EK-KY11R-TM-002

KY11-R Family of Electronic Consoles Technical Manual

digital equipment corporation • maynard, massachusetts

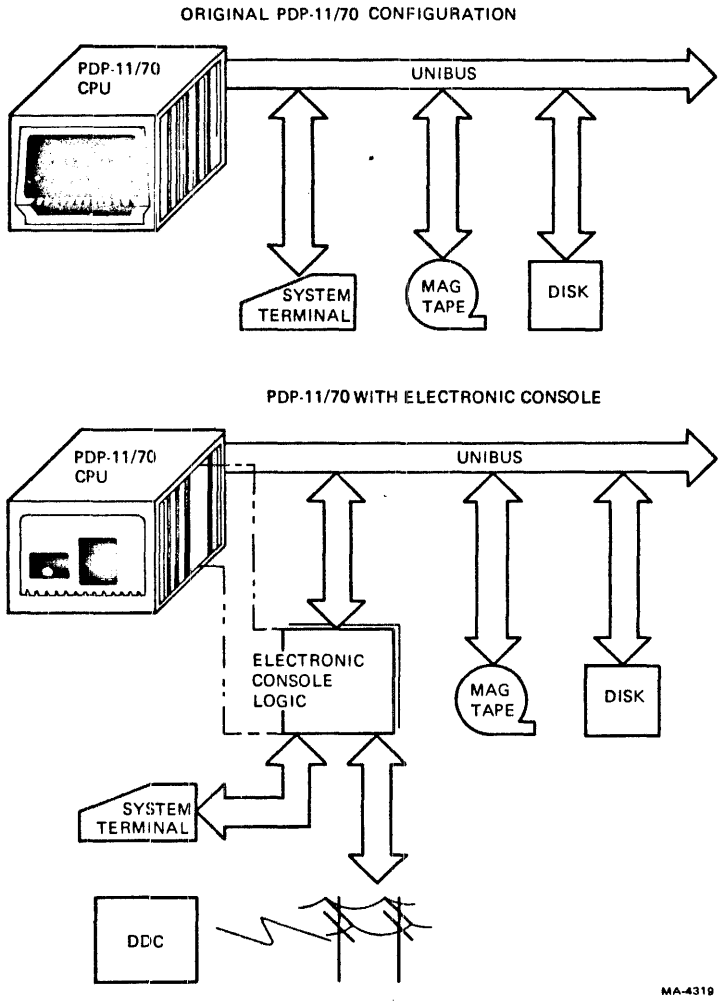


Figure 1-1 KY11-R Electric Console

Table 1-1 KY11-R Variant Summary

Feature	-R	-RB	-RC	-RE
Used on processor type	11/70	11/70	11/70	11/70
Microcode Version V01 available	X	X	X	-
Microcode Version V02 available	X	X	X	X
Kit includes a stand-alone modem	-	X	-	-
Kit includes an integral modem	X	-	X	-
Governmental authority provides modem	-	-	-	X
Kit includes a DAA	-	-	X	-

CHAPTER 2
CONTROLS AND INDICATORS

2.1 SCOPE

This chapter defines the functions of the three switches and six indicators on the electronic console (Figure 2-1).

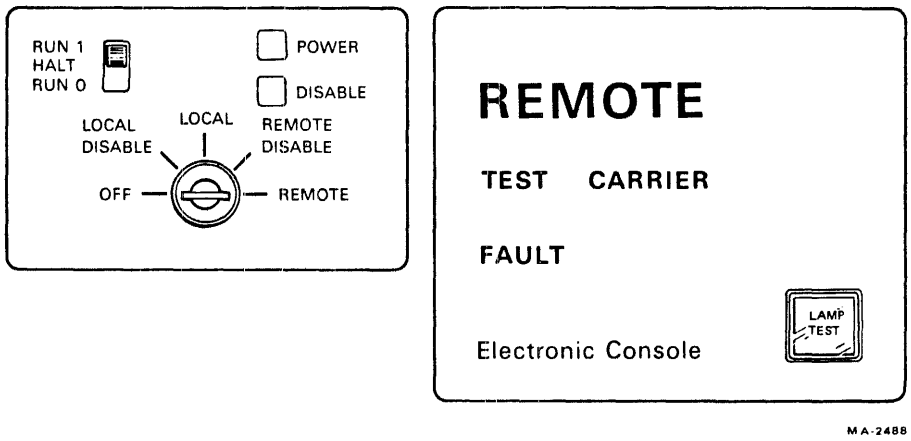


Figure 2-1 Electronic Console Panel Controls and Indicators

2.2 KEYSWITCH

The five-position keyswitch on the electronic console front panel replaces several "traditional console panel" functions. This switch permits the operator to:

- Turn system power on or off
- Select "panel lock" operation
- Permit or restrict DDC access to the system.

The following paragraphs describe system operation in each of the five switch positions.

2.2.1 OFF

The OFF position removes power from the electronic console; in every other position power is applied. This switch is usually the system's master power switch; however, power to certain system components may be controlled independently.

2.2.2 LOCAL DISABLE

The LOCAL DISABLE position is analogous to panel lock on the traditional control panel. Access to panel control and indicator functions (console state) is disabled. The electronic console is effectively bypassed, so that all system terminal communication is dedicated to the CPU. Thus, the system is forced into the program I/O state. LOCAL DISABLE is the normal operating position if panel lock is required.

2.2.3 LOCAL

The LOCAL position is used for system power-up, bootstrapping, and normal operation if panel lock is not required. Also, LOCAL provides access to the traditional panel control and indicator functions through commands typed at the system terminal keyboard. The following logical conditions are associated with LOCAL.

- Console, program I/O, or talk states may be selected.
- Data terminal ready (DTR) is cleared, thus disabling the remote serial interface.
- If a carrier signal is present, switching to LOCAL causes a carrier lost message (?CAR ER) to be printed. Printing of the message may be inhibited as explained in Paragraph 4.3.2.

2.2.4 REMOTE DISABLE

The REMOTE DISABLE position sets DTR and thereby enables the remote serial interface, allowing DDC access to the system. The following, however, are disabled.

- The system terminal keyboard is disabled to prevent operator intervention during DDC testing.
- The console state is disabled, both at the site and to the DDC, since the DDC becomes a user by logging into the customer's operating system.

In REMOTE DISABLE, DDC access to the system is subject to program-imposed limitations. There is no access to any of the console control or indicator functions. This protects the customer from unpredictable DDC intervention. The DDC may perform and monitor program I/O functions in duplicating or testing for system failures. DDC and system dialog is displayed on the system terminal to permit monitoring by the site operator. Also, the DDC may set programmable option bits and thereby establish terminal communication with the site operator if desired.

2.2.5 REMOTE

The REMOTE position is used exclusively to give the DDC access to the system for diagnostic or preventive maintenance purposes. All of the capabilities available at the site in LOCAL are available to the DDC in REMOTE. The DTR signal to the modem is asserted to enable the remote serial interface. In addition, although the system terminal is disabled except under DDC control, the talk state permits the DDC to print messages on, and solicit inputs from, the customer's system terminal.

2.3 RUN 1-HALT-RUN 0 (POWER-FAIL RESTART SWITCH)

The power-fail restart switch is a three-position slide switch mounted above the keyswitch. It allows the user to predetermine the system's response in a power-fail restart situation. Selection of the HALT position causes the system to come on in a halted state when power is restored.

Selection of RUN 1 or RUN 0 is determined by the requirements of the operating system. If the system anticipates all ones in the switch register at restart, selection of RUN 1 is appropriate. Conversely, if all zeros are expected, RUN 0 should be selected. Note that this switch determines switch register contents only at restart (power coming up); the Operator's Reference Summary (Appendix F), Paragraph 4.4.10, and Appendix B.1 (steps 2 through 5), explain how to set switch register contents as required for a power failure (power going down).

