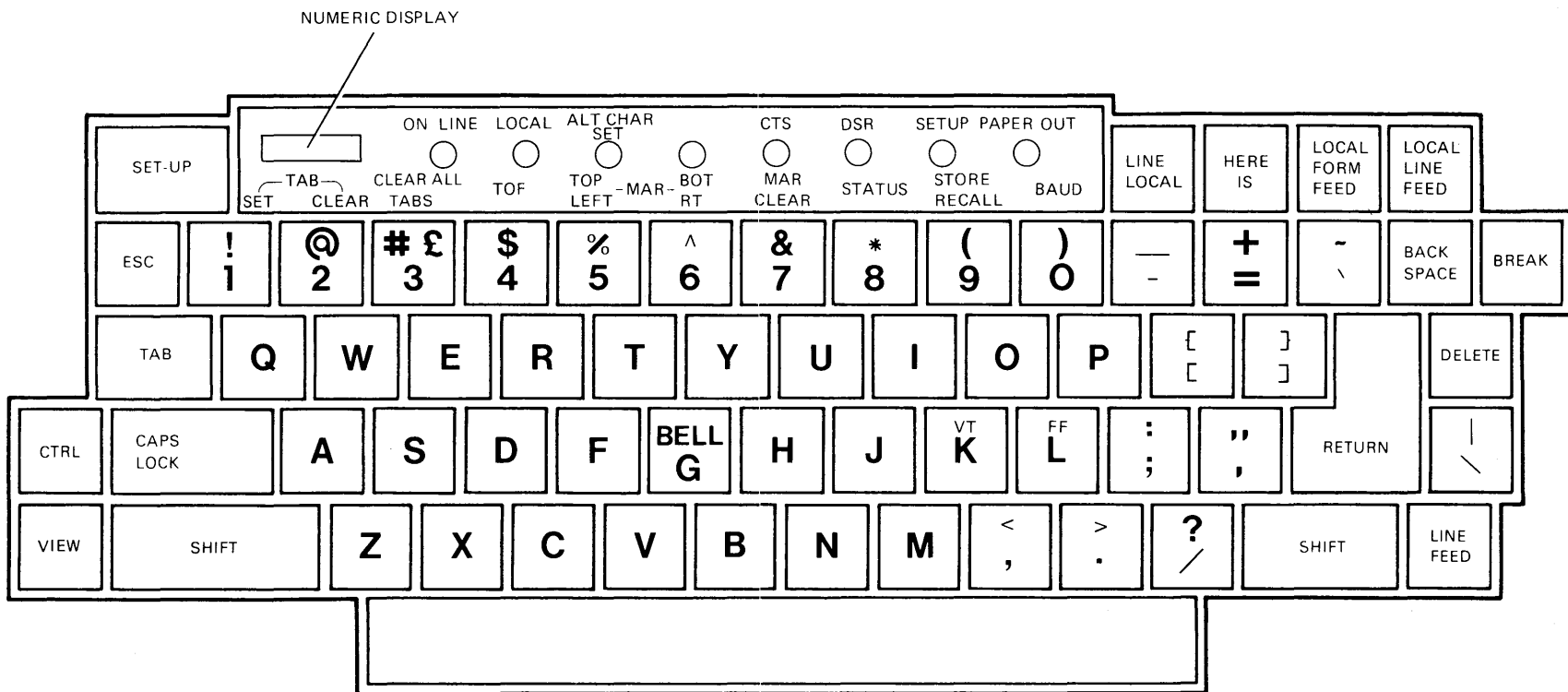


Figure 2-2 TU58 Cassette Tape Cartridge

2.3 LA120 CONSOLE TERMINAL

This section describes how to set up and operate the LA120 terminal on the VAX-11/730 system. For a complete description of the terminal's features, refer to the *LA120 User Guide*, (EK-LA120-UG).

Figure 2-3 shows the LA120 keyboard and control panel which contains a four-digit numeric display and seven indicators.



TK-8270

Figure 2-3 LA120 Keyboard and Control Panel

2.3.1 LA120 Indicators

When they are lit, seven LED indicators display the LA120 operating conditions described in Table 2-4.

Table 2-4 LA120 Indicators

Indicator	Function
ON LINE	The LA120 terminal is on-line. The terminal transmits keyboard characters to the CPU and receives printer characters. Characters typed on the keyboard are transmitted back to the printer by the program.
LOCAL	The LA120 keyboard is locally connected to the printer. The terminal is off-line and does not receive or transmit characters.
ALT CHAR SET	The alternate character set is enabled (in terminals optionally equipped with a foreign language character set).
CTS*	Data transmission is enabled (Clear To Send).
DSR*	The modem is in data mode (Data Set Ready).
SETUP	Blinks when the LA120 terminal is in the set-up mode.
PAPER OUT	Blinks when the LA120 terminal is disabled by one of the following conditions. <ul style="list-style-type: none">• The printer is out of paper• The cover is open• The print head is jammed
NUMERIC DISPLAY	During normal operation, indicates the horizontal column position of the print head. In set-up mode, the vertical line position is also indicated by pressing the SHIFT key.

*Used in terminals connected to a modem.

2.3.2 LA120 Control Keys

There are several control keys that do not transmit characters. Their functions are described in Table 2-5.

2.3.3 LA120 Set-up Functions

The terminal should be placed in the local mode to avoid transmitting characters while making changes in the set-up mode.

Table 2-5 LA120 Control Keys

Key	Function
SHIFT	When used with a character producing key, the key's uppercase character is transmitted. (The lowercase character is normally transmitted.)
CTRL	When used with a character producing key, the key's control character is transmitted. Use of the CTRL key is generally expressed as follows. CTRL/K = Press and hold the CTRL key and press the letter "K" key on the keyboard.
CAPS LOCK	When set, causes the alphabet keys to transmit uppercase characters regardless of the SHIFT key. Does not affect the number or symbol keys.
LINE/LOCAL	Changes the LA120 terminal to the on-line mode or local mode as displayed by the indicators.
LOCAL LINE FEED	Advances the paper one line at a time.
LOCAL	Advances the paper to the top-of-form position, or to form feed the top margin (if the top margin is set).
VIEW	Allows the operator to view the last character printed if the last-character-view feature is disabled.

There are two ways to enter and exit the set-up mode.

1. Press and hold the SET-UP key.
Make the changes.
Release the SET-UP key.
2. Press and hold the CTRL key and press the SET-UP key.
The terminal stays in set-up mode while changes are made.
Permanently store the changes if desired.
Press the SET-UP key and release it.

Most of the keys on the console keyboard have set-up functions. The functions for the top row of keys and some other commonly used features are briefly described in Table 2-6.

In set-up mode, the numeric display shows the current column number. When the SHIFT key is pressed, it shows the current vertical line number.

Table 2-6 LA120 Set-up Functions

Key	Name	Function
1	TAB SET	Sets horizontal tab at the current column. When used with the SHIFT key, sets vertical tab on the current line.
2	TAB CLEAR	Clears horizontal tab at the current column. When used with shift, clears vertical tab on the current line.
3	CLEAR ALL	Clears all tabs, horizontal and vertical.
4	TOF	<p>Resets the vertical line counter to line 1. Top-of-form (TOF) defines the first line after the perforation when fanfold paper or forms are loaded.</p> <p>If the top margin is set, the paper moves to the top margin (the first printable line) when the form feed command is sent by the computer or LOCAL FORM FEED is pressed.</p> <p>To avoid setting top-of-form each time the printer is turned on or the paper is changed, press LOCAL FORM FEED before turning off the system or the printer.</p>
5	TOP/LEFT MAR	Sets left margin at the current column. When used with the SHIFT key, sets top margin on the current line.
6	BOT/RT MAR	Sets right margin at the current column. When used with the SHIFT key, sets bottom margin on the current line.
7	MAR CLEAR	Clears left and right margins. When used with the SHIFT key, clears top and bottom margins.
8	STATUS	Prints a message that shows the state of the currently selected set-up features. (See the <i>LA120 User Guide</i> for a description of the letter key functions given by the printout.)
9	STORE/RECALL	Cancel all temporary set-up features and recalls the permanently stored features. When used with the SHIFT, permanently stores the currently selected set-up features.
0	BAUD	<p>Press once to view the current transmit and receive baud rate in the numeric display. Pressing the key again changes the baud rate until the desired rate is indicated in the numeric display.</p> <p>This value should not be changed because the CPU responds only to a fixed rate. The factory setting is for 300 baud. The CPU is switch selectable to 1200, 2400, or 9600 baud but should not be changed except by authorized service personnel.</p>

Table 2-6 LA120 Set-up Functions (Cont)

Key	Name	Function
G	Volume	Press once to view the current setting in the numeric display. Press again to set the desired bell and keyclick volume as indicated in the numeric display. 1 = High volume 0 = Low volume
K	Keyclick	Press once to view the current setting in the numeric display. Press again to enable or disable the keyclick feature as indicated in the numeric display. 1 = Enabled 0 = Disabled
Z	View Last Character	Press once to view the current setting in the numeric display. Press again to enable or disable the last character view feature as indicated in the numeric display. 1 = Enabled 0 = Disabled

2.3.4 Print Head Positioning

The following methods may be used in the set-up mode to position the print head for setting or clearing the margins or tabs.

Horizontal Margins and Tabs

1. First clear the horizontal margins (and the horizontal tabs, or use CLEAR ALL) and press RETURN.
2. Use the SPACE bar first to set the left margin, then use it to set the horizontal tabs and right margin.
3. The TAB key may then be used to find and clear horizontal tabs or to find the right-hand margin. (When found this way, the actual right margin is one column less than indicated by the numeric display.)

Vertical Margins and Tabs

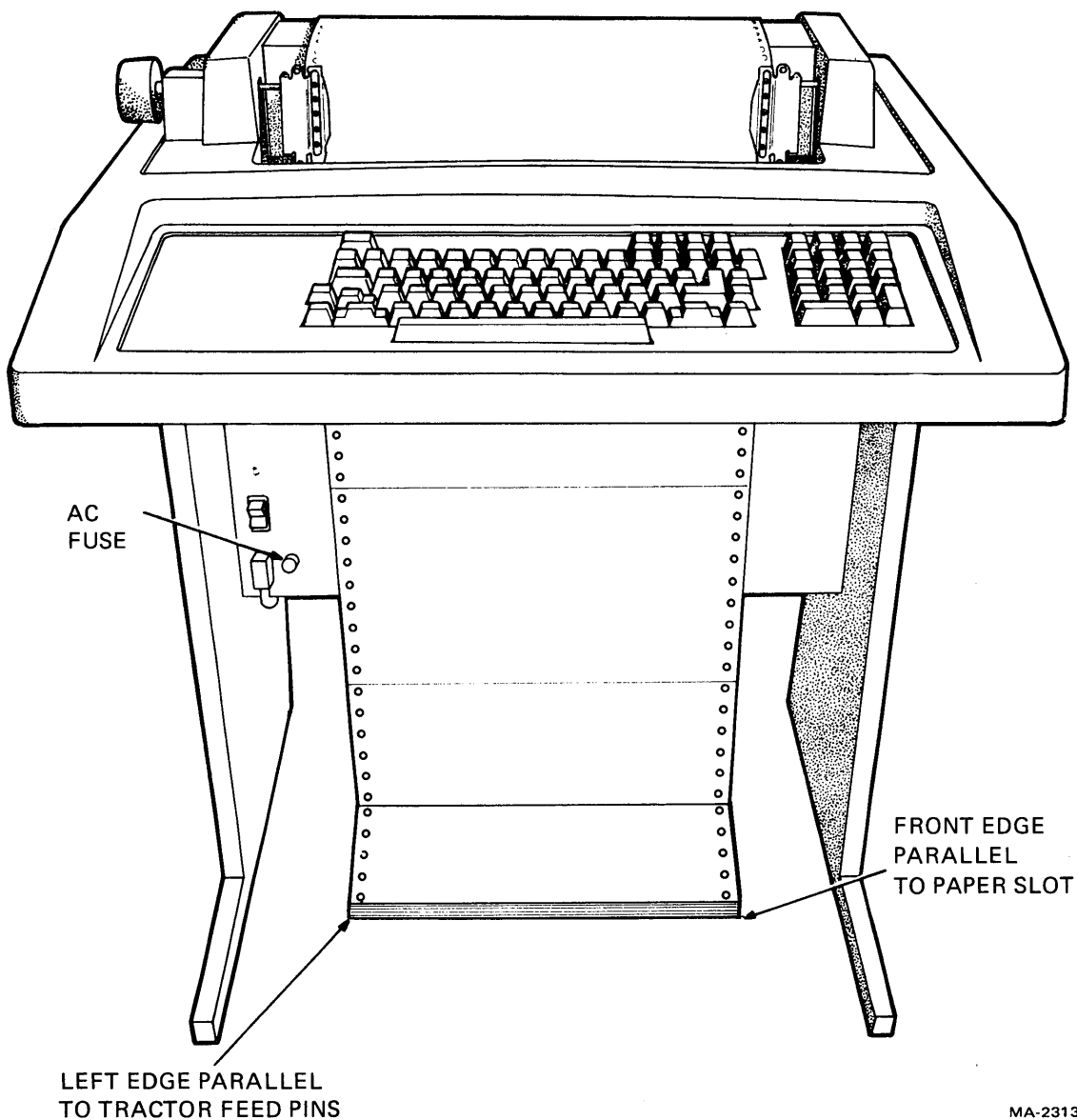
1. First clear the vertical margins (and the vertical tabs, or use CLEAR ALL).
2. Place the paper at the top-of-form (TOF).
3. Use LOCAL LINE FEED first to set the top margin, then use it to set the vertical tabs and bottom margin.
4. CTRL/K may be used to find and clear vertical tabs in the local mode.

5. The bottom margin may be found by using LOCAL LINE FEED with the SHIFT key. (The line at which the paper skips to the next page can be noted in the numeric display.)
6. The top margin or top-of-form may be found by using LOCAL FORM FEED, or by using CTRL/L in the local mode.

2.3.5 Loading Paper or Forms

It is advisable not to turn off the terminal when changing paper or forms, as all temporary features will be lost. The LA120 terminal accepts sprocket-fed, multiple-part paper or forms ranging in width from 3 to 14-7/8 inches. (Refer to the *LA120 User Guide* for paper specifications and methods of setting up the terminal for forms.) The general procedure for loading paper or forms is as follows.

1. Place the paper on the floor between the legs of the LA120 terminal (Figure 2-4) and align the leading edge of the paper so it is parallel to the paper slot. Align the left sprocket holes of the paper with the left tractor.



MA-2313

Figure 2-4 Paper Alignment

2. Open the printer cover. Open both tractor covers and move the print head adjustment lever away from the paper (Figure 2-5).
3. Feed the paper up through the paper slot. Align the left sprocket holes over the feed pins and close the left tractor cover (Figure 2-6).

The normal position of the left tractor feed pins is about 5.08 cm (2 in) from the left sideplate. This provides optimum margins for 132-column paper, but may be readjusted when using preprinted forms.

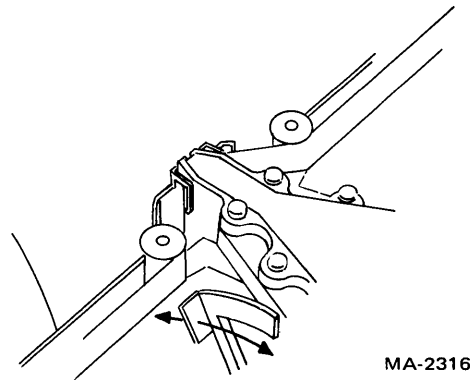
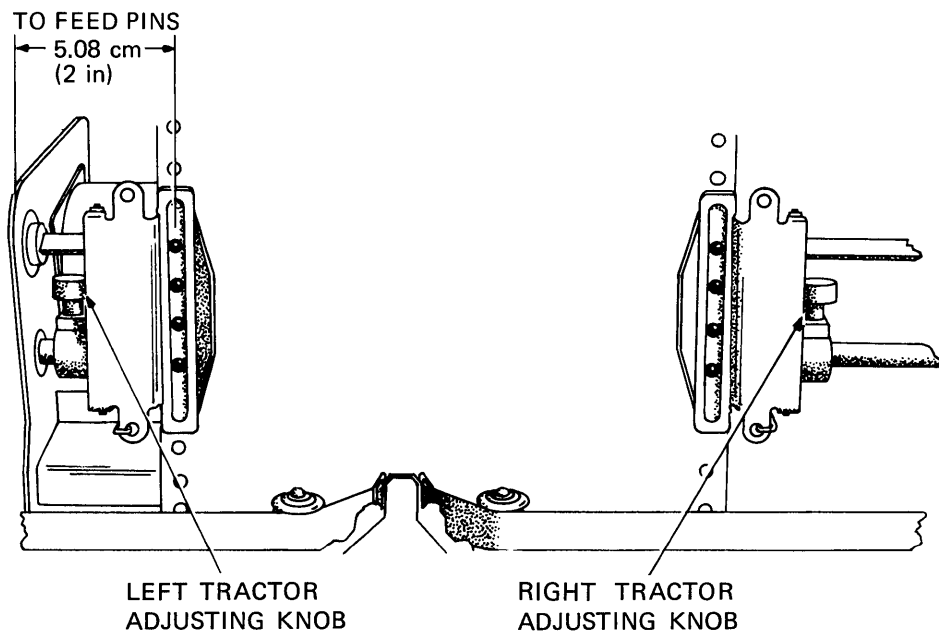


Figure 2-5 Print Head Adjustment



TK-11024

Figure 2-6 Tractor Adjustment

4. Making sure that the paper is straight, align the right sprocket holes over the feed pins, and close the right tractor cover. If the paper pulls against the pins or bows in the middle, loosen the right tractor adjusting knob and adjust the right tractor.