2.4 LAMP TEST (PUSHBUTTON SWITCH)

The lamp test switch is unidentified at its location, in the lower right corner of the status display area. Whenever power is on, pressing the switch turns on all indicators or, by exception, indicates a lamp failure.

2.5 POWER INDICATOR

The POWER indicator serves a dual purpose:

- To indicate that power is on within the electronic console (other system units may or may not have power on)
- In Microcode Version V02 or later, to indicate, by blinking, that the CPU is in a halted state.

Table 2-1 indicates all possible states of both POWER and DISABLE indicators.

Table 2-1 Power and Disable Indicator States

Keyswitch Position	Program State	Microcode Version V01		Microcode Version V02	
		POWER	DISABLE	POWER	DISABLE
LOCAL	Running	ON	OFF	ON	OFF
LOCAL DISABLE	Running	ON	ON	ON	ON
REMOTE	Running	ON	OFF	ON	OFF
REMOTE DISABLE	Running	ON	ON	ON	ON
LOCAL	Not Running	ON	OFF	Blinking	OFF
LOCAL DISABLE	Not Running	ON	ON	Blinking	Blinking
REMOTE	Not Running	ON	OFF	Blinking	OFF
REMOTE DISABLE	Not Running	ON	ON	Blinking	Blinking

2.6 DISABLE INDICATOR

The DISABLE indicator comes on whenever the keyswitch is in either LOCAL DISABLE or REMOTE DISABLE. This is also a dual purpose indicator, and, in Microcode Version V02, its continuous blinking in unison with POWER is a redundant indication that the program has halted. This redundancy is indicated in Table 2-1, which shows all possible states of both DISABLE and POWER.

The primary purpose of DISABLE is to remind the operator that a panel lock condition exists, the system is in program I/O state, and the system terminal is dedicated to program input/output.

2.7 REMOTE INDICATOR

The REMOTE indicator comes on (the word REMOTE lights up) whenever the keyswitch is in either REMOTE or REMOTE DISABLE. It indicates that the remote serial interface is enabled and the DDC has access to the system.

2.8 CARRIER INDICATOR

The CARRIER indicator comes on (the word CARRIER lights up) whenever the electronic console remote serial interface and modem receive a carrier-detected signal. It indicates that the DDC host computer is connected via telephone line to the electronic console.

2.9 TEST INDICATOR

The TEST indicator comes on (the word TEST lights up) whenever the customer's system is connected to the DDC host computer. Also, the DDC may initiate the running of a diagnostic at the site, turn on TEST, disconnect (CARRIER will be turned off) during the test period, then reconnect later to continue the session. The keyswitch must be in either REMOTE or REMOTE DISABLE for TEST to be on. In Microcode Version V01, TEST is disabled by REMOTE DISABLE.

2.10 FAULT INDICATOR

The FAULT indicator comes on (the word FAULT lights up) when the electronic console detects an error condition during a power-up self-test, a command V initiated self-test, or any operation involving the electronic console logic. An error message (?CON ER) is also displayed on the system terminal if the logic required to do so is operative. If a failure is transient in nature, the electronic console may still be operational; however, FAULT can be cleared only by a power-down, power-up sequence.

If a fault condition exists, or is suspected, contact DIGITAL's Service Response Group at the DDC as described in Chapter 5.

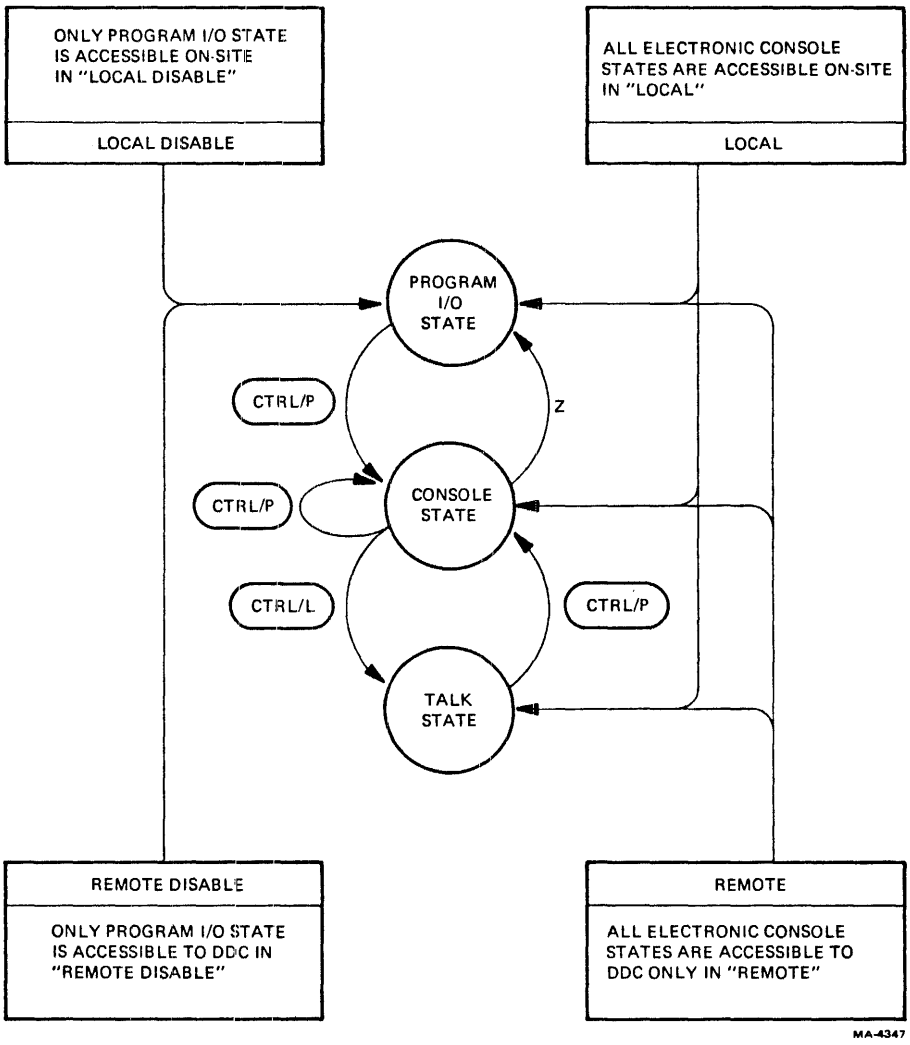


Figure 3-1 Operating States Transition and Accessibility

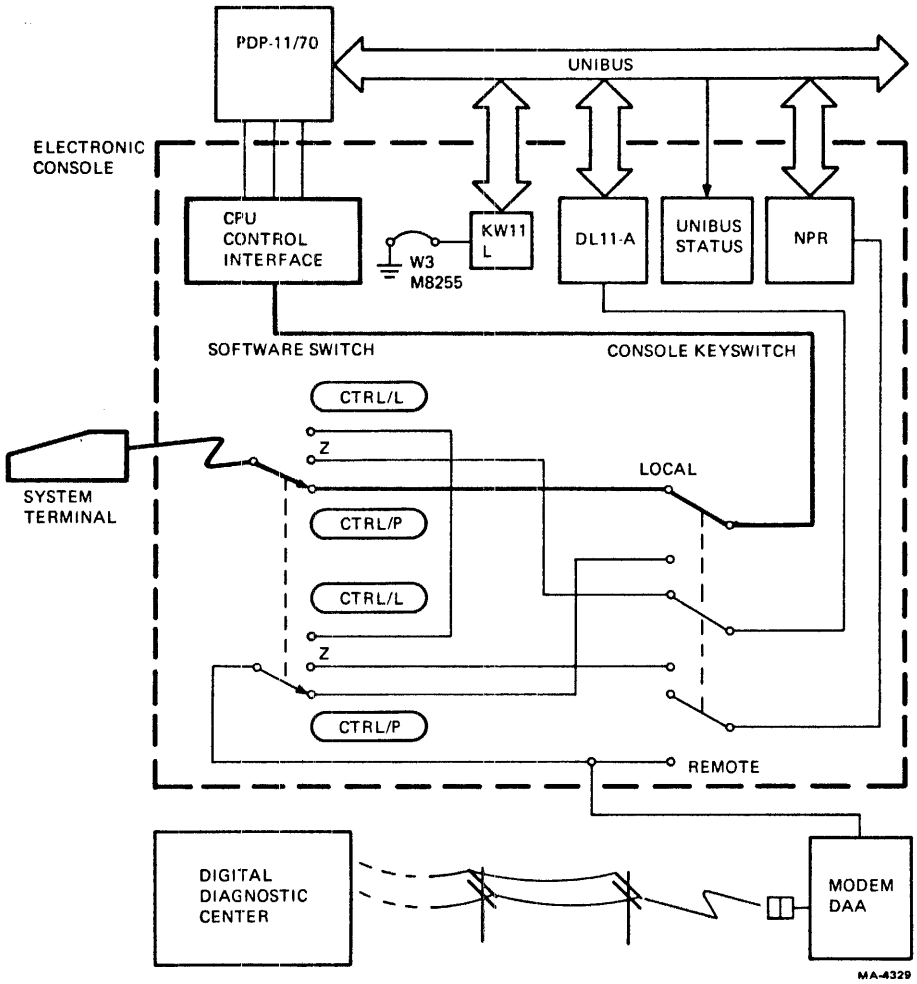


Figure 3-2 Local Console State

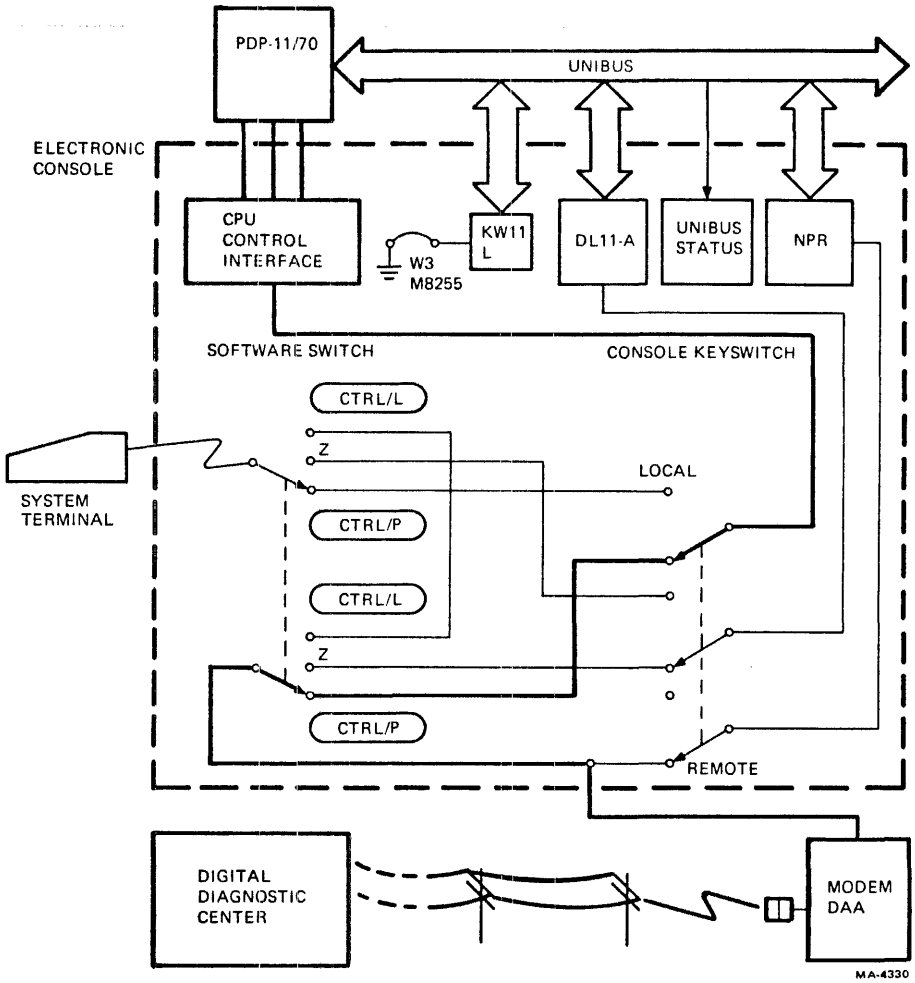


Figure 3-3 Remote Console State

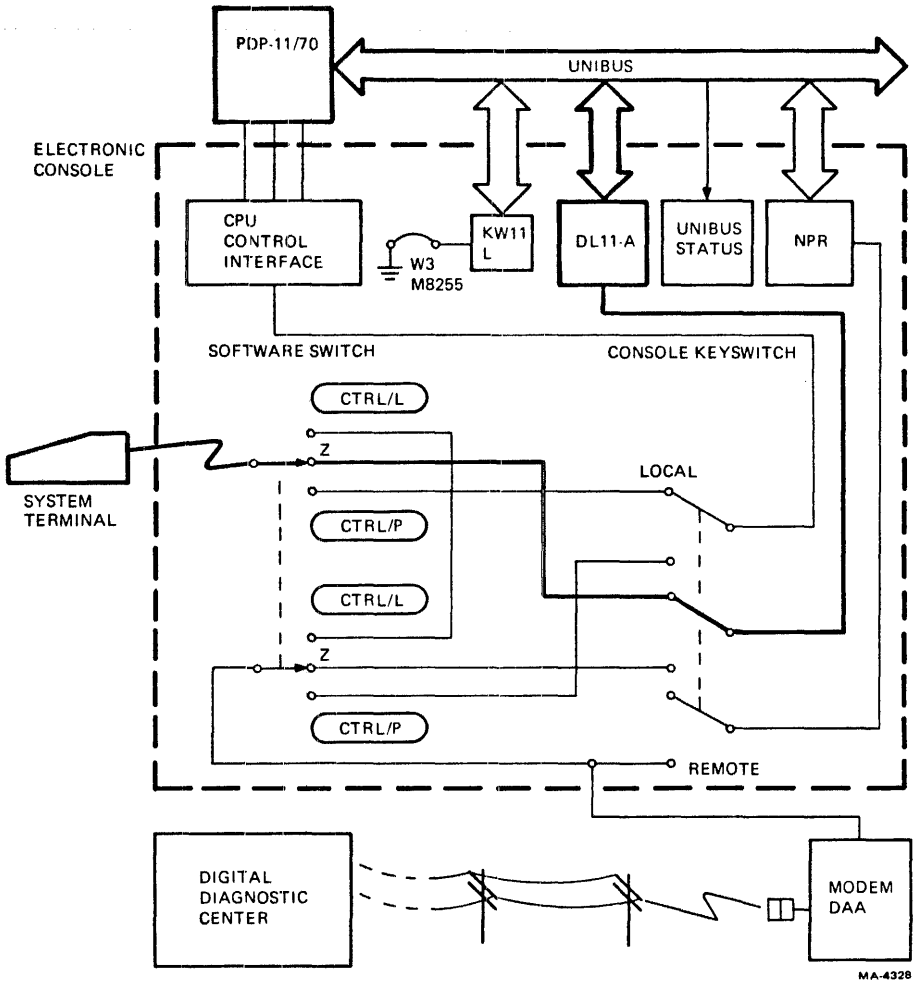


Figure 3-4 Local Program I/O State

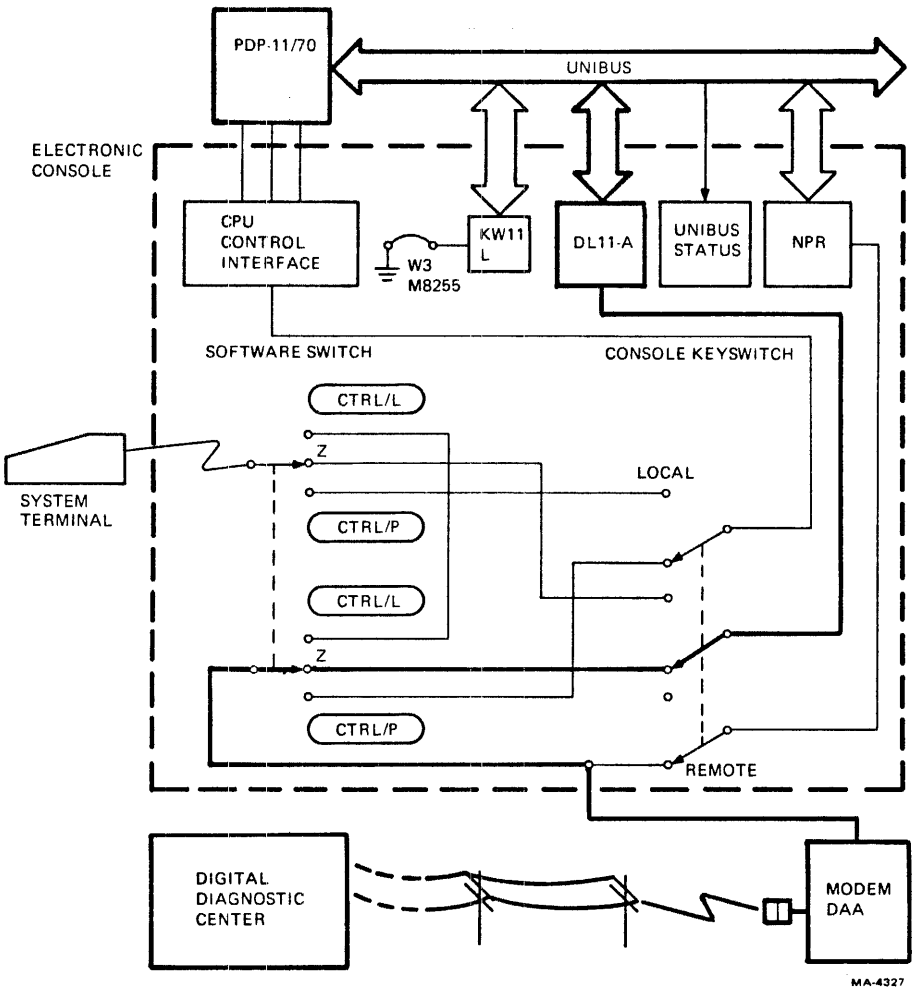


Figure 3-5 Remote Program I/O State

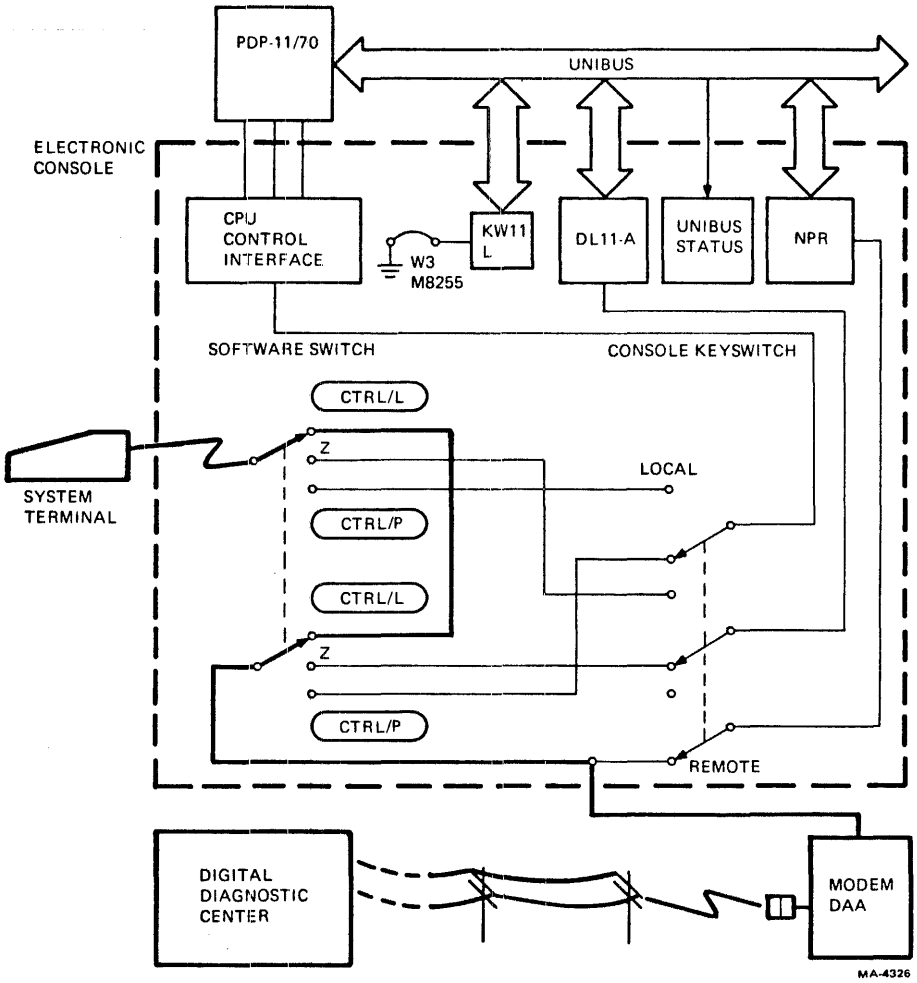


Figure 3-6 Remote Talk State

CHAPTER 4
OPERATING COMMANDS

4.1 SCOPE

This chapter lists and describes each command used to control a PDP-11/70 with an electronic console option installed.

4.2 COMMAND FORMAT

Each command or command string must conform to the following format, shown in Figure 4-1.

[[<OPTIONAL VALUE><SEPARATOR>]<ARGUMENT>]<COMMAND>[<RESPONSE>]<ACKNOWLEDGEMENT>

4.2.1 Argument Separator (,)