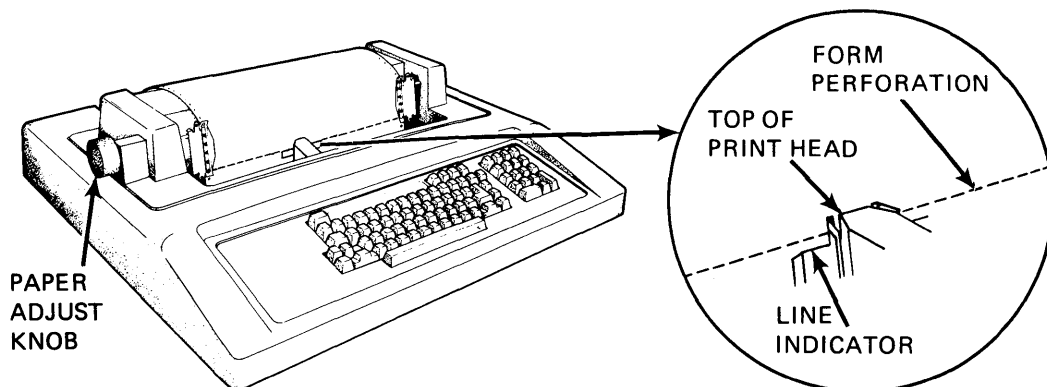
CAUTION

Do not overtighten the tractor adjusting knobs.

5. Reset the print head adjustment lever for the thickness of the paper or forms (Figure 2-5).
6. Set top-of-form (Figure 2-7). Press and hold the SET-UP key and press the number 4 (TOF) key to reset the line counter to 1. Using the paper adjust knob, set the paper perforation one character height above the line indicator on the print head. The paper adjust knob is pushed in to make fine vertical adjustments.

NOTES

1. **Multipart forms with 3- or 4-prong margin crimps on both margins are recommended.**
2. **Stapled forms are not recommended and may cause damage to the print head, tractors, or other sections of the machine, thus voiding the warranty.**
3. **Multipart forms may have only one card part. The card must be the last part.**
4. **Multipart carbonless forms of up to six parts may be used. Ribbon must be used on the top copy; first-surface impact paper is not recommended.**
5. **Dot or line glue margins are acceptable if the glue is on one margin only. Line glue on both margins prevents air from escaping, resulting in poor impressions.**
6. **Split forms with each side containing a different thickness or number of sheets are not recommended.**

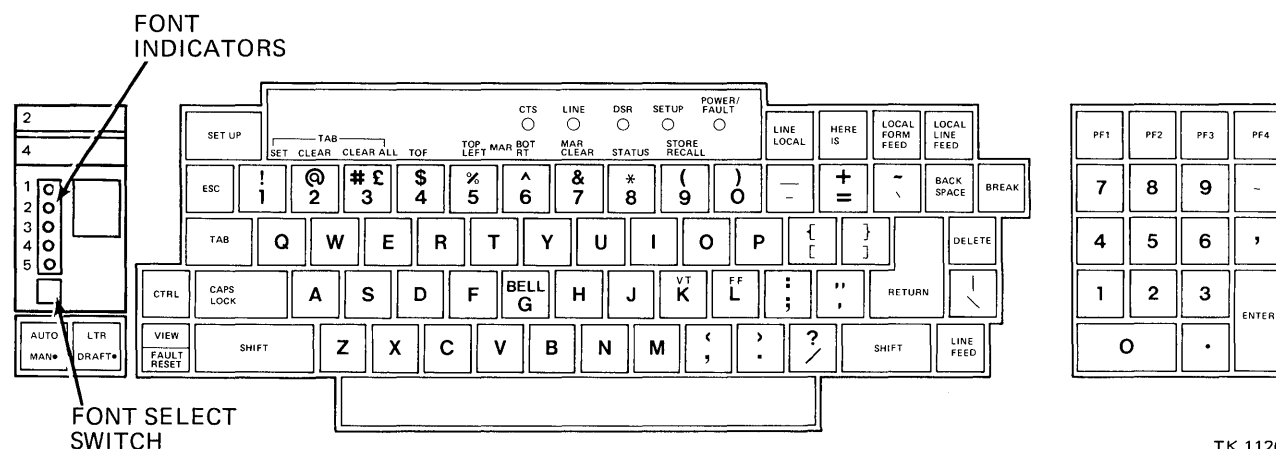


MA-2298

Figure 2-7 Setting Top-of-Form

2.4 LA100 CONSOLE TERMINAL

This section describes how to set up and operate the LA100 terminal on the VAX-11/730 system. For a complete description of the terminal's features, refer to the *Letterwriter 100 Operator Guide*, (EK-LW100-OP). Figure 2-8 shows the LA100 keyboard and control panel which contains five indicators.



TK 11209

Figure 2-8 LA100 Keyboard and Control Panel

2.4.1 LA100 Indicators

When they are lit, five LED indicators display the LA100 operating conditions described in Table 2-7.

NOTE

To force a font means everything is printed using the font despite all computer commands. The computer commands are processed but do not take effect until the terminal is set to computer select mode.

Table 2-7 LA100 Indicators

Indicator	Function
POWER/FAULT	The LA100 terminal is on. When power is first turned on, this indicator and the DSR indicator show any errors that occurred during power-up self-test. This indicator blinks when the terminal is not ready to print for any of the following reasons: <ul style="list-style-type: none"> • Paper is out or low • Access cover is open • Printhead is jammed (also indicated by multiple bell tones).
SET-UP	Blinks when the LA100 terminal is in set-up mode. When storing set-up features this indicator remains on for up to nine seconds.
DSR	The modem is in data mode (when the LA100 terminal is connected to a modem). It is also used with the POWER/FAULT indicator to indicate any errors during the power-up self-test (Data Set Ready).
LINE	The LA100 terminal is on-line. The terminal transmits keyboard characters to the CPU and receives printer characters. Characters typed on the keyboard are transmitted back to the print by the program.
CTS	Data transmission is enabled (Clear To Send). Used when LA100 terminal is connected to modem.

2.4.2 LA100 Control Keys

There are several control keys that do not transmit characters. Their functions are described in Table 2-8.

Table 2-8 LA100 Control Keys

Indicator	Function
FONT SELECT	<p>Forces a font. Each time this switch is pressed, the terminal advances to the next state, skipping fonts that are not installed. If the currently forced font is removed, the terminal advances to the next valid state. The terminal steps through the following states each time the switch is pressed:</p> <ul style="list-style-type: none">• Computer select (power-up state)• Font 1 forced• Font 2 forced (upper cartridge)• Font 3 forced• Font 4 forced (lower cartridge)• Font 5 forced
SHIFT	<p>When used with a character producing key, the key's uppercase character is transmitted. (The lowercase character is normally transmitted.)</p>
CTRL	<p>When used with a character producing key, the key's control character is transmitted. Use of the CTRL key is generally expressed as follows:</p> <p>CTRL/K = Press and hold the CTRL key and press the letter "K" key on the keyboard.</p>
CAPS LOCK	<p>When pressed, causes the alphabet keys to transmit uppercase characters regardless of the SHIFT key. Does not affect the numeric or symbol keys.</p>
LINE/LOCAL	<p>Changes the LA100 terminal to the ON-LINE mode or LOCAL mode as displayed by the indicators.</p>
LOCAL LINE FEED	<p>Advances the paper one line at a time.</p>
LOCAL FORM FEED	<p>Advances the paper to the top-of-form position, or to form feed the top margin (if the top margin is set).</p>
HER IS	<p>Causes the terminal to send an answerback message. The answerback message is selected in set-up.</p>
AUTO/MANUAL	<p>In the AUTO position (up), print quality (draft/letter) is controlled by the computer. The LETTER/DRAFT key is inactive.</p> <p>In the MANUAL position (down), the print quality (draft/letter mode) is controlled by the LETTER/DRAFT key. Quality (draft/letter mode) control escape sequences from the computer are processed, but only take action when auto mode is selected.</p>

Table 2-8 LA100 Control Keys (Cont)

Indicator	Function
LETTER/DRAFT	<p>In the LETTER position (up), the terminal prints letter mode (medium or high density depending on character ROM) characters.</p> <p>In the DRAFT position (down), the terminal prints draft mode (low density) characters.</p>
VIEW/FAULT RESET	<p>When manual last character view is selected, the VIEW key manually causes the printhead to move 1 cm (0.4 in.) to the right of the last character printed. This allows the user to see the last character printed. When the VIEW key is pressed along with the CTRL key, last character viewing is switched from manual to automatic. Last character viewing is then performed automatically without user control. When the VIEW key is pressed again with the CTRL key, the terminal switches back to manual last character view.</p> <p>FAULT RESET resets the fault indication of the terminal to permit continued operation after any fault (for example, printhead jam, cover open) has occurred and has been corrected.</p>

2.4.3 LA100 Set-up Functions

The terminal should be placed in the local mode to avoid transmitting characters while making changes in the set-up mode.

When changing more than one set-up mode feature, it is not necessary to enter and exit set-up mode each time. Also, if you press a key that has no function in set-up when changing a set-up feature, the terminal prints a question mark (?) a and bell tone sounds.

To enter the set-up mode, press and hold the CTRL key down, then press the SET-UP key and release both keys. When the set-up mode is entered, the SET-UP indicator blinks. Change set-up features changed by pressing the key or keys that correspond to the desired features.

To permanently store the set-up features, hold down the SHIFT key then press the “(” and “9” keys. The SET-UP indicator remains illuminated for approximately nine seconds. After the store is completed, the SET-UP indicator begins to blink again.

After changes to the set-up feature, set-up mode is exited by pressing the SET-UP key.

Most of the keys on the console keyboard have set-up functions. The functions for the top row of keys and some other commonly used features are briefly described in Table 2-9.

Table 2-9 LA100 Set-up Functions

Key	Name	Function
1	TAB SET	Sets horizontal tab at the current column. When used with SHIFT, sets vertical tab on the current line.
2	TAB CLEAR	Clears horizontal tab at the current column. When used with SHIFT, clears vertical tab on current line.
3	CLEAR ALL	Clears all horizontal and vertical tabs.
4	TOF	<p>Resets the vertical line counter to line 1. Top-of-form (TOF) defines the first line after the perforation when fanfold paper or forms are loaded.</p> <p>If the top margin (the first printable line) when the form feed command is sent by the computer or LOCAL FORM FEED is pressed.</p> <p>To avoid having to set top-of-form each time the printer is turned on or the paper is changed, press LOCAL FORM FEED before turning off the system or the printer.</p>
5	TOP/LEFT MAR	Sets left margin at the current column. When used with SHIFT, sets top margin on the current line.
6	BOT/RT MAR	Sets right margin at the current column. When used with SHIFT, sets bottom margin on the current line.
7	MAR CLEAR	Clears left and right margins. When used with SHIFT, clears top and bottom margins.
8	STATUS	Prints a message that shows the state of currently selected set-up features.
9	STORE/RECALL	Cancel all temporary set-up features and recalls the permanently stored features. When used with SHIFT, permanently stores the currently selected set-up features.

Table 2-9 LA100 set-up Functions (Cont)

Key	Name	Function																														
S	BAUD	<p>Press this and the RETURN to print the current transmit and receive baud rate on the printout. To change the terminal baud rate, press the indicated keys for the desired baud rate as shown below:</p> <table border="0"> <thead> <tr> <th>KEYS</th> <th>BAUD RATE</th> </tr> </thead> <tbody> <tr><td>S = A RETURN</td><td>50</td></tr> <tr><td>S = B RETURN</td><td>75</td></tr> <tr><td>S = C RETURN</td><td>110</td></tr> <tr><td>S = D RETURN</td><td>134.5</td></tr> <tr><td>S = E RETURN</td><td>150</td></tr> <tr><td>S = F RETURN</td><td>200</td></tr> <tr><td>S = G RETURN</td><td>300</td></tr> <tr><td>S = H RETURN</td><td>600</td></tr> <tr><td>S = I RETURN</td><td>1200</td></tr> <tr><td>S = J RETURN</td><td>1800</td></tr> <tr><td>S = K RETURN</td><td>2400</td></tr> <tr><td>S = L RETURN</td><td>4800</td></tr> <tr><td>S = M RETURN</td><td>7200</td></tr> <tr><td>S = N RETURN</td><td>9600</td></tr> </tbody> </table> <p>This value should not be changed because the CPU responds only to a fixed rate. The factory setting is for 1200 baud. The CPU CONSOLE Port is switch selectable to 1200, 2400 or 9600 baud, but should not be changed except by authorized service personnel.</p>	KEYS	BAUD RATE	S = A RETURN	50	S = B RETURN	75	S = C RETURN	110	S = D RETURN	134.5	S = E RETURN	150	S = F RETURN	200	S = G RETURN	300	S = H RETURN	600	S = I RETURN	1200	S = J RETURN	1800	S = K RETURN	2400	S = L RETURN	4800	S = M RETURN	7200	S = N RETURN	9600
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S = K RETURN	2400																															
S = L RETURN	4800																															
S = M RETURN	7200																															
S = N RETURN	9600																															
Q	Keyclick	<p>Press the following keys to enable or disable the keyclick:</p> <table border="0"> <tbody> <tr> <td>Q = A RETURN</td> <td>Enable keyclick</td> </tr> <tr> <td>Q = B RETURN</td> <td>Disable keyclick</td> </tr> </tbody> </table>	Q = A RETURN	Enable keyclick	Q = B RETURN	Disable keyclick																										
Q = A RETURN	Enable keyclick																															
Q = B RETURN	Disable keyclick																															

2.4.4 Print Head Positioning

The following methods are used in the set-up mode to position the print head for setting or clearing the margins or tabs.

Horizontal Margins and Tabs

1. Clear the left and right horizontal margins by pressing the MAR CLEAR key (7).
2. Set the left horizontal left margin by pressing the SPACE bar to position the print head to the desired print column, then press TOP/LEF MAR key (5).

3. Clear horizontal tabs by the following methods:
 - a. Clear tabs singularly by pressing the TAB key (to position print head to desired tab stop), then press the TAB CLEAR key (2).
 - b. Clear all tabs by pressing the TAB CLEAR ALL key (3).
4. Set the horizontal tabs by pressing the SPACE bar to position the print head to the desired print column for a tab stop, then press the TAB SET key (1). Repeat this step for each additional tab stop.
5. Set the right horizontal margin by pressing the SPACE bar to position the print head to the desired print column for the right margin, then press BOT/RT MAR key (6).

Vertical Margins and Tab Stops

1. Clear the top and bottom vertical margins by pressing the MAR CLEAR key (7).
2. Set the top margin by pressing the LOCAL LINE FEED key to advance the paper to the desired line, then while pressing the SHIFT key, press the TOP/LEF MAR key (5).
3. Clear vertical tabs by one of the following methods:
 - a. Clear tabs singularly by pressing and holding the CTRL key then press the "K" key to move the paper to a vertical tab. Then press and hold the SHIFT key and press the TAB CLEAR key (2).
 - b. Clear all vertical tabs by pressing and holding the SHIFT key, then press the TAB CLEAR ALL key (3).
4. Set the vertical tabs by positioning the print head to the desired print column with the LOCAL LINE FEED key. Then, while pressing the SHIFT key, press the TAB SET key (1).
5. Set the bottom vertical margin by positioning the print head to the desired print column with the LOCAL LINE FEED key. Then, while pressing the SHIFT key, press the BOT/RT MAR key (6).

2.4.5 Loading Paper or Forms

The LA100 terminal accepts friction feed or tractor feed paper ranging in width from 7.62 to 27.78 cm (3 to 14 7/8 in). Friction feed paper must be used to operate the printer as a graphics output printer. Use the following rules when selecting paper for the LA100 terminal.

Friction Feed Paper

- Use single sheet or roll paper.
- Do not use preprinted roll paper forms.
- Do not use multipart forms.
- Do not use impact paper.
- Do not use card stock.