The electronic console command set uses the comma (,) to separate the optional value (switch register setting) from the argument (data value or address). Paragraph 4.2 contains an example of the use of this argument separator.

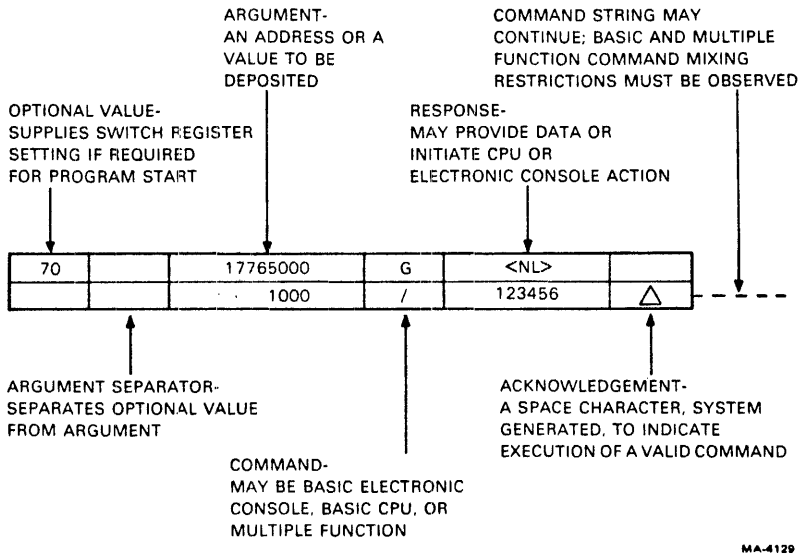


Figure 4-1 Command Format

4.2.2 Argument

The argument, always a numerical quantity, may be an octal address or a value to be deposited. When you are typing a command string, the electronic console accumulates numerical data (not commands) in a temporary input register. You may transfer, modify, or clear the contents of this register as follows:

- Transferred (temporary input register left cleared)
  If the numerical data is intended to be a switch register value, the transfer from the temporary input register to the switch register occurs when the argument separator (,) is typed.