Tractor Feed Paper

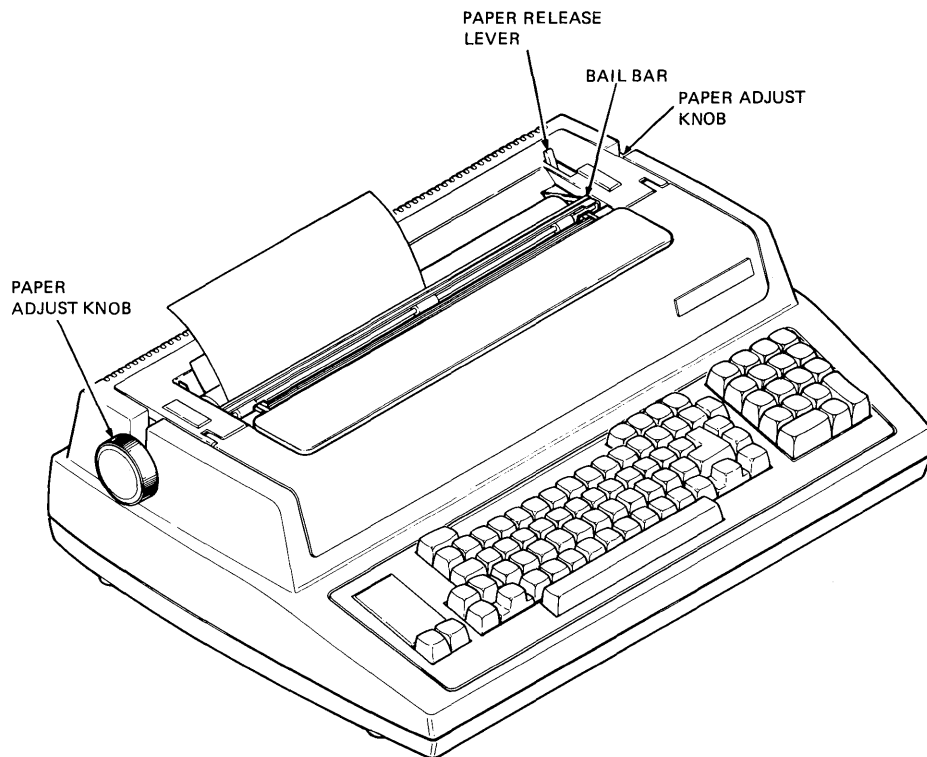
- Use only multipart forms of three or four parts and one card part. The card must be the last part.
- Dot or line glue margins are acceptable (one margin only).
- Do not use first-surface impact paper.
- Do not use split forms (different number of sheets on each side of form).
- Do not use stapled forms.

2.4.6 Loading Friction Feed Paper

The following paragraphs describe how to load friction feed paper, including single sheet and roll paper. It is not necessary to turn the power off to load friction feed paper.

2.4.6.1 Single Sheet – To use single sheets of paper in the LA100 terminal, you must disable the PAPER OUT or PAPER LOW detection options (LAX34-PL or LAX34-LL) if either is installed. (To disable these options refer to the installation guide.) To load single sheets of paper, refer to Figures 2-9 and 2-10 and perform the following procedure.

1. Feed the sheet of paper under the platen from the back. Lift the bail bar and advance the paper, using the paper advance knob, until the top edge of the paper is even with the bottom edge of the paper.
2. Pull the paper release lever toward the front of the printer and position the paper to the left of the printer (as seen from the front).
3. Smooth the paper over the surface of the platen and align the top and bottom edges.
4. Push the paper release lever toward the back of the printer and lower the bail bar to its original position.
5. If necessary, adjust the printhead as described later in this chapter.



MA-7244B

Figure 2-9 Loading Single Sheet Paper

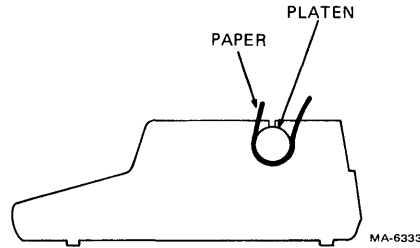


Figure 2-10 Single Sheet Paper Path

2.4.6.2 Roll Paper – The LAX34-RL roll paper holder option must be installed to use friction feed roll paper. (Refer to installation guide.) Perform the following procedure to load friction feed roll paper or preprinted forms into the LA100 terminal.

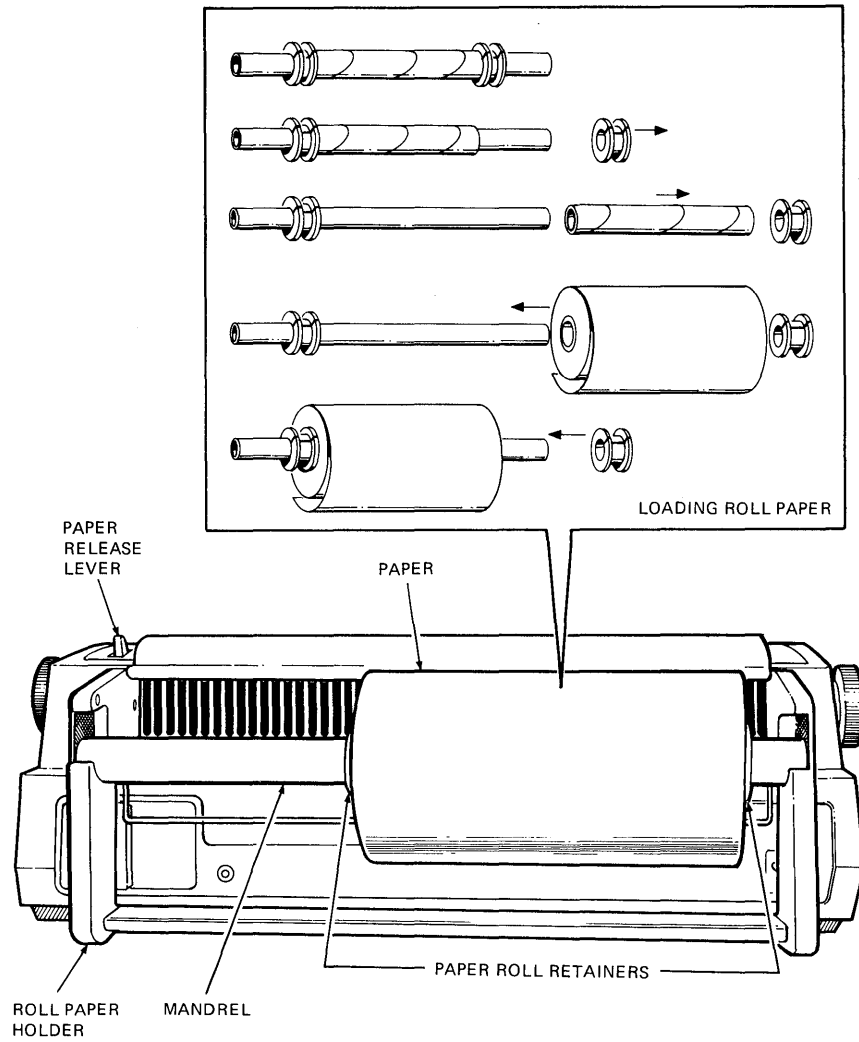
1. Remove the mandrel from the roll paper holder and slide one paper roll retainer from the mandrel (Figure 2-11).
2. Remove the old roll of paper. Slide the new roll of paper onto the mandrel. Replace the paper roll retainer previously removed.
3. Reinstall the mandrel on the roll paper holder assembly so that the paper feeds from the bottom of the roll (Figure 2-12).
4. Position the paper roll to the left of the holder (as seen from the front). Make sure the paper roll retainers are touching the paper roll to prevent it from moving from side to side. Do not let the paper roll retainers touch the side of the roll paper holder or they will create unnecessary friction.
5. Feed the paper over the roll holder apron and under the platen from the back. Lift the bail bar and advance the paper, using the paper advance knob, until the top edge extends back over the apron (Figure 2-12). Make sure the paper does not pass under the paper low sensor (Figure 2-12).
6. Pull the paper release lever toward the front of the printer (Figure 2-11). Smooth the paper over the surface of the platen and line up the sides of the paper with the supply roll edges.
7. Push the paper release lever toward the back of the printer and lower the bail bar to its original position.
8. Adjust the printhead as described later in this chapter.

2.4.6.3 Loading Tractor Feed Paper/Forms – The following paragraphs describe how to load tractor feed paper or preprinted forms into the LA100 terminal. The LAX34-AL tractor option must be installed to use tractor feed paper. Digital Equipment Corporation also recommends using the LAX34-SL printer stand option for the most effective paper feeding. Tractor feed paper may be loaded through the bottom or from the back of the printer. It is not necessary to turn power off when reloading tractor feed paper. Perform the following procedure to reload tractor feed paper.

NOTE

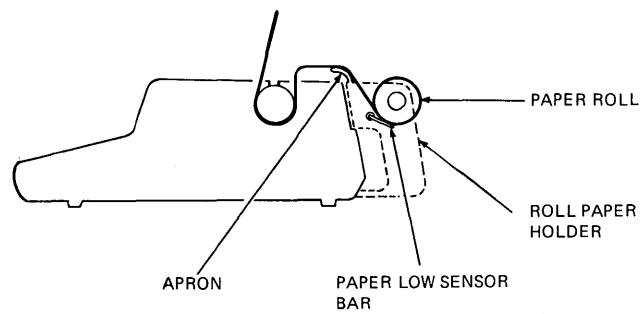
If paper is loaded from the back of the terminal, the paper out detection option does not operate.

1. Make sure that the bail bar is behind the tractors. If not, remove the tractors and reinstall according to the LAX34-AL tractor option instructions in the installation guide.



MA-7241

Figure 2-11 Loading Roll Paper



MA-7242

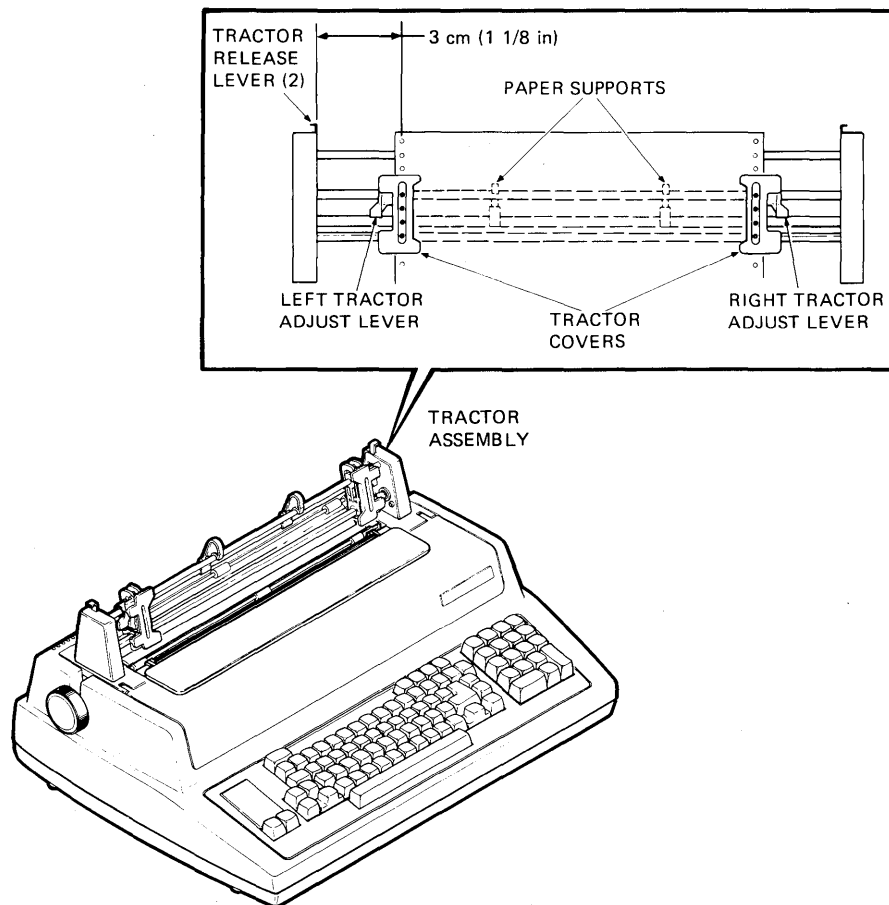
Figure 2-12 Roll Paper Path

2. If you are using a different size paper, pull the right tractor adjust levers toward the front of the printer to loosen the right tractor (Figure 2-13).
3. Move the right tractor to the right side plate. Do not tighten the right tractor adjust lever at this time.

NOTE

Step 3 provides margins for 33.53 cm (13.2 in) wide paper. If you are using smaller paper, move the right tractor to the place that corresponds to the size of your form. Do not move the left tractor when using smaller forms.

4. Open both tractor covers (Figure 2-13).



TK-11022

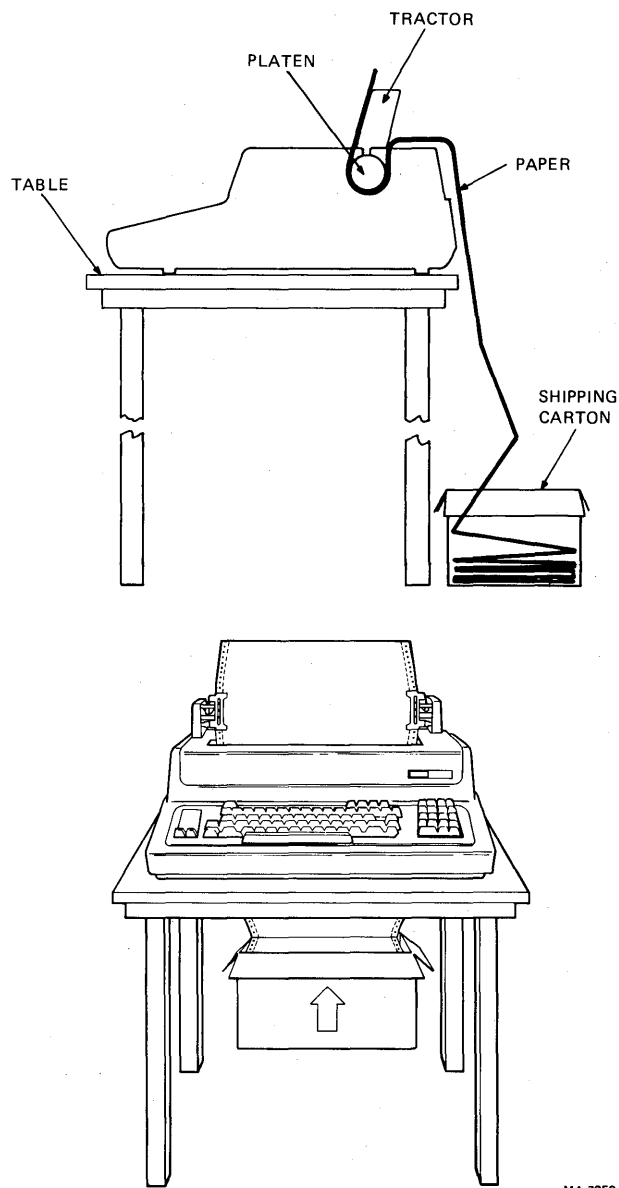
Figure 2-13 Loading Tractor Feed Paper

5. If you are not using the printer stand option, position the printer as shown in Figure 2-14. Place the back edge of the printer parallel to and slightly over the edge of the table.

6. Position the paper to feed correctly into the printer.
 - a. If you are using the printer stand, place the paper/forms on the crossmember between the legs of the printer stand (Figure 2-15).
 - b. If you are not using the printer stand, place the paper/forms on the floor behind the table as shown in Figure 2-14. The paper can be left in the shipping container if the container top is removed.