  Other data contents (such as an address or memory value) is transferred to the appropriate destination upon issuance of the command which always immediately follows that data.

- Modified (character-by-character deletion and re-entry)
  The command <DELETE>, explained in Paragraph 4.3.10, is used to delete the last previous character typed into the temporary input register. You may repeat the command and enter or delete new data as required.

- Cleared (contents disposed of)
  The command <CTRL/U>, explained in Paragraph 4.3.11, is used when you intend to clear the entire contents of the temporary input register.

4.3 CONSOLE CONTROL COMMANDS

Console control commands, Table 4-1, are executed within the electronic console and do not directly affect the CPU. These commands can be grouped into four categories, by function: those which control the electronic console; those which set operating states; those which define data format; and those which allow the operator to correct character type-in errors.

NOTE

In the following examples in this chapter, the operator types all characters printed in red. The expected system prompts and responses are also shown.

4.3.1 Command <CTRL/E>, Read CPU Identity

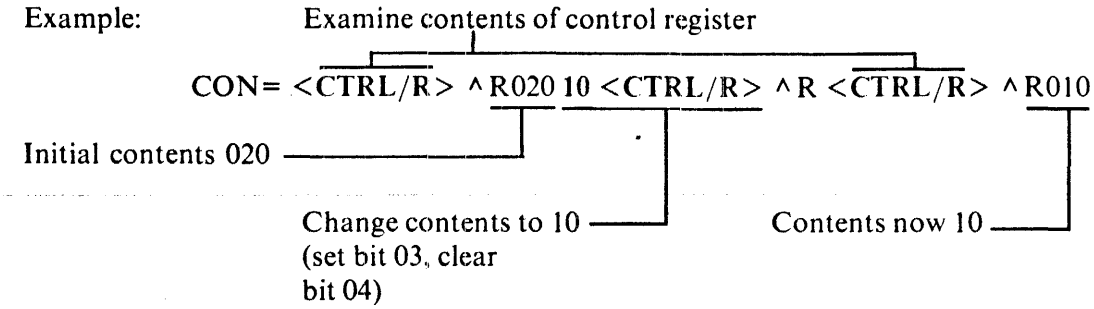
This command results in a printout that identifies both the CPU type and the electronic console microcode version in use.

Example: <CTRL/E> 11/70 V01

4.3.2 Command <CTRL/R>, Read or Load Console Control Register

This command results in either examining or changing the current contents of the console control register. If an octal value precedes the command, that value replaces the current contents of the register; if no octal value is entered, the current contents are examined but remain unchanged.

Example:



The console control register (Figure 4-2) consists of seven programmable bits. These bits are either cleared or set to predetermined conditions both at power-up and when the keyswitch is changed to LOCAL or LOCAL DISABLE. Each may be set or cleared by the DDC as required for remote diagnosis purposes. Bits 03 (expand printout), and 04 (special mode), may be set or cleared at the system terminal by the <CTRL/R> command. Table 4-2 provides a detailed description of each console control register bit.

Table 4-1 Summary of Electronic Console Control Commands Arranged by Function

Command Function	Command	Description	Paragraph Reference
Electronic console control	<CTRL/E>	Identify system and Microcode Version	4.3.1
	[n] <CTRL/R>	Read or change contents of console control register	4.3.2
	V	Verify electronic console logic (self-test)	4.3.3
Setting of operating states	<CTRL/P>	Set console state	4.3.4
	Z	Set program I/O state	4.3.5
	<CTRL/L>	Set talk state	4.3.6
Defining data formats	$	Open register address	4.3.7
	'	Set octal data display format	4.3.8
	"	Set hexadecimal data display format	4.3.9
Type in error correction	<DELETE>	Delete last character typed into temporary register	4.3.10
	<CTRL/U>	Delete all characters in temporary register	4.3.11
Delimiter		Argument separator	4.2.1

Commands may be entered in either upper or lower case (for example, A or a).

Note that the commands listed in this table are executed within the electronic console and do not involve the CPU. The symbol [n] indicates optional data.

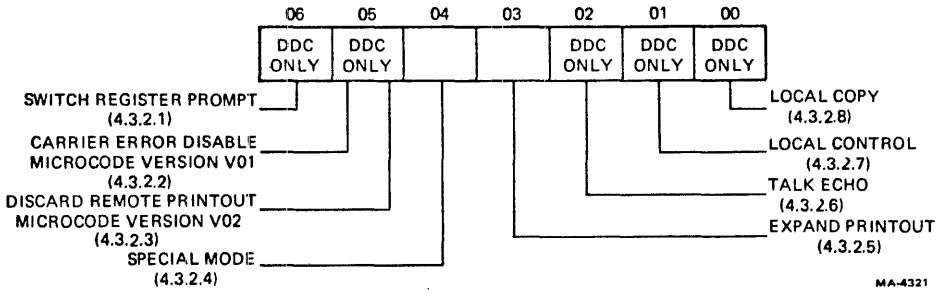


Figure 4-2 Console Control Register

Table 4-2 Console Control Register Bit Description

Bit Position	Description
0	**Local Copy** – Setting bit 0 allows the DDC to provide the system operator with an audit trail of remote activity. It enables printing, on the system terminal, of messages or commands being tested or exercised by the DDC. The system terminal keyboard is disabled to prevent operator intervention.
1	**Local Control** – Bit 1 may be set by the DDC to permit parallel system control at both the system terminal and the DDC. This allows the DDC operator to "observe" as the site operator re-creates failure circumstances at the system terminal. Setting bit 1 also forces local copy, which is equivalent to setting bit 0. Thus, all commands issued at the site are echoed and performed as if the electronic console keyswitch were in LOCAL.
2	**Talk Echo** – Bit 2 is effective only when the talk state has been selected by the DDC. Bit 2 controls the way character transmissions are echoed by the electronic console. When the remote DDC operator and the site operator communicate with (talk to) each other at their respective terminals, the electronic console returns an echo for each character typed. It also transmits the character to the receiving terminal. Bit 2 must be set by the DDC for that purpose. If, however, the DDC host computer sends a message to the site operator at his/her terminal, no echo from the electronic console would be expected. When bit 2 is cleared, which is its initialized condition, the electronic console suppresses such undesirable or redundant character echoes.
3	**Expand Printout** – Bit 3, when set, causes an automatic command M (read data display) to be executed following a command N (execute next instruction or bus cycle). Command N causes the CPU to execute a single instruction (or bus cycle), then halt and print the location. If bit 3 is set, the command M is executed automatically, printing the contents of the selected CPU data display register. This feature is particularly useful when tracing programs in single instruction mode. Example: <CTRL/P> ^P <BELL> CON= 1000$L_{\Delta}I_{\Delta}$10 <CTRL/R> ^R N00001002 1M00016701
4	**Special Mode** – Bit 4 is set when system troubleshooting suggests the use of otherwise illegal command formatting. The logic ignores syntax and CPU errors, and permits abnormal operations such as entering an initialization command when the CPU is in a run state.
5	**Carrier Error Disable (Microcode Version V01 only)** – Bit 5 is set when the DDC wants the electronic console to ignore receipt of a loss-of-carrier indication. (No ?CAR ER message will be printed.)
5	**Discard Remote Printout (Microcode Version V02 only)** – Bit 5 may be set by the DDC to eliminate system terminal printout of unwanted data. For example, the DDC may initiate a diagnostic, set bit 5 to disable printout, disconnect for a period of time, then reconnect to evaluate results and continue the session.
6	**Force Switch Register Prompt (Microcode Version V02 only)** – Bit 6 is normally set and can be cleared only by the DDC. When commands C, P, S, or G (commands that initiate or continue program instruction execution) are issued with bit 6 set, a command R is forced. The current setting of the switch register is printed on the system terminal to remind the operator that the setting may require changing to the predetermined power-fail setting.