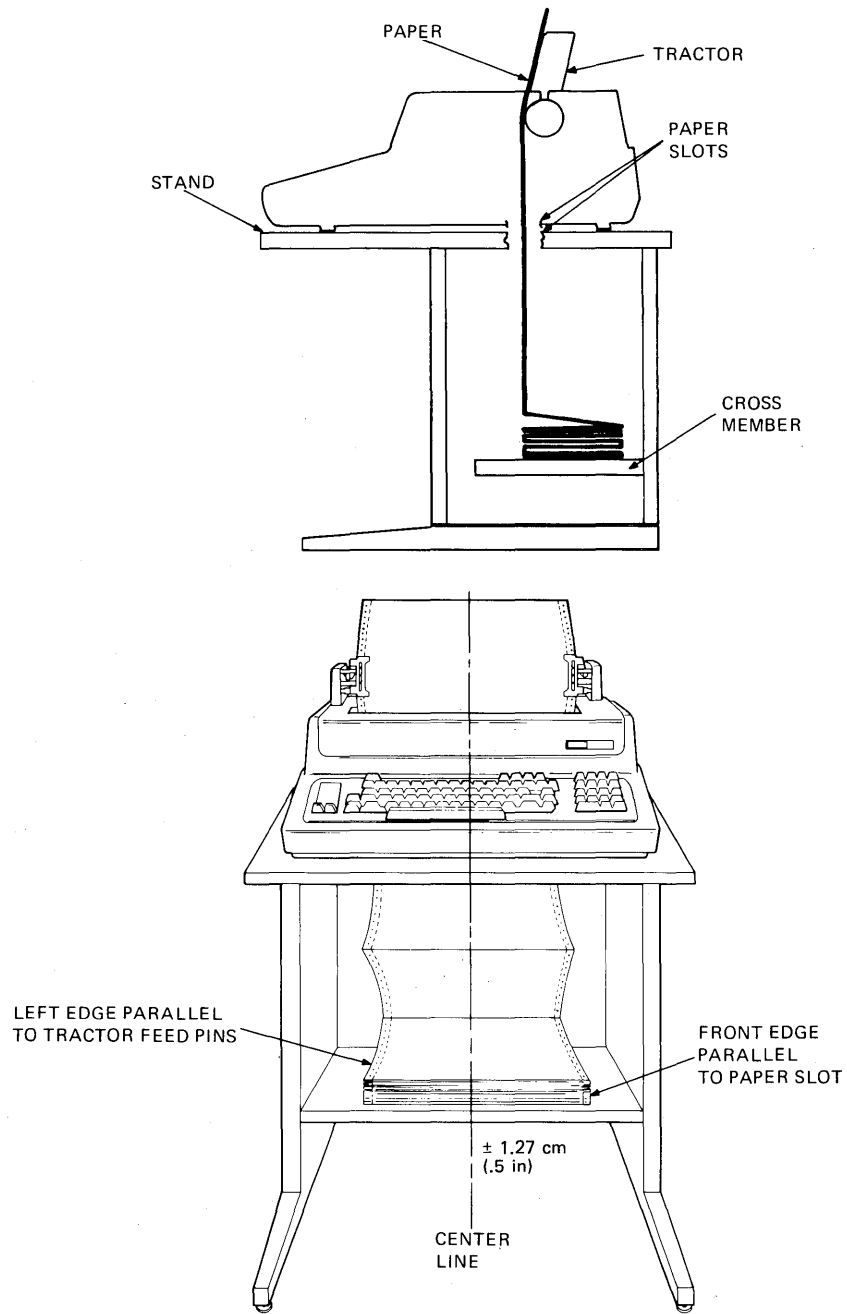
NOTE

If it is not possible to place the paper supply on the floor, place it on the table behind the printer. However, use the LAX34-SW paper tray accessory to prevent interference between the printout and supply paper unless the printer is continuously watched.



MA-7352

Figure 2-14 Tractor Feed Paper Path (without Stand)



TK-11022

Figure 2-15 Tractor Feed Paper Path (with Stand)

7. Feed the paper through the paper slot.
 - a. If you are using the printer stand, align the paper parallel to the bottom paper slot and route the paper through the paper slot (Figure 2-15).

NOTE

Multipart forms might separate if loaded into the printer from the back.

- b. If you are not using the printer stand, feed the paper through the paper slot behind the platen. Rotate the paper advance knob clockwise until the top edge of the paper extends above the tractors (Figure 2-14).

NOTE

Feeding supply paper under the LA100 terminal and through the bottom paper slot is not recommended unless the printer stand is used. If paper is loaded from the bottom without the paper stand, the paper perforations might catch on the table and cause the terminal to print uneven lines across the paper.

8. Place the left margin holes over the tractor feed pins. Close the left tractor cover.
9. Position the right tractor to place the right margin holes over the tractor feed pins. Close the right tractor cover.
10. Tighten the right tractor adjust lever to clamp the right tractor in place.

CAUTION

Do not stretch the paper too tight. If the paper pulls against the tractor pins or is loose in the center, readjust the right tractor.

11. Position the paper supports one third of the distance from each tractor (Figure 2-13).
12. Make sure that the paper stack is centered directly under the tractors.
13. Pull the paper release lever toward the front of the printer (Figure 2-11).
14. Adjust the print head as described later in this chapter.

2.4.7 Print Head Adjustment

Perform the following procedure to adjust the print head.

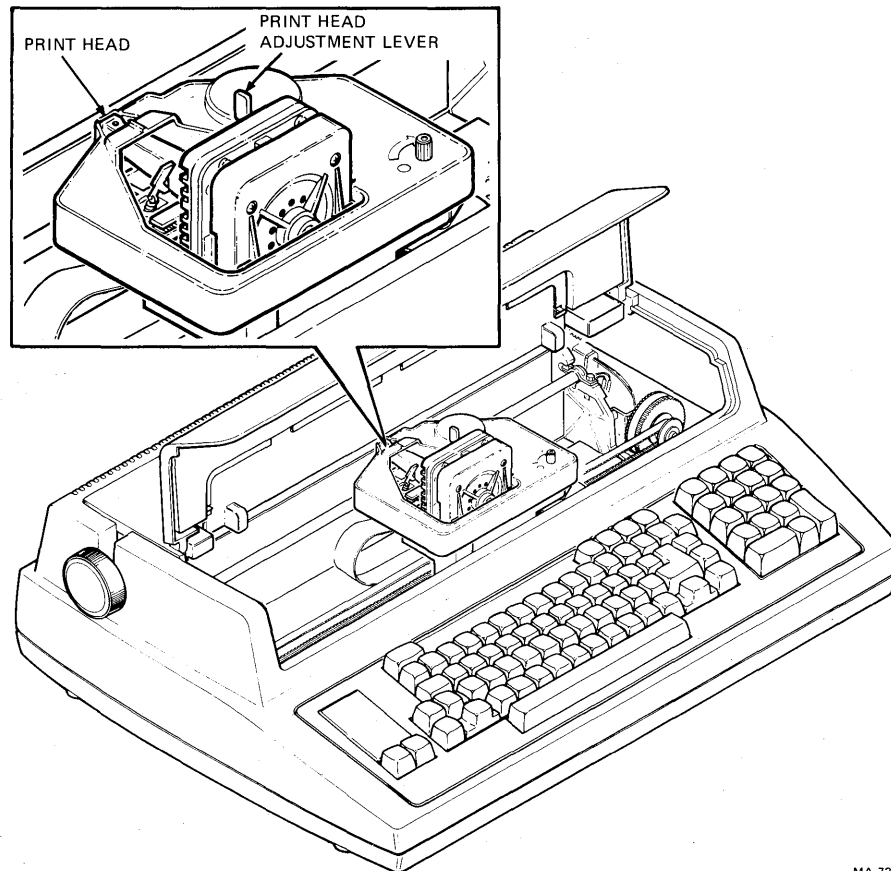
1. Make sure that the power ON/OFF switch is on.
2. Open the access cover and move the print head adjustment lever all the way to the right (Figure 2-16).
3. Carefully move the print head adjustment lever one position to the left.
4. Manually move the print head to the right and left to check for smudging. If the ribbon smudges, first make sure that the paper is installed correctly. If the paper is installed correctly, move the print head adjustment lever to the right until the smudging stops.

5. Close the access cover and press the FAULT RESET key.
6. Type a line of characters and check the printed characters for print quality.

NOTE

If the form ripples or is pulled by the print head, the print head is not adjusted correctly. Repeat Steps 2 through 6.

7. If necessary, repeat steps 3 through 6 until the printed characters are clear and sharp.

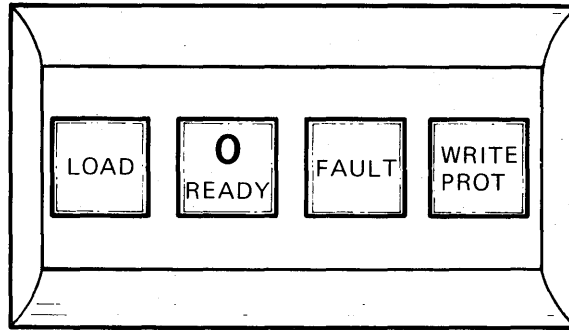


MA-7231C

Figure 2-16 Print Head Adjustment

2.5 RL02 REMOVABLE-MEDIA DISK DRIVE

Figure 2-17 shows the RL02 control panel. Two of the indicators are combination indicators and alternating-action pushbutton switches. When pushed inward to the ON state, they stay in that position until pushed and released to the OFF state.



TK-8272

Figure 2-17 RL02 Control Panel

2.5.1 LOAD Switch and Indicator

The LOAD indicator is lit when the following conditions are true and it is safe to insert or remove the RL02K disk cartridge.

- The heads are retracted.
- The spindle motor is completely stopped.

The LOAD switch, when pushed to the ON state, locks the access cover and applies ac power to the spindle motor if the following conditions are true.

- The heads are retracted.
- The drive's ac and dc voltages are within specified limits.
- The disk cartridge is properly seated.
- The protective cover (cartridge bottom cover) is in place over the disk.
- The access cover is closed and latched.

The LOAD indicator turns off when the spindle motor starts. The READY indicator turns on when the heads are loaded and the disk is ready for use.

The LOAD switch, when pressed again, is released to the OFF state, the READY indicator is turned off, the heads are retracted, and ac power is removed from the spindle motor. The LOAD indicator turns on when it is safe to remove the cartridge.

2.5.2 READY Indicator and Unit Select Switch

The READY indicator turns on when the spindle motor is up to operating speed, the heads are loaded, and the disk is ready for use.

The unit select switch is actuated by a cammed button that is encoded to the drive unit select number indicated by the label. When inserted in the switch, the unit select button designates the unit select number for the drive. The system disk is normally designated as unit 0. The first, second, and third user disks are designated as units 1, 2, and 3, respectively.

2.5.3 FAULT Indicator

The FAULT indicator turns on if a hardware failure occurs in the drive. There are three failures that may respond to operator intervention.

1. Write Protect error – The program attempted to write data to a write-protected disk (the WRITE PROTECT switch is ON).
2. Drive Select error – The program attempted to perform an operation to a drive under one of the following conditions.
 - a. The addressed drive does not exist or is not ready.
 - b. The disk cartridge is not loaded.
 - c. The unit select button is not in place.
3. Spin error – The LOAD indicator stays on and the spindle motor does not respond if the LOAD switch is in the ON position and one of the following conditions exists.
 - a. The disk cartridge is not loaded.
 - b. The protective cover (cartridge bottom cover) is not in place over the disk.
 - c. The access cover is not latched.

If these items are checked and the drive does not respond, a solid hardware failure exists and an authorized Field Service engineer should be notified.

2.5.4 WRITE PROTECT Switch and Indicator

The WRITE PROTECT switch, when pushed to the ON state, turns the WRITE PROTECT indicator and disables the write circuitry in the drive. Disk data is then protected from being inadvertently altered.

When the switch is released to the OFF state, the WRITE PROTECT indicator is turned off and write protection is removed from the drive.

2.5.5 Cartridge Loading Procedure

The following cartridge loading and drive start-up procedure is recommended.

CAUTION

In the case of the lower RL02 disk drive, first extend the safety foot from the front of the cabinet, then gently slide the drive forward until the access cover is clear of the CPU.

1. Unlatch and raise the drive access cover (drive power must be on for the access cover to unlock).
2. Prepare the cartridge for loading as follows:
 - a. Lift the cartridge by grasping the top cover handle with the right hand.
 - b. Support the cartridge under the protective (bottom) cover with the left hand.
 - c. Lower the top cover handle and push the handle slide to the left with the right hand thumb. Raise the handle to its full upright position to release the protective cover.
 - d. Lift the cartridge from the protective cover and carefully set the cartridge on the spindle with the top cover handle recess facing the rear of the drive.

- e. Carefully rotate the top cover handle in both directions to ensure that the spindle locating arms seat properly in the cartridge housing slots.

CAUTION

Use care when seating the cartridge on the drive spindle. Rough handling of the cartridge may cause damage to the interface between the spindle and cartridge. This can cause excessive cartridge runout and positioning errors.

- f. Gently lower the top cover handle to the horizontal position to engage the cartridge on the spindle.
 - g. Turn over the protective cover and place it over the cartridge.
 - h. Close and latch the drive access cover.
3. Start the drive as follows.
 - a. Press the LOAD switch.
 - b. When the drive start-up sequence is completed and the heads are loaded (about 30 seconds), the READY indicator will turn on.
 - c. Press the WRITE PROTECT switch if write protection is desired.

2.5.6 Cartridge Unloading Procedure

1. Turn off the drive as follows.
 - a. Press and release the LOAD switch and wait for the LOAD indicator to turn on (about 30 seconds).

CAUTION

In the case of the lower RL02 disk drive, first extend the safety foot from the front of the cabinet, then gently slide the drive forward until the access cover is clear of the CPU.

- b. Unlatch and raise the drive access cover (drive power must be on for the access cover to unlock).
2. Remove the cartridge as follows.
 - a. Remove the protective cover and hold it with the left hand.
 - b. Before raising the top cover handle, push the slide to the left.
 - c. Raise the top cover handle to its full upright position to release the cartridge from the drive spindle.
 - d. Carefully lift the cartridge out of the drive and place it in the protective cover.
 - e. Lower the top cover handle to the horizontal position to lock the protective cover in place.
 - f. The top cover handle may now be raised to carry the cartridge. Be sure that the cover is fully locked.

2.5.7 Disk Cartridge Handling and Care

Extreme care should be used when handling, loading, or unloading the disk cartridge. The following list is a summary of RL02K cartridge care and cleaning considerations.

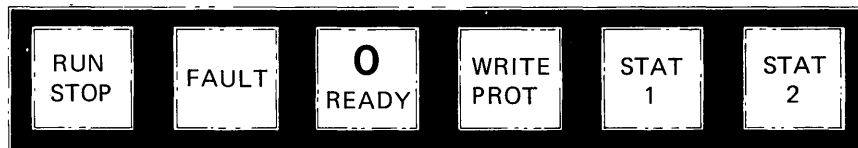
When handling cartridges:

- Keep cartridges clean.
- Use cartridges at computer room temperature only.
- Handle cartridges only by the top cover handle.

2.6 R80, RA80, RA81 AND RA60 DISK DRIVES

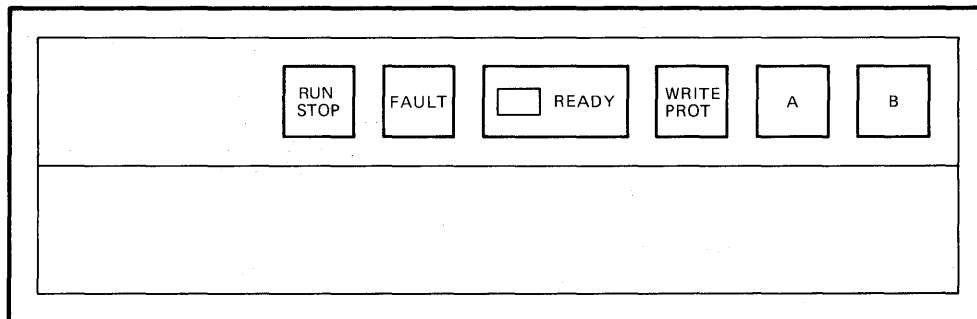
The R80, RA80 and RA81 are self-contained, non-removable media disk drives. The RA60 drive is a removable-media disk drive. All operator controls and indicators for these disk drives are located on the front panel of the drive unit. Since the controls and indicators for these disk drives have similar operational functions, they will be presented together in this section.

Figures 2-18 and 2-19 show the control panels for the disk drives. Five of the indicators are combination indicators and alternating-action push-button switches. When pushed inward to the ON state, they stay in that position until pushed and released to the OFF state.



TK-8273

Figure 2-18 R80 Control Panel



TK 11208

Figure 2-19 RA80, RA81 and RA60 Control Panels

2.6.1 RUN/STOP Switch and Indicator

When the switch is pushed to the ON state, the indicator turns on and ac power is applied to the spindle motor. When the switch is pushed again and released to the OFF state, the indicator is turned off and ac power is removed from the spindle motor.

CAUTION

A three minute delay is recommended between a stop and a restart to prevent opening the thermal circuit breaker to the spindle motor.

2.6.2 FAULT Indicator and Reset Switch

The FAULT indicator turns on whenever an unsafe or error condition occurs in the drive. If a fault occurs during a start-up attempt, the start-up is aborted.

Fault Reset Sequence – When the FAULT indicator is lit, the general fault code is obtained by pressing the FAULT switch. All indicators momentarily light then are lit again to display the fault code. This is the fault display mode and the drive is in an off-line state. The drive stays off-line as long as the fault code is displayed. Refer to Chapter 3 for a description of the fault codes. Pressing the FAULT switch again stores the fault code and clears the fault condition if it is not a hardware fault. A hardware fault relights the FAULT indicator and the service engineer can later retrieve the stored fault codes through the internal maintenance controls and indicators. Certain errors can be cleared through the program and no operator intervention is required. If the errors are not correctable within the program, the operator must perform the FAULT reset sequence.