4.3.3 Command V, Verify Console Logic

This command allows the operator to initiate the electronic console self-test. The same self-test is always initiated by system power-up. Successful completion of the test results in the message V000377 being printed on the system terminal. The electronic console self-test is described in Paragraphs 3.2.2. Command V is illegal if issued when the processor is running.

4.3.4 Command <CTRL/P>, Set Console State

This command sets the electronic console to the console state, which allows the operator to issue control commands from the system terminal. In this state, the terminal communicates with the electronic console to perform functions equivalent to those previously performed using the traditional panel. Selecting console state forces several other conditions.

- Octal data display format is selected (Paragraph 4.3.8).
- Address display multiplexer position 3 (console physical) is selected (Paragraph 4.4.1).
- Memory data display multiplexer position 1 (data paths) is selected (Paragraph 4.4.14).
- **IF** in the last previous condition the keyswitch was in LOCAL,

  AND the talk state <CTRL/L> had been entered (by which the remote interface would have been enabled),

  THEN the remote serial interface is disabled by clearing DTR.

Although a program may be running, it will be unable to print on the system terminal. This may lead to undesirable buffer overflow conditions. In Microcode Version V02, when the electronic console is in the console state and a program is running and attempting to print out on the system terminal, keyboard activity is monitored and resets a twenty-second timer. If there is no keyboard input for a twenty-second period, a time-out occurs, console state is terminated, program I/O state is set automatically, and the terminal is returned to CPU control.

Example:

```
<CTRL/P> ^P <BELL>
CON= T14050 (No keyboard activity for twenty seconds)
Z <NL>
(Terminal under CPU control)
```

Also see Figure 3-1, Operating States Transition and Accessibility.

4.3.5 Command Z, Set Program I/O State

This command causes the console state to be terminated and the program I/O state to be entered. The system terminal keyboard and printer are dedicated to communication with the CPU for program I/O. The keyswitch positions LOCAL DISABLE and REMOTE DISABLE both force the program I/O state logically.

Also see Figure 3-1, Operating States Transition and Accessibility.

4.3.6 Command <CTRL/L>, Set Talk State

This command enables person-to-person typed messages between the system terminal and the remote line. When a <CTRL/L> command is typed, the DTR (data terminal ready) signal is enabled which, in turn, enables the remote serial interface. This feature permits interconnection of the DDC and the customer's system terminal for message interchange during remote diagnosis. With the exception of <CTRL/P>, which returns the terminal to console state, all characters are interpreted as message text.

Example:

<CTRL/L> ^L Is drive 2 at BOT? <CR>
Checking - yes <CR>
Standby

Also see Figure 3-1, Operating States Transition and Accessibility.

4.3.7 Command $, Set Register Address

This command is used as a prefix to the data argument that precedes load address commands L, /, or <CTRL/D> in Microcode Version V01, and commands G, S, and \ in Microcode Version V02. It masks the leading zeros in the temporary input register with ones so that the argument represents a register address rather than a memory address. Paragraph 3.4.3 provides an example of the use of command $; Illustration 4-1 provides several examples.

When command $ is issued, the contents of the temporary input register are masked with 17777700 before transfer to the CPU address register occurs. Thus, any register or I/O page area requiring the high-order bits to be set may be accessed readily. Comparative examples showing use of command $ with both 16-bit words and 8-bit bytes are given in Paragraph 4.5.2. (The 8-bit byte format is available only in Microcode Version V02.)

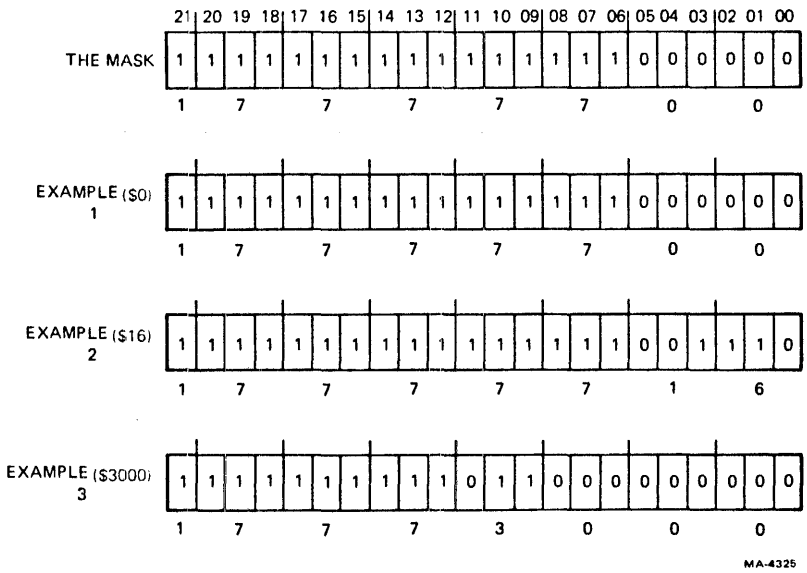


Illustration 4-1

Example 1: Microcode Version V01 provides access to the low-order six bits only (you may type two octal digits maximum). In this example the command string CON= $0/ opens processor register 0 (address 17777700) with either Microcode Version V01 or V02.

Example 2: In this example the command string CON= $16/ opens processor register 16 (address 17777716) with either Microcode Version V01 or V02.

Example 3: Microcode Version V02 provides access to the complete range of register and I/O addresses. Note that this example is invalid for Microcode Version V01 because of its two low-order digits maximum range. The command string CON= $3000/ opens address 17773000, an example of command $ providing simplified access to the I/O page area.

4.3.8 Command ' (Single Quote), Select Octal Data Display Format

This command is not available in Microcode Version V01. When command ' (single quote) is issued to select octal data display format, the following data display commands produce octal displays:

E	Examine	Basic CPU Commands
M	Read Memory Data	
<CTRL/D>	Dump Memory	
/	Open Word Location	Multiple Function Commands
\	Open Byte Location	

The octal data display format is automatically selected at power-up, initialization, or by the command <CTRL/P>; it is cleared by command " (double quote). The example given in Paragraph 4.3.9 shows a useful exception to the general rule that multiple function and basic commands should not be mixed. The explanation of that aspect of the example applies equally to both the command ' (single quote) and " (double quote).

4.3.9 Command " (Double Quote), Select Hexadecimal Data Display Format

This command is not available in Microcode Version V01. When command " (double quote) is issued to select hexadecimal data display format, the same data display commands listed in Paragraph 4.3.8 produce a hexadecimal display. Whenever this format is selected, the double quote (") symbol is printed as a prefix to the displayed data to remind the user that the data is in hexadecimal format. The hexadecimal data display format is cleared at power-up, by initialization, by command <CTRL/P>, or by command ' (single quote), select octal data display.

Example:

CON= 'Δ1000/ 177570	<CR>	<NL> (octal notation)
CON= "Δ1000/"EE78	<CR>	<NL> (hexadecimal notation)
CON= 'Δ1000/177570 "	<NL>	In Microcode Version V02, if either command ' (single quote) is issued or " (double quote is issued when a location is open, the contents will be displayed again in the format selected by the command. Thus, these two basic commands may be mixed with the multiple function command group in this single, useful exception.
1000/"EE78	<NL>	
1000/177570	<CR>	
CON=		

4.3.10 Command <DELETE>, Delete Last Character Typed

The <DELETE> key permits you to delete the last previous data digit typed. The backslash (is printed on the terminal with each digit as it is deleted in Microcode Version V01, but with only the first and last digits deleted in Microcode Version V02. Command characters cannot be deleted using the <DELETE> command.

The examples below represent the same sequence of keystrokes and demonstrate the delete format for each microcode version. The number **1324** is typed in; the 4, the 2, then the 3 are deleted; and a **1** is typed. The temporary input register contains 11 following each exercise.

Example: (Microcode Version V01)
CON= **1324** <DELETE>\4 <DELETE>\2 <DELETE>\3 **1**

The printout will be in this format: CON= **1324**\4\2\3 **1**

Example: (Microcode Version V02)
CON= **1324** <DELETE>\4 <DELETE> 2 <DELETE> 3\ 1

After the **1** is typed, the final backslash is printed before the 1 is echoed.

The printout will be in this format: CON= **1324**\423\ **1**

There is a significant difference between Microcode Versions V01 and V02 in the processing of data out of the temporary input register. V02 counts the characters typed in and those deleted; if no typed-in characters remain in the register, there is no transfer. In V01, however, the typing of the first character enables the logic, which forces a transfer of the temporary input register contents when the subsequent argument separator or command is issued. V01 does not count characters typed or deleted. The transfer of register contents occurs even though all typed-in characters have been deleted (contents all zeros). If the subsequent command is D (deposit) the location contents are changed to all zeros. For example (using Microcode Version V01), you intend to change the contents of location 1000 to 12706. After typing **1000/**, you begin to type the new contents, **12** – then realize that the address should be 1010. Typing <DELETE> <DELETE> deletes the 2 and the 1. Then, when <CR> is typed, the contents of the temporary register (all zeros) are deposited into address 1000.

CON= **1000**/nnnnnn **12** <DELETE>\2 <DELETE>\1 <CR> <NL>
CON= **1000**/000000

Use of command <CTRL/U> eliminates this possibility.

CON= **1000**/nnnnnn **12** <CTRL/U> ^U <NL>
<CR> <NL>
CON= **1000**/nnnnnn

4.3.11 Command <CTRL/U>, Delete All Characters of Current Type-In

This command deletes all characters which have been typed into the temporary input register. It terminates any data value entry and prevents a deposit into memory if it is issued before an argument separator, <LF>, <CR>, or other command is typed. If you are operating Microcode Version V01, you should develop the habit of using this command rather than <DELETE> for reasons described in Paragraph 4.3.10.

Example: You make a mistake typing 12706 to be deposited into location 1000.

CON= **1000**/nnnnnn **1207 <CTRL/U>** ^U <NL>
12706 <CR> <NL>
CON= **1000**/12706

4.4 CPU CONTROL - BASIC COMMANDS

Table 4-3 summarizes the commands that you use to communicate with the CPU. Paragraphs 4.4.1 through 4.4.19 describe those commands in detail.

Table 4-3 Summary of Basic CPU Control Commands Sorted by Function

Command Function	Command	Description	Paragraph Reference
To examine data from CPU	[n]A	Display CPU address register contents	4.4.1
	n <CTRL/D>	Dump sequential memory locations	4.4.2
	E	Examine previously opened location	4.4.3
	[n]M	Read CPU memory data display register	4.4.4
	R	Read switch register setting	4.4.5
	T	Read CPU status	4.4.6
	U	Read UNIBUS status	4.4.7
To deposit data into CPU	[n]D	Deposit data in previously opened location	4.4.8
	nL	Load CPU address register	4.4.9
	nW	Write into switch register	4.4.10
Program execution control	C	Continue instruction execution in console state	4.4.11
	[n,]nG	Go; initiate instruction execution in program I/O state	4.4.12
	H	Halt program instruction execution	4.4.13
	I	Initialize system	4.4.14
	P	Continue instruction execution in program I/O state	4.4.15
	[n,]nS	Start instruction execution in console state	4.4.16
System maintenance	J	Set single bus cycle	4.4.17
	K	Clear single bus cycle	4.4.18
	[n]N	Cause next instruction to be executed	4.4.19
Delimiter	,	Argument separator	4.2.1

Commands may be entered in either upper or lower case (for example, A or a).

Note that the electronic console serves as a preprocessor for these commands which are executed by the CPU. The symbol [n] indicates optional data; n indicates required data.

4.4.1 Command A, Display Address Information

This command is used to print a 22-bit address from the CPU address display register. The eight display positions (address sources) are shown in Figure 4-3. The address display multiplexer is initialized to position 3 (console physical) at system power-up and by entering the console state, <CTRL/P>. If an octal digit precedes the command A, that digit specifies a new address display position. Unless a new address display position is specified, the multiplexer remains at its current position. The switch position number is printed on the system terminal with the contents of the CPU address display register.

Example: If the address display is currently in its initialized position, 3, when command A is typed, system response includes that preselected switch position number:

```
CON= 3A00001024
```

Example: To display a user instruction address, switch position 7.

```
CON= 7A00113737
```

Command A can be issued while the CPU is running; however, the address display information is only valid if the command is issued when the CPU is halted.

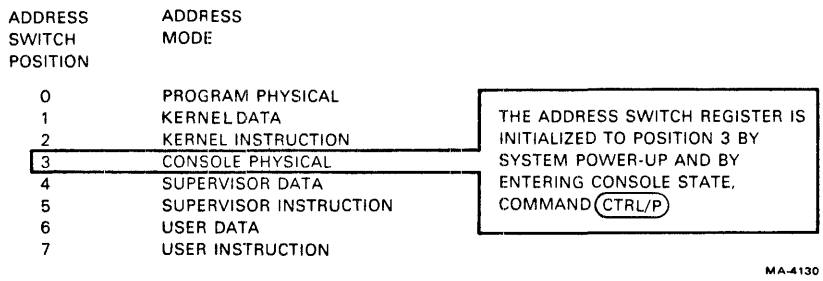


Figure 4-3 Address Display Multiplexer

4.4.2 Command <CTRL/D>, Dump Memory

This command displays the contents of successive memory locations continuously. Any character typed on the keyboard terminates the dump. This command must be preceded by an octal value which defines the beginning address of the dump. This command is illegal if issued when the CPU is running.

The memory data display multiplexer is reset to position 1 (data paths) by this command; the address display multiplexer is unaffected.

Example:

```
CON= 37744 <CTRL/D> ^D <NL>
00037744/016701   000026   012702   000352
00037754/005211   105711   100376   type any character
CON=
```

4.4.3 Command E, Examine Memory

This command displays the 16-bit contents of the memory location, which is referenced by the CPU address register. Command E must be preceded by a command L to open the address to be examined. Successive E commands display the contents of sequential locations.

Command E sets the memory data display multiplexer to the data paths position, 1. (See Paragraph 4.4.4.) The address display multiplexer is unaffected by command E.

4.4.4 Command M, Read Memory Data Display

This command displays the contents of the CPU memory data display register (Figure 4-4). The memory data display multiplexer provides access to four sources of data register as shown in Diagram 4-1.

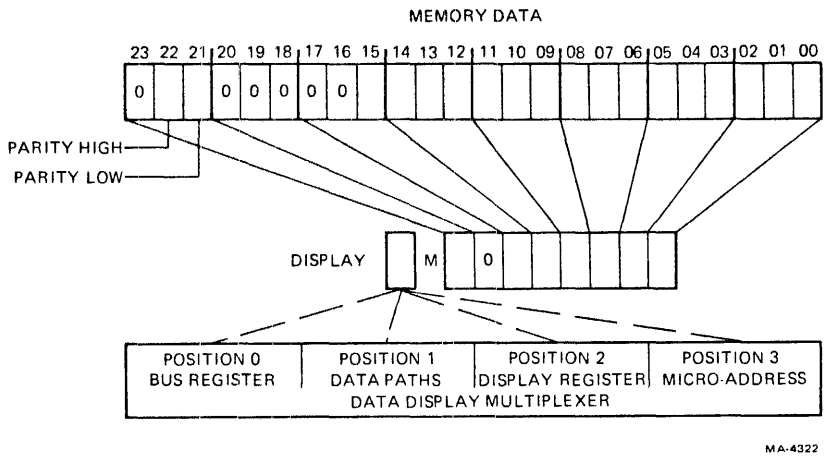


Figure 4-4 Command M Response Format

POSITION	SOURCES
0	BUS REGISTER
1	DATA PATHS
2	DISPLAY REGISTER
3	MICRO ADDRESS

THE MEMORY DATA DISPLAY MULTIPLEXER IS INITIALIZED TO POSITION 1, AT SYSTEM POWER-UP, AND BY COMMANDS E, P, /, \, CTRL/P, AND CTRL/D

MA 5985

Diagram 4-1

If an octal digit precedes the command M, that digit specifies a new memory data display multiplexer position.