2.6.3 READY Indicator and Unit Select Switch

The READY indicator turns on after a successful start-up sequence. This indicates that the disk is up to operating speed, the heads are loaded, and the drive is ready for use. The READY indicator turns off during seek operations. The unit select switch is actuated by a cammed button that is encoded to the drive unit select number indicated by the label.

2.6.4 WRITE PROTECT Switch and Indicator

The WRITE PROTECT switch, when pushed to the ON state, turns on the WRITE PROTECT indicator and disables the write circuitry in the drive. Disk data is then protected from being altered. When the switch and indicator are OFF, write protection is removed from the drive.

2.6.5 STATUS 1 and 2 Indicators and Switches (R80 Drive)

These indicators are used with the other panel indicators to identify FAULT conditions as described earlier. The switches are normally placed in the OFF state and are used by the service engineer to perform drive diagnostic tests.

2.6.6 A and B Port Select Switches (RA80, RA81 and RA60 Drives)

These switches have built-in lights that indicate the port through which the drive is being accessed (A or B). When the port A button is pushed in and the port B button is out, only port A can be accessed. When the opposite condition exists, only port B can be accessed. However, when both push buttons are in at the same time, either port A or port B can be accessed by the controller. When either or both buttons are out, the drive is off-line to the port or ports indicated. Port A should be the port used.

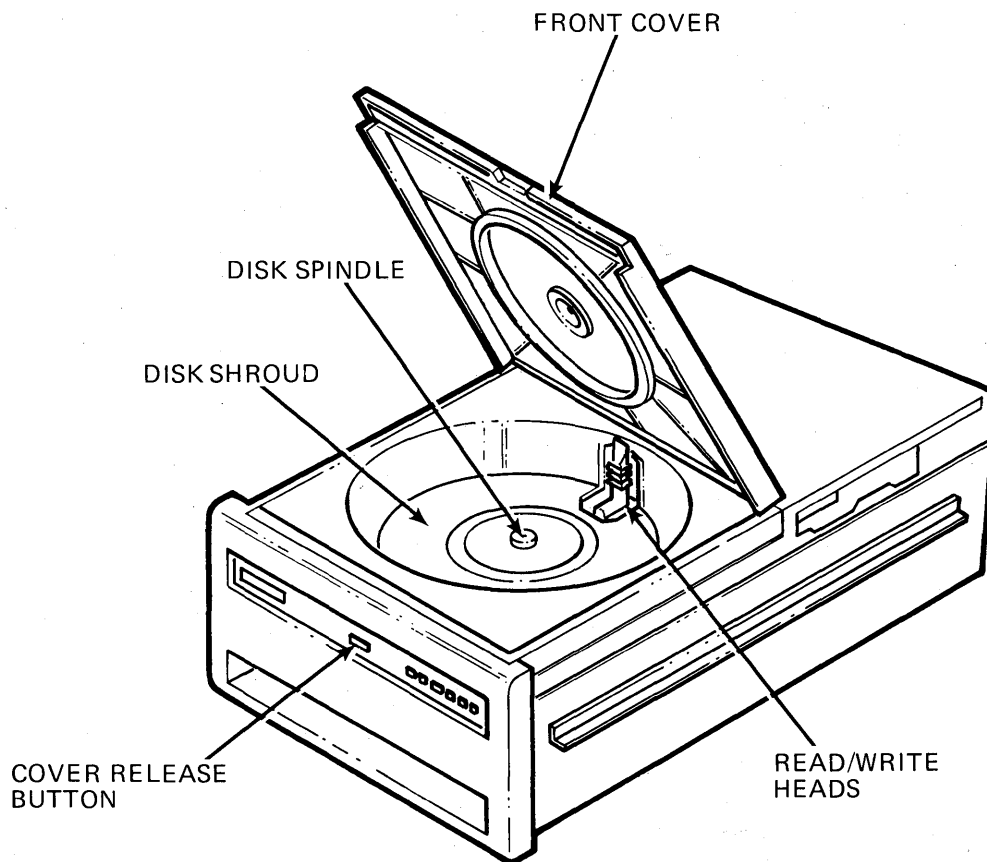
2.7 RA60 CARTRIDGE LOADING AND UNLOADING PROCEDURES

The RA60 drive must be loaded with an RA60 disk pack and then be brought to the ready state before information can be stored or read. The procedures for loading and unloading the disk pack are described in the following paragraphs.

2.7.1 Loading the Disk Pack

Use the following procedure to load the disk pack.

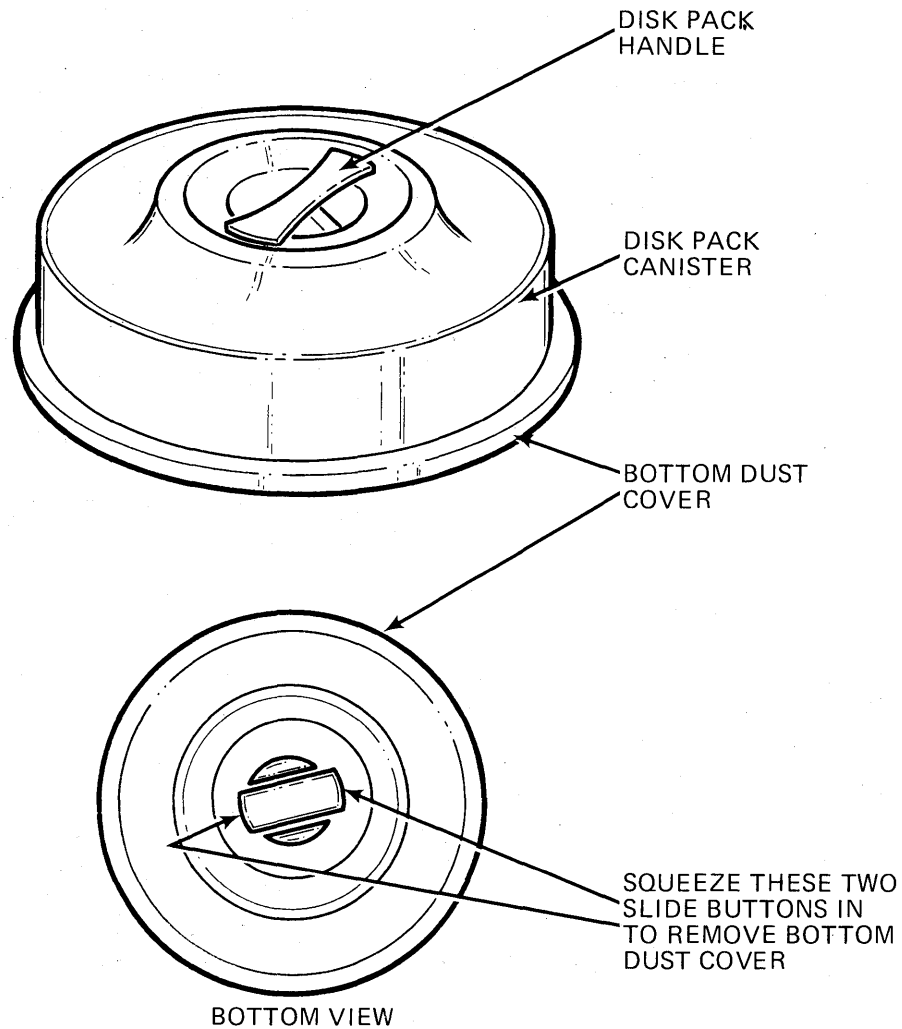
1. Apply power by turning on the drive circuit breaker located at the back of drive.
2. Make sure that the RUN light is off (RUN/STOP switch is not pushed in).
3. Push the release button to raise the front cover. Drive power must be on to operate the cover release button. Refer to Figure 2-20.
4. Look into the disk well to make sure that the read/write heads are retracted from the disk shroud area. Failure to make sure that the heads are fully retracted could cause damage to the heads and/or the disk pack.



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Figure 2-20 Gaining Access to the Disk Spindle

5. Remove the bottom dust cover from the disk pack canister by squeezing together the two slide buttons on its underside. Avoid placing fingerprints on the exposed disks inside the canister. Refer to Figure 2-21.
6. Lifting the canister by its handle, set the pack onto the disk spindle.



TK 11206

Figure 2-21 RA60P Disk Pack Storage Canister

7. Using one hand to turn the handle while holding the disk pack cover stationary with the other, rotate the pack handle *clockwise* until it stops turning. Give one last, firm twist to the handle and lift the storage canister off the pack.
8. Close the front cover of the disk drive.
9. Push in the RUN/STOP switch and wait for the READY light to come on. The disk drive is then ready to accept read and write commands.

2.7.2 Unloading the Disk Pack

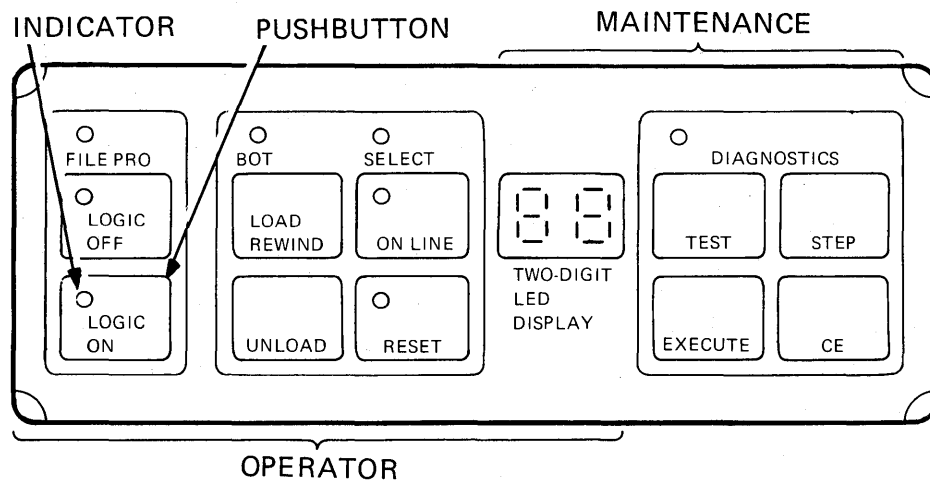
Use the following procedure to unload the disk pack.

1. Release the RUN/STOP switch and wait for the RUN light to go off.
2. Push in the release button and raise the front cover.
3. Place the storage canister over the disk pack so that the post protruding from the center of the disk pack contacts the canister handle.
4. Using one hand to turn the handle and the other to hold the disk pack stationary, rotate the canister handle *counterclockwise* until the pack is free of the spindle.
5. Using the canister handle, lift the pack out of the disk drive and close the front cover.
6. Install the bottom dust cover on the base of the storage canister by pressing it on gently until it locks into place.

2.8 TU80 MAGNETIC TAPE DRIVE

Figure 2-22 shows the control panel which is located in the upper right corner of the cabinet. The switches are all push-button switches. Indicators for the operation selected are LEDs either on or above the selected switch.

The left part of the control panel contains the operator switches and indicators. The 2-digit display indicates a fault code related to an abnormal operating condition or a test code when in the diagnostic mode. The right side of the panel contains the switches for diagnostic procedures (refer to Chapter 3).



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Figure 2-22 TU80 Control Panel

2.8.1 Control Switches

Table 2-10 describes the functions of the control switches on the control panel.

Table 2-10 TU80 Control Switches

Switch	Function
LOGIC OFF	When pressed, power is removed from the transport logic, the LOGIC OFF indicator goes on.
LOGIC ON	If LOGIC ON is pressed when the power is on, the transport logic and control system is powered up and the TU80 is ready for operation.
LOAD/REWIND	If the transport is turned on and tape is threaded, pressing this switch causes a load operation to be performed. If tape is loaded, pressing the switch causes a rewind operation to BOT.
UNLOAD	If tape is loaded at BOT, pressing this switch causes tape to unload from the take-up reel and tape path onto the supply reel. If tape is loaded beyond BOT, it rewinds to BOT. If tape is threaded but not loaded, pressing the switch causes the transport to slowly unload tape onto the supply reel.
ON-LINE	If tape is loaded, pressing this switch causes the transport to go on-line to the host system. Press the RESET switch to take the TU80 drive off-line.
RESET	When pressed, this switch places the transport off-line, stops tape motion, and clears error status. The switch can stop a load and rewind operation. It also turns off the RESET indicator and clears diagnostic test conditions.
TEST	If the transport has tape threaded but not loaded, pressing this switch places the unit in the diagnostic/test mode.
STEP	If the transport is in the diagnostic/test mode (and the test number is displayed), pressing this switch allows the diagnostic/ test sequence numbers in the two-digit display to increment by one.
EXECUTE	If the transport is in the diagnostic/test mode (the test number is displayed), pressing this switch initiates the internal diagnostic test shown on the two-digit display.

2.8.2 Drive Status Indicators

Table 2-11 describes the functions of the indicators on the control panel.

Table 2-11 TU80 Drive Status Indicators

Indicator	Definition
LOGIC OFF	<p>When on, LOGIC OFF indicates that a standby power condition exists (power supply is on, transport logic is off).</p> <p>If the indicator is off and no other indicators are on, then the POWER switch is set to off or there is a power supply problem. If this indicator is off and LOGIC ON indicator is on, all transport circuitry is in the power-on condition.</p>
LOGIC ON	<p>When on, LOGIC ON indicates that the transport is powered up and ready for use.</p>
FILE PRO	<p>When on, FILE PRO indicates absence of a write-enabled ring in the supply reel and write operation is inhibited. Otherwise, write operations are allowed.</p>
BOT	<p>When on, BOT indicates that the tape is positioned at the beginning-of-tape (BOT) marker.</p>
ON-LINE	<p>When on, ON-LINE indicates that the TU80 drive is ready for on-line operation. All switches except RESET and LOGIC-OFF are inhibited.</p>
SELECT	<p>When on, SELECT indicates that the transport is selected by the host system for write/read operation.</p>
RESET	<p>When on, RESET indicates that the transport is in fault or diagnostic status. Two-digit display may contain a fault or diagnostic code.</p>
DIAGNOSTIC	<p>When on, DIAGNOSTIC indicates that the transport is in the diagnostic/test mode. The indicator remains on until the RESET switch is pressed.</p>

2.8.3 Threading and Loading Tape

Figure 2-23 shows the transport tape path. The following procedure may be used to thread and load the tape.

1. Pull the cover latch toward the front and lift the top access cover. Be sure that the power switch is in the ON position (1 pressed). The LOGIC OFF indicator should be on.

NOTE

The power switch can be in the ON position all the time to enable the TU80 drive to be powered on under the CPU.

2. Press the LOGIC ON switch. The power-up health check is initiated. The LOGIC OFF indicator goes off and all other indicators momentarily go on. The LOGIC ON and FILE PRO indicators should remain on.

NOTE

Pressing the LOGIC ON switch enables the drive power amplifier module, control logic, and support circuit. If a fault code displays at this time, press the RESET and LOGIC OFF switches and then LOGIC ON switch to repeat the check. If the fault code persists, call Field Service.

3. Press the inner button on the face of the supply reel hub.
4. Mount the supply onto the hub so that the reel is seated on the bottom flange. Secure the reel by pressing the periphery of the hub face to latch the reel.
5. Thread the magnetic tape through the tape path as shown in Figure 2-18.
6. Wrap the tape leader (a length of tape before the BOT marker) onto the take-up reel for several turns.

CAUTION

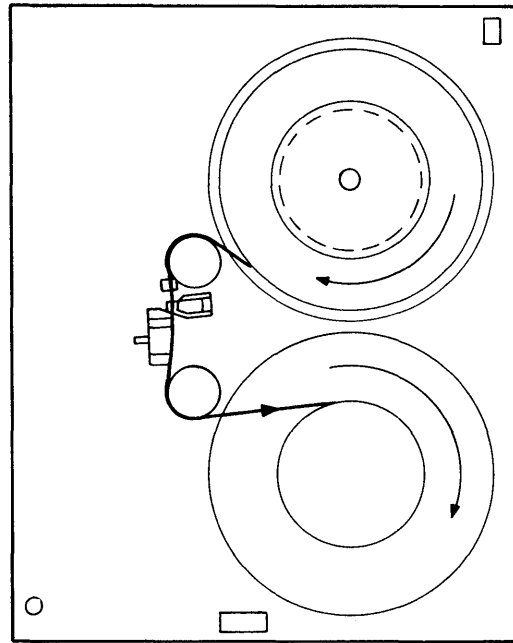
Make sure that the tape is positioned correctly over all tape path components, otherwise, tape damage may occur.

7. Close and latch the top cover.
8. Press the LOAD/REWIND switch. In one second, air pressure builds at the air bearings and tape starts moving in the forward direction. This motion stops when the BOT marker on the tape is detected. If the tape was over-threaded and the BOT marker was positioned after the sensor, forward tape motion continues for approximately 12.19 m (40 ft). Then the drive initiates reverse tape motion until the BOT marker is detected. At this moment, tape motion stops and the BOT indicator is on.

NOTE

If LOAD fails and tape does not move to BOT, check for the BOT marker on the tape. If there is no BOT marker, attach one.

9. Press the ON-LINE switch to place the unit on-line to the host. The switch may be pressed while the load operation is in progress. On completion of a load operation, the drive indicates on-line status by turning the ON-LINE indicator on. (If the transport is ready for a write operation, the FILE PRO indicator goes off.) Now the drive is ready for use.



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Figure 2-23 Tape Threading Path

2.8.4 Care of Magnetic Tape

The following guidelines are provided to ensure proper handling and storage of magnetic tape.

1. Keep magnetic tapes clean. Store them in their proper container when not in use and keep empty containers tightly closed.
2. Do not expose tapes to heat or dust. Do not place them near a line printer or any device that produces paper dust. Do not place them on top of the tape drive or in any location where they may be affected by hot air.
3. Never touch the tape between the BOT and EOT markers. Oil from the fingers attracts dust, dirt and oxide.
4. Never use a contaminated reel of tape. This can spread to clean tapes and affect transport reliability.
5. Always handle tape reels by the hub hole. Squeezed reel edges can damage the tape when winding or unwinding.
6. Do not smoke near the tape drive or storage areas. Tobacco smoke and ash are very damaging to tapes.
7. Do not store tapes in the vicinity of electric motors, and avoid contact with magnetized tools or instruments.

2.9 BOOTSTRAPPING AND OPERATING THE SYSTEM

This section describes the sequences of events that occur when the system is initiated and when the system is halted.

2.9.1 Power-Up Sequence

When the CPU power/control switch is moved from the OFF to the LOCAL position, the following power-up sequence is initiated by the console subsystem.

1. A series of power-up tests is performed. One letter of the word CONSOLE is printed between each test. The last two letters are printed after the final test.
2. If the console tape is not inserted in the TU58 drive 1, the console tries to read from drive 0. If neither TU58 drive contains a tape, the console enters an idle state and prints the error prompt "ROM>". The operator may proceed by inserting the microcode tape and typing CTRL/C.
3. With the tape inserted, the version number of the console code is printed when it has successfully loaded. A series of files (including the command files POWER.CMD and CODE0n.CMD) is then listed on the console as they are loaded from the tape and executed.

The microcode is loaded in stages and the entire sequence must be complete for the console to fully communicate with the system.

4. The AUTO RESTART switch is checked at this point. If the switch is in the OFF position, the CPU is placed in the console mode and the console prompt ">>>" is printed. At this time the system can be operated by entering console commands from the console keyboard.

If the AUTO RESTART switch is in the ON position, or is moved to the BOOT position, the system will begin the cold start (boot) sequence described in Section 2.9.2.

2.9.2 Cold Start Sequence – Booting VMS

The cold start sequence (boot) can be initiated in several ways.

- Power-up sequence with the AUTO RESTART switch in the ON position
- Moving the AUTO RESTART switch to the BOOT position
- Executing the boot command on the console terminal
- Failure of an attempted warm start (restart).

Initiation of the cold start sequence causes the console subsystem to search the console tape for the default bootstrap command file DEFBOO.CMD. When DEFBOO.CMD is found it is loaded into memory. If the file is not found, the error number and file name are printed with the "FILE NOT FOUND" and the system returns to console mode.

When the bootstrap file has successfully loaded from the tape, the name of the file is printed and the file is executed. In the case of VAX/VMS, DEFBOO.CMD first initializes the system. It then loads internal CPU registers by executing console commands which it lists on the console.

DEFBOO.CMD then loads the main bootstrap program, VMB.EXE, from the TU58 drive to memory and starts it. VMB.EXE, in turn, attempts to load and start the VMS operating system from the system disk. (The operating system must have been installed and must be in place on the system disk.)

1. When VMS has loaded successfully, the version number and date are printed and the operator responds to the time-of-year message shown in the following example.

```
VAX/VMS Version V3.5 13-OCT-1983 12:02  
PLEASE ENTER DATE AND TIME (DD-MMM-YYYY HH:MM)
```

2. The operator enters the date/time information in the following format.
15-NOV-1983 17:25
3. VMS performs a series initialization and the set-up tasks, then logs out the terminal. The operator or system manager must then log in to an authorized account.

When in program mode, the console subsystem allows the console terminal to be addressed as an I/O device by the system software and monitors keyboard characters for CTRL/P. The console subsystem continues operation under its own program control and performs a wide variety of system tasks and services.

2.9.3 Warm Start Recovery (Restart)

Warm start recovery refers to restarting the operating system without reloading it into memory. The restart will be attempted when the console subsystem gains control of the system following a CPU halt or a power restoration. The console subsystem monitors the AUTO RESTART switch to determine if restart is enabled. If the AUTO RESTART switch is in the OFF position, restart is disabled and the CPU will enter the console I/O mode wait loop. If restart is enabled (AUTO RESTART is ON), the console subsystem will print "ATTEMPTING SYSTEM RESTART" and will initiate restart procedures.

If the warm restart fails, the console subsystem prints "SYSTEM RESTART FAILED" and attempts to cold start the operating system.

2.9.4 Shutting Down the System

It sometimes becomes necessary to halt a running VAX/VMS operating system. If possible, the system manager should perform the shutdown in an orderly manner to prevent loss of data. When the orderly shutdown fails, an emergency shutdown may be attempted before turning off the power to the system.

2.9.4.1 Orderly System Shutdown – The following procedure outlines the steps in an orderly system shutdown. More information on system shutdown can be found in the *VAX/VMS System Management and Operations Guide* (AA-M5474-TE).

To begin an orderly system shutdown, the system manager must type the following command after the "\$" prompt.

```
@SYS$SYSTEM:SHUTDOWN
```

This system will then prompt the system manager with a series of questions, as shown in the following example.

```
How many minutes until shutdown [0]? 5
Reason? WEEKLY SYSTEM DISK BACKUP
Do you want to spin down the disks [No]? YES
Expected uptime (<RET> if not known)?
Enable automatic reboot [No]?
```

When these questions have been answered the system warns users of the impending shutdown and requests that they log out. Batch and device queues are stopped and logins are disabled. Volumes are dismounted, user processes are stopped, and files are closed.

2.9.4.2 Emergency System Shutdown – If it is necessary to shut down the system quickly, the system manager may use the following command to force an immediate shutdown.

```
$ RUN SYS$SYSTEM:OPCRASH
```

When the system is shut down using this method, users are not warned and files are not necessarily closed. However, memory is saved on the disk in the system dump file.

2.10 CONSOLE COMMANDS

The VAX-11/725 console is implemented to perform the following functions and services.

- Serves as controller for the LA120 console terminal, the dual-drive TU58 cassette tape unit, and the remote diagnostic interface.
- Operates under the control of its own RAM-resident program when the microcode is fully loaded as described in Sections 2.9.1 and 2.9.2.
- In program mode, performs hardware functions related to the operating system and (except for CTRL/P) allows the program to address the local terminal as an I/O device.
- In console mode, communicates with the system microcode to perform commands typed on the local or remote terminal.

Descriptions of console commands most commonly used by the operator or programmer are provided here. (The *VAX-11/725 Diagnostic System Overview Manual* [EK-DS725-UG] contains descriptions of user-runnable diagnostics and maintenance commands.)

A console command is issued as follows.

1. The command is specified by typing only its abbreviation (shown in parentheses) in upper or lower case.
2. Any qualifiers that follow must be separated by a slant (/) sign.
3. Address and data information are separated by one or more spaces and are expressed by one to eight hexadecimal (hex) digits.
4. The command is executed when the RETURN key is pressed.

2.10.1 Directory (DIR)

The directory command types a directory listing of the tape inserted in the TU58 default drive unit unless the other unit is specified.

Examples:

>>>DIR Types a directory of the tape inserted in the current TU58 default drive unit.

>>>DIR DDn: Types a directory of the tape in unit n. "DD0:" sets unit 0 as the default unit; "DD1:" sets unit 1.

NOTE

During a power-up sequence, the default tape unit is unit 1. The default changes to unit 0 if the console tape is not inserted in unit 1. The default unit may then be changed by the operator with a console command that accesses the TU58 drive.

2.10.2 Boot (B)

The boot command loads and executes a bootstrap command file from the default TU58 tape unit.

Examples:

>>>B	Loads/executes DEFBOO.CMD from the default unit.
>>>B DDn:	Loads/executes DEFBOO.CMD from unit n (DD0: or DD1:).
>>>B SUO	Loads/executes SUOBOO.CMD from the default unit.
>>>B DDn:SUO	Loads/execute SUOBOO.CMD from unit n (DD0: or DD1:).

2.10.3 Test (T)

The test command performs the self-test then loads and starts one of three diagnostic programs from a console drive device, depending on whether a qualifier is used, and if so, which one. The qualifiers used are:

none	Loads and starts the customer-runnable diagnostic AUTO mode package (ENSAB.EXE).
/M	Loads and starts the customer-runnable diagnostic MENU mode package.
/C	Loads and starts the micro-diagnostic monitor package (ENKAA.EXE).

2.10.4 Initialize (I)

The initialize command clears system error and status flags and sets the CPU and its internal constants to a specified starting condition.

2.10.5 Start (S)

The start command initializes the CPU, deposits the specified starting address into the CPU program counter (PC), and performs a continue function to begin program operation. The program starts from the current contents of the PC if no address is specified.

Examples:

>>>S 1000	Starts the main memory program from address 1000 (hex) in the PC.
>>>S @	Stores the address of the data last examined or deposited in the PC and uses it as the starting address.

2.10.6 Halt (H)

The console halt command is not implemented in the VAX-11/725. CTRL/P is used to halt the CPU. Giving the halt command while the CPU is halted, however, causes the console to type the contents of the CPU program counter (PC).

2.10.7 Continue (C)

The continue command causes the CPU to continue the program from the current address in the CPU program counter (PC). Initialization does not take place, as it does for the start command, and the system state and registers are unaffected.

If the CPU clock is stopped due to a microcode breakpoint, or if the CPU is in microstep mode, the continue command restarts the CPU clock and stays in console mode.

2.10.8 Examine (E) and Deposit (D) Commands

Examine (E) – This command allows the operator to examine the contents of a specified address. If no address or address symbol is given, the contents of the next address are examined by default.

Examples:

>>>E 1000	Examines the contents of address 1000 (hex).
>>>E	Examines the contents of address 1004 (hex), assuming that the data size is a longword.

Deposit (D) – This command allows the operator to deposit data. The address must be specified, or an address symbol given, with each deposit command.

Examples:

>>>D 1000 DEF21345	Deposits DEF21345 (hex) in address 1000 (hex).
>>>D * 21345	Deposits 00021345 (hex) in address 1000 (hex), assuming that the data size is a longword.

Qualifiers – When the system is initialized, the defaults are set up as follows.

Address = 00000000
Address Space = Physical
Data Size = Longword

The address space and data size may be changed by including default qualifiers shown in Table 2-12 with the examine or deposit command. It is not necessary to give the qualifiers again for subsequent examines or deposits.

Table 2-12 Examine and Deposit Qualifiers

Qualifier	Description
Address Space Qualifiers	
/P	Main memory physical address space.
/V	Virtual address space (does not work unless mapping is set up for the virtual address reference. Also, virtual address examines the display of the translated physical address.)
/I	Internal processor register (IPR).
/G	General purpose register (GPR).
/M	Machine-dependent internal register.
/U	Console microprocessor (ROM or RAM). A console I/O device may also be examined using the command. Example: >>>E/U FFaa, where aa is an I/O device address 00 through FF.
/C	CPU writeable control store (WCS).
Data Size Qualifiers	
/L	Longword
/W	Word
/B	Byte
Repeat Qualifier	
/N:n	Examine or Deposit n+1 successive locations. Example: >>>E/P/L/N:10 1000 examines 11 successive hexadecimal addresses (17 decimal addresses) in the physical address space, starting in location 1000. Returns longword data.

System Register Addressing – Table 2-13 shows the symbolic addresses used to reference internal system registers. When initial reference has been made to a register in internal CPU address space (/I, /G, /M, /U, or /C in Table 2-12), the symbols shown in Table 2-14 may be used for examines and deposits to subsequent registers. Longword reference is made to IPR (/I) or GPR (/G) address space regardless of the data size default.

Physical and Virtual Addressing – Address and data for physical main memory and virtual address space are expressed by one to eight hexadecimal digits. If more digits are supplied for a deposit command than the data size allows, the extra digits to the left are ignored. If fewer digits are supplied, the console appends zeros to the left.

Table 2-13 Internal Register Access

Designation	Registers Accessed
PSL or PS	Processor status longword (PSL)
Rn	General purpose register (GPR); n = 0 to F (hex)
SP	Currently active stack pointer (GPR E)
PC	CPU program counter (GPR F)

Table 2-14 Symbolic Addresses

Symbol	Function
*	Reference current address (last address referenced).
+	Reference next address “+” is assumed for an examine if no address or symbol is given.
–	Reference previous address.
@	Indirect address reference. Uses the address of the data last examined or deposited as the address for the command. Also works for a Start (>>>S @) or Load/Start (>>>L/S:@).

When reference has been made to an initial address, the symbols shown in Table 2-14 may be used for subsequent examines and deposits to physical or virtual address space. (The address mapping must be set up for translation to take place or virtual address references will not work.)

The subsequent address referenced by the plus (+) or minus (–) symbol is the current address plus or minus the data size default: 1 for byte, 2 for word, or 4 for longword.

2.10.9 Repeat (R)

The repeat command may be used to continually execute the examine or deposit command until stopped by CTRL/C, CTRL/P, or the BREAK key.

Example:

>>>R E 1000 Repeatedly examines address 1000 (hex) until stopped by the operator.

2.10.10 Console Mode Control Keys

Table 2-15 gives a description of console mode control key functions.

Table 2-15 Console Mode Control Keys

Key	Control Function
RETURN	Terminates the command string and causes the console to execute the command.
CTRL/C, CTRL/P, or BREAK	Aborts the current command and returns the console to the idle state. (See also the repeat command description.)
DELETE	Deletes previous characters in the command string (if the carriage return has not been given). Each delete causes a backslash (\) to be printed.
ESCAPE (ESC)	Reexecutes the last command given (current contents of the command input buffer).
CTRL/R	Retypes the last command given (current contents of the command input buffer).
CTRL/U	Aborts the current command and clears the command input buffer.
CTRL/O	Enables or disables console printouts.
CTRL/S	Stops console printout. Only keyboard control characters are recognized; all others are stored in a 64-character buffer and are accepted only when CTRL/Q is given.
CTRL/Q	Resumes console printout. Console responds to stored input characters.

2.10.11 Load (L)

The load command causes file data to be read from the TU58 drive to main memory (/P), the CPU writeable control store (/C), or the console microprocessor memory (/U).

Examples:

>>>L/P/S:aaaa
DDn: filename

Loads the specified file data to physical main memory starting at address aaaa (hex). If no starting address is specified, it starts the load at address 0. The console tries to read from the default TU58 unit if none is specified.

>>>L/P/S:

Loads data from the default TU58 unit to main memory, starting at the address of the last data examined or deposited.

2.10.12 Next (N)

The next command is given when it is desired to step through the program one instruction (macro-instruction) at a time.

Example:

>>>N nnnn

The CPU executes nnnn instructions.

If the number is not given, one instruction is executed and the console enters the spacebar step mode. The console enters the program mode to perform the instruction, returning to the console mode when the step is complete. It then types the current contents of the PC. Interrupts are blocked while executing the next command from the console.

2.10.13 Microstep (M)

The microstep command is given when it is desired to step through each instruction, one micro-instruction at a time.

Example:

>>>M nnnn The CPU executes nnnn micro-instructions.

If the number is not given, one micro-instruction is executed and the console enters the spacebar step mode. The contents of the micro-program counter (UPC) are typed after each step. (Stepping through instructions that access the console does not work.)

Typing the next command (N) causes the program to complete the current instruction and halt. The program may then be continued by typing the continue command (C).

2.10.14 Test (T)

The test command tries to find the customer-runnable diagnostic package ENKAB.EXE on the TU58 default unit. The command (T/C) tries to load and start the microdiagnostic monitor ENKAA.EXE. The operating state of the machine is altered whether or not the file is found. If not, the console subsystem returns to the console mode to reload itself from the console tape. The following tests are called by this command:

>>>T Calls the CRD AUTO test.

>>>T/M Calls the CRD MENU mode.

>>>T/C Calls the microdiagnostic monitor (MICMON).

2.10.15 Wait (W)

The wait command is reserved for the use of the console subsystem to detect the completion of POWER.CPU on the power-up sequence described in Section 2.9.1.

2.10.16 Indirect (@)

This command loads and executes the indirect command file specified on a power-up sequence or by the operator. It must not be confused with the indirect symbolic address described in Table 2-14.

Example:

>>>@POWER.CMD

2.10.17 Binary Load/Unload (X)

This command is reserved for the use of an automated device that communicates with the console to transfer data between itself and main memory (/P), the CPU writeable control store (/C), or the console microprocessor (/U).

Example:

>>>X/P aaaaaaaa nnnnnnnn(RETURN)(CHECKSUM)

Except for data bit <31>, transfers nnnnnnnn data bytes, starting at physical address aaaaaaaa.

If data bit <31> is a 1, the operation is Binary Unload (the console unloads memory data to the device).

If data bit <31> is a 0, the operation is Binary Load (the console loads memory with data from the device).

After a carriage return, the device supplies a command checksum to continue the operation. A data checksum is then provided on nnnnnnnn+1.

2.10.18 Console Command Errors

If the operator gives a command that the console cannot properly process, it prints a question mark followed by the error code and an explanation of the problem.

2.10.19 Processor Halt Codes

When the CPU is halted for any reason, it returns to console mode and a question mark is printed, followed by the applicable halt or error halt code as described in Table 2-16.

Table 2-16 Processor Halt Codes

Code	Description
00	Halt command, when given by the operator while the processor is in console mode. Also prints the contents of the CPU PC.
01	Microverify was successful.
02	CPU Halt – Operator typed CTRL/P while the processor was in program mode.
03	Typed by the console on a power fail restart. Does not appear in a halt message.
04	Invalid Interrupt Stack (IS).
05	CPU double error. A second machine check occurred before a previous one could be reported.
06	CPU Halt – CPU executed a HALT instruction in kernel mode.
07	Invalid System Control Block (SCB) vector (bits <1:0> of the SCB vector = 3).
08	No User WCS – SCB vector bits <1:0> = 2 with no user WCS installed.
09	Error Pending on Halt – Processor was halted by a CTRL/P before an error halt could be performed.
0A	Change Mode from Interrupt Stack instruction was executed when the PSL <IS> bit was set.
0B	Change Mode to Interrupt Stack instruction was executed when the exception vector for a change mode had bit <0> set.
0C	SCB Read Error – Uncorrectable memory error occurred when the CPU tried to read an exception or interrupt vector.

CHAPTER 3 USER MAINTENANCE PROCEDURES

3.1 GENERAL

This chapter describes procedures and precautions that must be followed to ensure that regular user-level maintenance is properly performed. Also, this chapter lists the faults that may occur in the system peripheral devices.

Refer to the individual device user documentation, listed in Chapter 1, for a full explanation of user maintenance procedures.

3.2 SYSTEM POWER

System power for the VAX-11/730 systems is controlled by circuit breakers located in the front and rear of the system cabinets.

3.2.1 VAX-11/730 System 1 and 2 Power

Power to devices in the VAX-11/730 system 1 and 2 system cabinets is controlled by a circuit breaker on the power controller that is located in the bottom rear of the system cabinet. This circuit breaker is located in the middle of the power controller and is labeled MAIN POWER. This circuit breaker controls the SWITCHED outlets on the front of the power controller, into which the CPU mounting box, drive devices and console terminal are plugged. Power to other devices in the system cabinet is taken from the UNSWITCHED outlets.

Power to the CPU mounting box is controlled by a circuit breaker that is located behind the front panel on top of the box. The circuit breaker is accessed by extending the safety foot from the front of the cabinet and sliding the CPU mounting slightly forward.

Power to drive devices in the system cabinet is controlled by circuit breakers located at middle rear of each drive device. These are accessed by removing the system cabinet door.

3.2.2 VAX-11/730 SBB

Power to devices in the VAX-11/730 SBB system is controlled by a circuit breaker on the power controllers. The controllers are located in the bottom right rear of the cabinets in the system configuration. The circuit breaker is labeled MAIN POWER. This circuit breaker controls the SWITCHED outlets on the front of the power controller, into which the CPU mounting box (in the system cabinet), drive devices (in the drive device cabinet) and console terminal are plugged. Power to other devices in the cabinet is taken from the UNSWITCHED outlets.

Power to the CPU mounting box is controlled by a circuit breaker located at the middle rear of the mounting box.

Power to the disk drive devices is also controlled by circuit breakers which are located at the middle rear of each device.

Power to the magnetic tape transport is controlled by a circuit breaker located in the upper right corner of the transport under the access cover.

All circuit breakers for the power controllers, CPU mounting box and disk drive devices are accessed by removing the cabinet rear door.

NOTE

The normal position for all system circuit breakers is ON (1).

The normal position for the REMOTE/OFF/LOCAL switch on all power controllers is REMOTE. This allows the CPU front panel keyswitch to switch system power to devices in the system.

CAUTION

VAX-11/730 subsystems are equipped with power select switches that allow them to be used with either 120 VAC or 240 VAC power in a variety of applications. The position of these switches should not be changed since the power supplies of these devices may be seriously damaged.

3.3 LA120 CONSOLE TERMINAL

The LA120 is a smart, bidirectional, 7×7 dot-matrix impact printer. It contains a 1000-character input buffer and has a maximum print rate of 180 characters per second. If characters are transmitted to the printer at a high baud rate, they are stored in the input buffer until the printer catches up. If the LA120 terminal is changed from the on-line to the local mode, printing continues until the buffer is empty.

3.3.1 Power Switch, Fuse, and Cover Interlock

The console terminal is plugged into a switched ac outlet of the system power control. The normal position for the ac power switch is ON to allow the terminal to turn on and off with the system. A safety interlock is provided to prevent printer operation when the cover is opened. The ac power switch and line fuse are located in the lower left-hand corner of the front panel below the keyboard. The line fuse is a 250 V slow-blow, rated at 3 A.

3.3.2 Changing the Ribbon

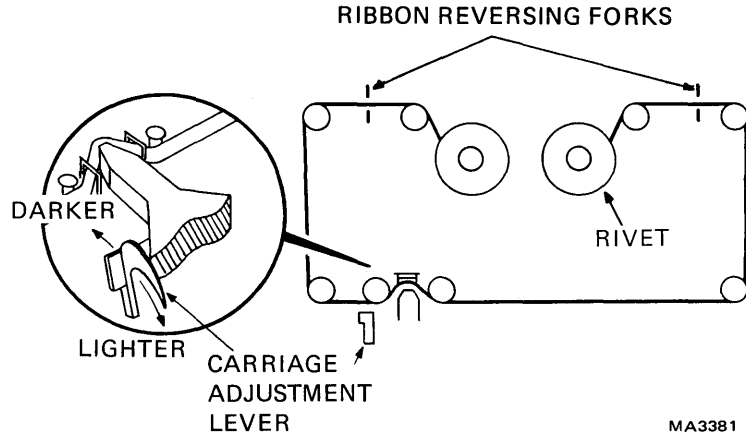
The LA120 ribbon provides from six to eight hours of continuous printing. When the print contrast becomes too light, the ribbon may be turned over for one or two more hours of printing. It should then be replaced as follows.

1. Turn the printer off and open the top cover.
2. Move the print head adjustment lever away from the paper (see Figure 2-5).
3. Wind the old ribbon up entirely on one spool and remove it.
4. Save the empty spool and discard the old ribbon.
5. Attach the end hook of the new ribbon to the empty spool.
6. Wind ten turns of new ribbon on the empty spool.

7. Place the full spool on the left spool shaft (which turns freely) and turn clockwise until it drops into position.
8. Thread the new ribbon around the print head and guides, and through the direction-changing guides (Figure 3-1).
9. Make sure that the ribbon rivet is on the empty spool, or is between the empty spool and the direction-changing guide.
10. Adjust the print impression as follows.
 - a. Move the head adjustment lever toward the paper and make light contact with the paper or form.
 - b. Manually move the print head to the side to check for smudging or paper rippling.
 - c. Close the cover and type several characters. If smudging or rippling occurs, open the cover and move the head adjustment lever slightly away from the paper and check it again.

CAUTION

Only DIGITAL recommended ribbons (part no. 36-12153-01) should be used in the LA120 terminal. Using other ribbons may damage the print head and void the warranty.



MA3381

Figure 3-1 Threading the Ribbon

3.3.3 Error Display

When the LA120 terminal is turned on, it runs several internal tests. Any error results are viewed in the numeric display, as shown in Table 3-1. If the error cannot be cleared, an authorized service engineer should be notified.

3.3.4 Self-test Feature

The self-test may be performed in one of two modes, printing or non-printing.

Table 3-1 LA120 Error Display

If Display Indicates	Problem Is Caused By
0	Error at ROM address 0
1	Error at ROM address 2048
2	Error at ROM address 4096
3	Error at ROM address 6144
4	Error at ROM address 8192
5	Error at ROM address 10240
6	(reserved for future use)
7	RAM diagnostic failure
8	Microprocessor failure (see note 1)
9	Nonvolatile memory failure (see notes 1 and 2)
8888	Cover open or paper-out indication (see note 3)

NOTES

- 1. Turn the LA120 printer OFF, then back ON. If an error indication reappears, record the indication and call for service.**
 - 2. If the original problem was a flashing “9”, check the stored set-up features to ensure that they were not affected. The printer self-test can also be performed as described in Section 3.3.4. The test may help to determine if the problem is in the printer or in the console subsystem.**
 - 3. Close cover, reload paper, or clear paper jam.**
-

3.3.4.1 Printing Self-test – The following actions run the printing self-test.

1. Hold the CTRL key and press the SET-UP key.
2. Press the letter “T”.
3. The test continues until the SET-UP key is pressed.

3.3.4.2 Nonprinting Self-test – The following actions run the nonprinting self-test.

1. Hold the CTRL key and press the SET-UP key.
2. Hold the SHIFT key and press the “period” key.
3. The test continues without printing characters until the SET-UP key is pressed.

3.4 LA100 CONSOLE TERMINAL

3.4.1 Power Switch and Fuse

The LA100 terminal is plugged into a switched ac outlet of the system power controller. The normal position for the ac power switch is ON to allow the terminal to turn on and off with the system. The ac power switch and line fuse are located in the lower right corner of the rear panel. The line fuse is a 250 V slow-blow, rated at 3 A.

3.4.2 Changing the Ribbon

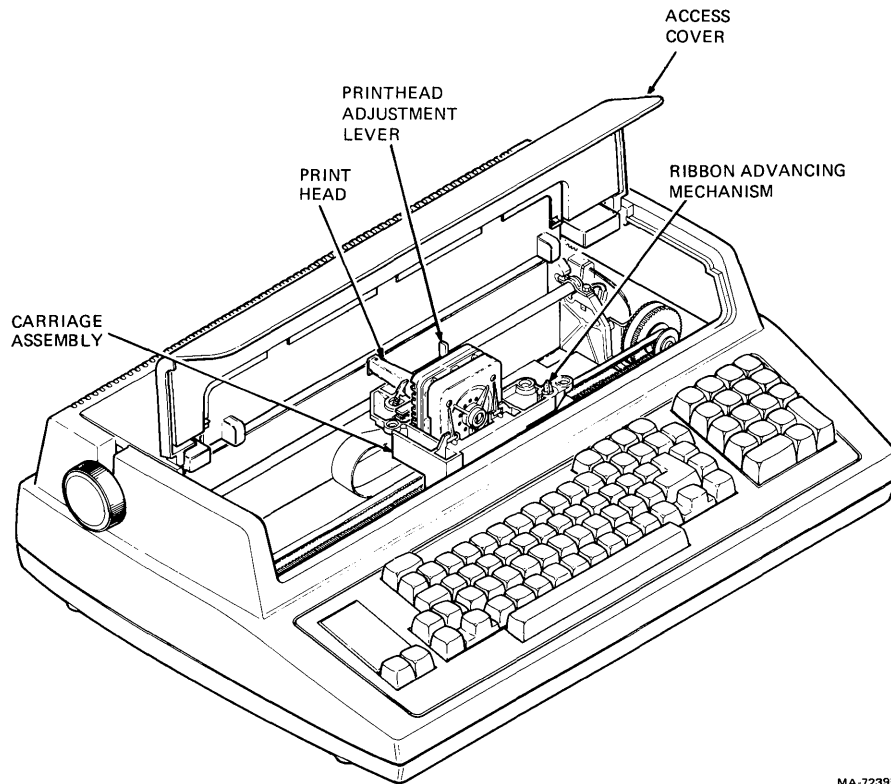
The ribbon cartridge used in the Letterwriter 100 terminals usually provides 40 hours of continuous printing. Actual cartridge life depends on the type of printing done by the terminal. When the print density is too light, check the printhead adjustment (described later in this chapter). If the printhead is adjusted correctly and the print density is still too light, replace the ribbon cartridge.

CAUTION

Although you can use the DECwriter IV ribbon cartridge with the Letterwriter 100, DIGITAL recommends the Letterwriter 100 ribbon cartridge (P/N LA10R). Using other ribbon cartridges may damage the printhead and void the warranty. Refer to the Accessories and Supplies chapter for ordering information.

Perform the following procedure to install a ribbon cartridge. It is not necessary to turn the power off when installing a ribbon cartridge.

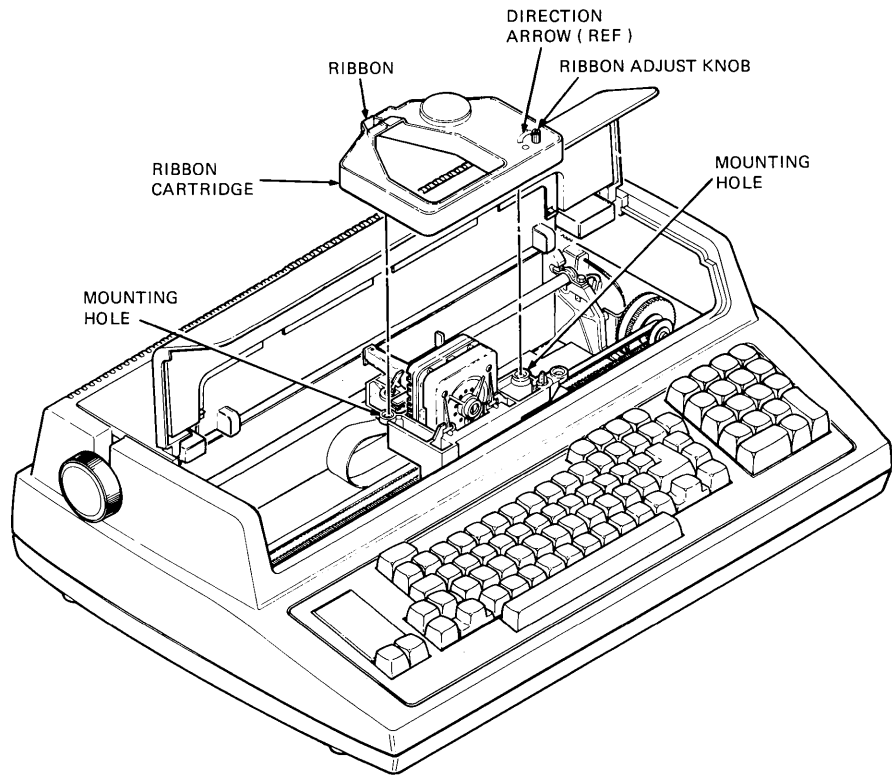
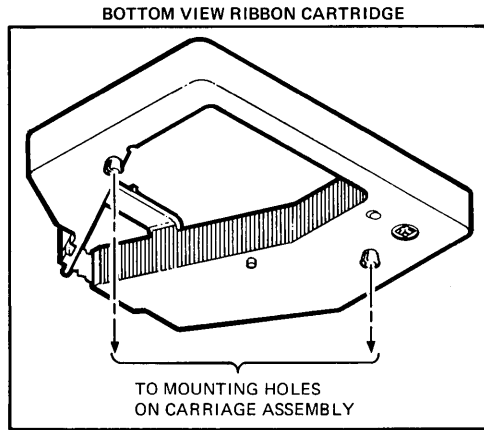
1. Open the access cover (Figure 3-2).
2. Remove (lift) and discard the old ribbon cartridge.



MA-7239B

Figure 3-2 Carriage Assembly

3. Move the printhead adjustment lever all the way to the right (Figure 3-2).
4. Turn the ribbon adjust knob on the new ribbon cartridge clockwise to tighten the ribbon (Figure 3-3).
5. Line up the snap buttons on the new ribbon cartridge with the mounting holes in the cartridge assembly (Figure 3-2).
6. Slowly press the new ribbon cartridge onto the cartridge assembly while turning the ribbon adjust knob. Verify that the slot in the ribbon cartridge (Figure 3-3) engages the tab on the ribbon advancing mechanism (Figure 3-2).



MA-7240B

Figure 3-3 Ribbon Cartridge

3.4.3 Self-Test

The LA100 terminal performs a power-up self-test whenever power to the terminal is turned on. Any errors during this self-test are displayed by the keyboard indicators. Refer to Table 3-2 for the power-up self-test indications.

Table 3-2 Power-Up Self -Test Indications

DSR Indicator	POWER/FAULT Indicator	Probable Cause	Action
Off	Off, no carriage motion	Power supply	Refer to the <i>LA100 Operator's Guide</i> .
Off	Off, carriage motion	Defective indicators	Request service.
1 flash	1 flash	Defective font ROM 1	Replace ROM.
2 flashes	2 flashes	Defective font ROM 2 (may be cartridge or plug-in ROM)	Replace ROM.
3 flashes	3 flashes	Defective font ROM 3	Replace ROM.
4 flashes	4 flashes	Defective font ROM 4 (may be cartridge or plug-in ROM)	Replace ROM.
5 flashes	5 flashes	Defective font ROM 5	Replace ROM.
6 flashes	6 flashes	Defective first microcode ROM	Request service.
7 flashes	7 flashes	Defective second microcode ROM	Request service.
8 flashes	8 flashes	Defective RAM	Request service.
9 flashes	9 flashes	Defective optional RAM	Request service.

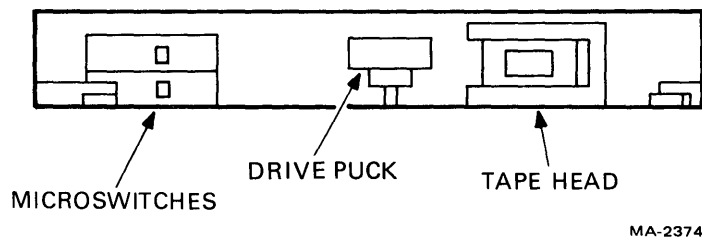
Table 3-2 Power-Up Self-test Indications (Cont)

DSR Indicator	POWER/FAULT Indicator	Probable Cause	Action
On or off	Flashing, no bell	Cover open or paper fault	Close cover. Press CLEAR FAULT key.
On or off	Flashing, bell tones	Head jam	Clear jam. Press CLEAR FAULT key.
On	On	On-line/ready to receive data	
Off	On	Terminal is in modem mode with no DSR signal, or SELF-TEST key was pressed before power-up.	Release SELF-TEST key.

3.5 TU58 CASSETTE TAPE DRIVES

3.5.1 Drive Cleaning

After 250 hours of tape running time, or twice a year, record head and puck (Figure 3-4) should be cleaned with a long-handled cotton applicator. The applicator should be moistened with cleaning fluid supplied in the Tape Drive Cleaning Kit TUC-01, with 95 percent isopropyl alcohol, or with fluorocarbon TF, 113, or equivalent.



MA-2374

Figure 3-4 TU58 Cassette Tape Cartridge Slot

Turn the puck with the applicator and clean its entire surface. Regular cleaning minimizes tape and head wear and prevents tape damage and data errors caused by contamination. This is the only regular maintenance required on the TU58 tape drives. For further information on operator fault isolation and cartridge repair, refer to the *TU58 DECtape II Technical Manual (EK-0TU58-TM)*.

3.5.2 Tape Wear

Cassette cartridge tape is expected to last for about 5000 passes, end-to-end and back. If a cartridge is near the end of its useful life, a read operation may require several retries to read the data. A soft error (a temporary data loss) is usually caused by a speck of dirt or oxide on the tape or head surface. The speck lifts the tape from the head, causing signal loss and subsequent read errors. Extra passes of the tape past the head may remove the speck and allow error-free reading. If this happens often, the tape may be old and shedding oxide. It should be copied and discarded as soon as possible.

NOTE

Keep magnetized tools or objects away from the cartridge or data may be erased or altered. When handling the cartridge, do not touch the tape surface. Fingerprints collect dirt and oxide particles and cause errors.

3.6 RL02 DISK SUBSYSTEM

User maintenance procedures are limited to care and external cleaning of the RL02K disk cartridge and cleaning of the drive spindle assembly. It should be noted that the RL02K cartridge is physically interchangeable with the RL01K cartridge; however, each is factory certified to a different format and they are *not* functionally interchangeable.

3.6.1 Cleaning the Cartridge Cover

The user should clean the outer sides of a completely assembled cartridge by using a lint-free wiper dampened with a solution of 9 percent water and 91 percent isopropyl alcohol. The cartridge must *not* be saturated and all excess solvent must be removed with a dry wiper. This is necessary to prevent solvent from entering the seams of the assembly and contaminating the platter.

CAUTION

For cleaning purposes, only a solution of 9 percent water and 91 percent isopropyl alcohol should be used. Do not use water, trichlorethylene, carbon tetrachloride, or other solvents.

3.6.2 Professional Cartridge Cleaning

Cartridges should be professionally cleaned every six months or whenever practical. Complete cartridge cleaning procedures must be performed by a professional cleaning service.

CAUTION

Cleaning procedures exercised by unqualified personnel may void not only the cartridge warranty, but the warranty for any drive in which the cartridge is operated.

3.6.3 Spindle Assembly Cleaning

Use a lint-free wiper dampened with the 91 percent isopropyl alcohol solution to clean the spindle cone before loading the cartridge. Do not saturate the assembly, and remove all excess with a dry, lint-free wiper. This is necessary to prevent contamination of the cartridge when it is loaded. In addition, ensure that the shroud is as free of dust and lint as possible before loading the cartridge. Dry lint and dust may be blown from the spindle area using canned air or filtered dry air.

CAUTION

Use of manufacturing environment air, which may contain water or oil, is not permissible.

3.7 R80, RA80, RA81 AND RA60 DISK SUBSYSTEMS

3.7.1 Fault Identification Codes

For faults not locally or program correctable, a general fault code is displayed during the fault reset sequence, as shown in Table 3-3 through Table 3-6. The specific fault is stored internal to the disk drives for later retrieval by the service engineer.

Table 3-3 R80 Fault Identification Codes

Type of Fault	RUN STOP	FAULT	READY	WRITE PROT	STAT 1	STAT 2
Spin-up	*	ON				ON
Read/Write Unsafe	*	ON			ON	ON
Write Protect	*	ON		ON		ON
Spindle Motor Interlock	*	ON		ON	ON	
Spindle Motor Speed	*	ON		ON	ON	ON
Invalid Interface Command	*	ON	ON			ON
HDA or Servo Board Overtemp	*	ON	ON		ON	
Read/Write Diagnostic	*	ON			ON	
Microcode	*	ON	ON		ON	ON
Servo Diagnostic	*	ON	ON	ON		ON
Initial Recalibrate	*	ON	ON	ON	ON	
Microprocessor Hardcore Test	ON	ON	ON	ON	ON	ON

*The RUN/STOP indicator state remains the same as it was before the FAULT switch was pushed.

Table 3-4 RA80 Fault Identification Codes

Type of Fault	RUN STOP	FAULT	READY	WRITE PROT	A	B
Spin-up		ON				ON
Read/Write Unsafe	*	ON			ON	ON
Spindle Motor Interlock	*	ON		ON	ON	
Spindle Motor Speed	*	ON		ON	ON	ON
Drive Disabled by "DD" Bit	*	ON	ON			ON
HDA or Servo Board Overtemp	*	ON	ON		ON	
Read/Write Diagnostic	*	ON			ON	
Microcode	*	ON	ON		ON	ON
Servo Diagnostic	*	ON	ON	ON		ON
Initial Recalibrate	*	ON	ON	ON	ON	
Microprocessor Hardcore Test	ON	ON	ON	ON	ON	ON

*The RUN/STOP indicator state remains the same as it was before the FAULT switch was pushed.

Table 3-5 RA81 Fault Identification Codes

Type of Fault	RUN STOP	FAULT	READY	WRITE PROT	A	B
Spin error		ON				ON
Microprocessor Fault		ON			ON	
SDI Error		ON			ON	ON
Master/Slave Error		ON		ON		
Servo Fine Positioning Error		ON		ON		ON
Servo Course Positioning Error		ON		ON	ON	
Spindle Motor Interlock Error		ON		ON	ON	ON
Servo or HDA Overtemp Error		ON	ON			
Read/Write Unsafe Error		ON	ON			ON
Read/Write Command Error		ON	ON		ON	ON
Servo/HDA Interlock Error		ON	ON		ON	ON
Servo/Microprocessor Interlock Error		ON	ON	ON		
Read/Write Microprocessor Interlock Error		ON	ON	ON		ON
Control Panel/ Microprocessor Interlock Error			ON	ON	ON	ON
Personality/ Microprocessor Interlock Error		ON	ON	ON	ON	ON

Table 3-5 RA81 Fault Identification Codes (Cont)

Type of Fault	RUN STOP	FAULT	READY	WRITE PROT	A	B
Index Error	ON	ON				
Write and Bad Embedded Data	ON	ON				ON
Drive Disabled by DD Bit	ON	ON			ON	
Write Enable and Write Embedded Asserted Error	ON	ON			ON	ON
Servo Diagnostic Test Error	ON	ON		ON		
Read/Write Diagnostic Test Error	ON	ON		ON		ON
Diagnostic Idol Loop Test Error	ON	ON		ON	ON	
DC Low	ON		ON	ON	ON	ON
Microprocessor Hardcore Test Error	ON	ON	ON	ON	ON	ON

Table 3-6 RA60 Fault Identification Codes

Type of Fault	RUN STOP	FAULT	READY	WRITE PROT	A	B
Microcode Error	*					
Heads Home Switch Fault	*					ON
Front Panel Fault	*				ON	
Long Spin-up Time Fault	*				ON	ON
Bad Servo Samples Fault	*		ON		ON	
Bad Velocity Fault	*		ON	ON		
Linear Mode Fault	*		ON	ON	ON	
Retry on Seek Fault	*		ON			
Last Servo Samples Fault	*		ON			ON
Heads Home Switch Would Not Open	*		ON		ON	

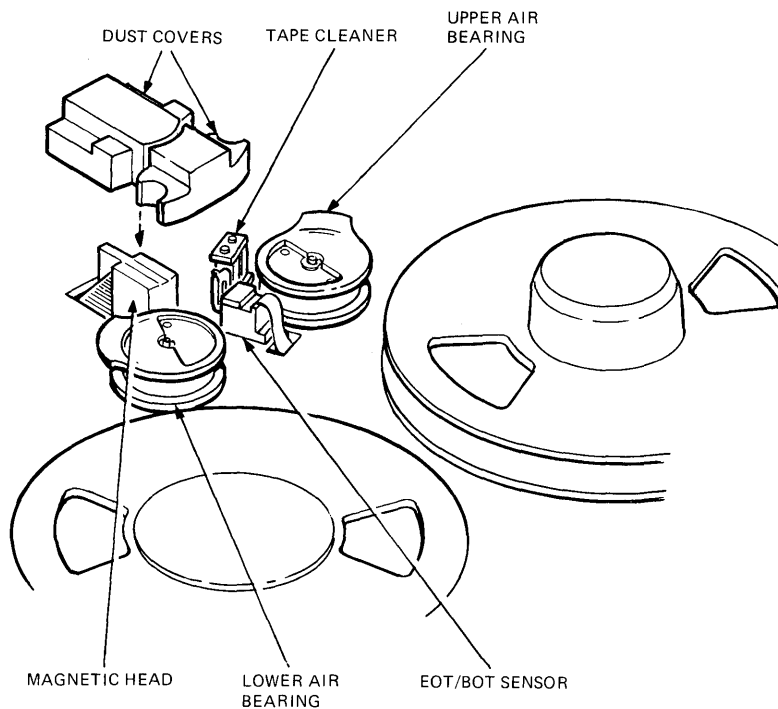
*The RUN/STOP switch may be on or off, depending on the state of the drive.

3.8 TU80 MAGNETIC TAPE SUBSYSTEM

3.8.1 Cleaning Procedure

All transport components that need regular cleaning are located on the tape deck. These components include the magnetic head assembly, EOT/BOT sensor, tape cleaner, and air bearings. Also, the user should regularly examine and clean, as required, the top of the tape deck, reel hubs, and top cover door.

To access the magnetic head components (Figure 3-5), pull up the two-part head assembly dust cover from the tape deck.



MA-0087-82

Figure 3-5 Magnetic Head/Tape Path Components

3.8.1.1 Magnetic Heads – Use the following procedure to clean magnetic heads.

1. Clean the magnetic head working surface with a soft lint-free wipe moistened with the cleaning fluid.

NOTE

Wipe the head surface in the same direction that the tape travels during data recording (forward motion).

2. Clean area adjacent to the head of any dirt that can be transported with the tape.

3.8.1.2 EOT/BOT Sensor and Tape Cleaner – Use a swab moistened with the cleaning fluid to remove dirt or oxide from sensor surfaces and reflective strip, and from the tape cleaner blades.

3.8.1.3 Air Bearings – Use the following procedure to clean the air bearings.

1. Clean both air bearings with a swab moistened with the cleaning fluid.
2. Make sure that foil area, guide springs, and both tape guides are cleared of any oxide/dirt buildup. If available, use a small mirror to inspect inner edge of the guides.

3.8.1.4 Top Cover, Tape Deck, and Head Assembly Dust Covers – To prevent the transfer of dirt to the tape components, *do not* allow dust or dirt to accumulate on the inside of the dust cover. Clean the inside cover surface with a clean, lint-free wipe and any cleaning fluid that is safe for plastic, painted surfaces.

3.8.2 Customer Confidence Check

The customer confidence check consists of the power-on health check and the basic operator diagnostic test 01.

3.8.2.1 Power-On Health Check – The power-on health check is a microdiagnostic (resident) test that is performed when the TU80 is successful, the LOGIC OFF indicator turns OFF and the two-digit display on the TU80 front panel momentarily shows “00”. Then the BOT, RESET, ON-LINE, DIAGNOSTIC, and SELECT indicators go on momentarily. The LOGIC ON and FILE PRO indicators go on and stay on. Otherwise, a fault code is displayed in the two-digit display. Press the RESET, LOGIC OFF and LOGIC ON switches to repeat the check. If the fault code reappears, proceed with the operator corrective actions as indicated in Table 3-7.

Table 3-7 TU80 Operator Corrective Actions

Fault	Corrective Actions
01-09	Clean the magnetic head and tape path.
10	Make sure the cover door is securely closed.
11	Thread the tape.
12	Latch the supply reel.
13	Thread the tape correctly as shown in Figure 2-23.
14	Check for BOT marker on tape. Attach BOT/EOT marker.
15	This fault codes indicates that the RESET switch was pressed inadvertently. Reinitiate the test.
16	Check for presence of the write-enable ring at the supply tape reel. Install the ring if not present.
17	Check for presence of EOT marker. Attach EOT marker.
18	Indicates that the tape was loaded when the test was initiated. Thread the tape, but <i>do not</i> press the LOAD switch.
20-29	Mount a tape of known good quality.
All others	Run the basic operator diagnostic test 01 and report any fault code to Field Service Personnel.

Also, during a load or read/write operation, if a fault occurs that cannot be corrected by the host computer, and the transport takes itself off-line, the operator is informed of the fault by the fault code in the two-digit display.

3.8.2.2 Basic Operator Diagnostic Test 01 – The basic operator diagnostic test 01 is used to check the basic operating functions of the TU80 transport and to verify malfunctions when a fault code indicates failure.

CAUTION

This test reads and writes on the tape. Therefore, remove any mounted tape to save the data on it. Replace it with a tape of known quality, reserved for this purpose.

Perform the basic operator diagnostic test 01 by performing the following steps:

1. Assure that the power switch is in the ON position, LOGIC ON switch is pressed to run the built-in power-on health check (LOGIC ON indicator on).
2. Mount and thread the tape through the tape path and onto the take-up reel, but **DO NOT LOAD**.
3. Close and latch the top cover.
4. Press the RESET switch.
5. Press the TEST switch.

DIAGNOSTICS indicator goes on.

Two-digit display indicates a 01.

6. Press the EXECUTE switch.

Test 01 starts with the two-digit display incrementing from 00 to 99. Make sure all segments of the numerical display are functioning.

Make sure that all indicators except LOGIC OFF, BOT and SELECT are on.

Test 01 continues with various tape motion and read/write exercises for approximately ten minutes (with a 2400 foot reel of tape).

7. If the test is successful, it runs to completion and performs a REWIND/UNLOAD operation. The two-digit display indicates a 00, with the RESET indicator ON. Return the TU80 drive to normal operation.
8. If the test is unsuccessful, the diagnostic programs halt (tape motion stops), and a numerical fault code appears in the two-digit display (other than 00), with the RESET indicator on. Record this number, perform the action in Table 3-7, then if the action did not correct the fault, report the recorded display number to Field Service Personnel.

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