If no octal value precedes the command, the contents of the CPU memory data display register are printed from the currently selected multiplexer position number, which remains unchanged. The command M can be issued while the processor is running; however, the read-out will not provide useful information. The memory data display information is only valid if read when the CPU is halted.

4.4.5 Command R, Read Switch Register

This command displays the current setting of the switch register. Following any command which initiates program instruction execution (C, G, P, or S), Microcode Version V02 forces a command R. This prompt reminds the operator that the switch register must be set to a predetermined, system-specific, power-fail value. The examples in Paragraph 4.4.16, and the Operator's Reference Summary (Appendix F) illustrate the command R prompt.

4.4.6 Command T, Read CPU Status

This command causes processor status bits to be displayed in octal notation (Figure 4-5).

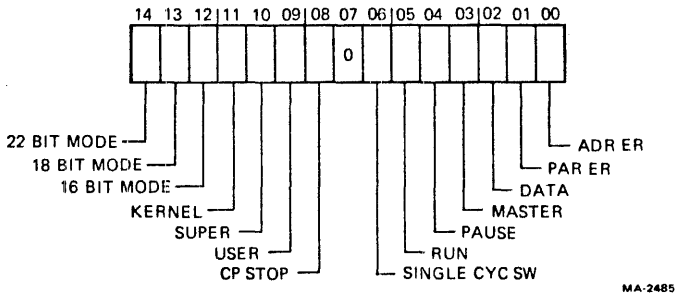


Figure 4-5 CPU Status Response Format

4.4.7 Command U, Read UNIBUS Status

This command produces a display of the UNIBUS status bits in octal notation (Figure 4-6). The command U may be issued with the processor running or halted; the status displayed will always be valid if the processor is halted, but may or may not be valid if the processor is running.

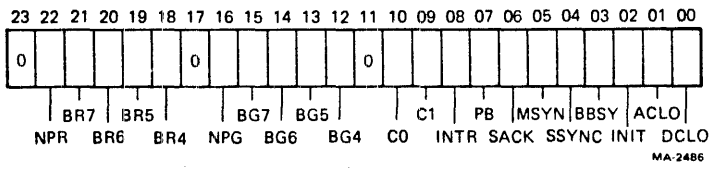


Figure 4-6 UNIBUS Response Format

4.4.8 Command D, Deposit

This command causes the contents of the electronic console temporary input register to be deposited into the address referenced by the CPU address register. Successive D commands deposit new or current contents of the temporary register into sequential locations.

Command D is illegal if it is issued when the CPU is running, or if it is not preceded by a command L (unless the special mode option bit, 4, is set as described in Paragraph 4.3.2).

4.4.9 Command L, Load Address

This command transfers the numerical value that precedes it from the temporary input register into the CPU address register. Command L is illegal if it is issued when the processor is running, or if the command is not preceded by octal digits. The requirement for a data argument may be overridden by setting the special mode bit (Paragraph 4.3.2). The override makes it possible to perform repetitive operations when troubleshooting load address problems.

4.4.10 Command W, Write Switch Register

This command transfers the numerical value that precedes it from the temporary input register into the switch register. This command is illegal unless preceded by octal digits.

The switch register setting may be included as part of a Go or Start command string (Paragraph 4.4.12).

4.4.11 Command C, Continue Program Instruction Execution

This command causes the CPU, without initialization, to resume program instruction execution at the address specified by the program counter (PC). The halt switch is cleared to permit continuous execution. Console state is retained, which disables CPU output to the system terminal. (Typically, a command Z is issued subsequently to enable CPU I/O.) This command is illegal if issued when the CPU is running. Note that command C is functionally similar to command P, except that command P sets program I/O state and clears the special mode bit in the console control register. With Microcode Version V02, command C causes a system-generated command R prompt. (See Paragraph 4.4.5.)

4.4.12 Command G, Go

This command causes a system initialization and transfers the contents of the temporary input register to the program counter (PC). The halt switch is cleared and the CPU begins program instruction execution at the address specified by the PC. The switch register may be set to a new value by typing an octal value and argument separator (both optional in the command string), in addition to the address value that must precede this command. Command G is illegal if it is issued when the CPU is running, or if it is not preceded by data. The special mode bit, 4, in the console control register (Paragraph 4.3.2) is cleared by this command. Program I/O state is set, which enables CPU access to the system terminal. Note that command G is functionally similar to command S, except that command S neither clears the special mode bit nor sets program I/O state.

Example:

CON= 177406,17773100G <NL> (Terminal is under program control)	Set the switch register to 177406 and start program execution at 17773100. Note that Microcode Version V02 forces an R prompt (Paragraph 4.4.5) following the command G.

4.4.13 Command H, Halt Program Execution

This command sets the processor to the halt state. If a program was running, the halt address followed by CPU status is printed on the system terminal.

Example:

CON= H00132564/T14410	The processor was halted by the command H at location 132564 and CPU status is indicated by 14410. (See Figure 4-5 for CPU status bit format.)
*H00132564/T14410	The * indicates that a programmed halt has occurred. A <BELL> will be system generated between the * and the H.

If the processor is already halted when command H is issued, only the H is echoed on the system terminal.

4.4.14 Command I, Initialize CPU

This command causes a system reset, which is comparable to actuating the traditional panel start switch with the halt switch on. This command is illegal if issued when the processor is running.

4.4.15 Command P, Proceed

This command causes the CPU, without initialization, to resume instruction execution at the address specified by the program counter (PC). The halt switch is cleared to permit continuous execution. Program I/O state is set, which enables CPU access to the system terminal for program I/O. The special mode bit, 4, in the console control register (Paragraph 4.3.2) is cleared by command P.

This command is illegal if issued when the processor is running. Note that command P is functionally similar to command C, except that command C neither clears the special mode bit nor sets program I/O state. With Microcode Version V02, command P causes a system-generated command R prompt. (See Paragraph 4.4.5.)

4.4.16 Command S, Start Program

This command causes system initialization and transfers the contents of the temporary input register to the program counter. The halt switch is cleared and the CPU begins program instruction execution at the address specified by the program counter (PC). The switch register may be set to a new value by typing an octal value and argument separator (both optional in the command string), in addition to the address value which must precede this command.

Command S is illegal if it is issued when the CPU is running, or if it is not preceded by data. Console state is maintained, which disables CPU output to the system terminal. (Typically, a command Z is issued subsequently to enable CPU I/O.) Note that command S is functionally similar to command G, except that command G clears the special mode bit in the console control register and sets program I/O state.

Example:

CON= 177406,17773100S$_{\Delta}$R00177406 Z <NL>

The above command string sets the switch register to 177406 and starts program execution at location 17773100 following system initialization. Microcode Version V02 prints the command R prompt as described in Paragraph 4.4.5.

The following command string starts program execution at location 17773100 without changing the switch register value. The command R prompt is forced as noted in the previous example.

CON= 17773100S$_{\Delta}$R00177406 Z <NL>

4.4.17 Command J, Set Single Bus Cycle

This command sets the processor's single bus cycle switch to ON. The command is illegal if issued when the processor is running.

4.4.18 Command K, Clear Single Bus Cycle

This command clears the processor's single bus cycle switch and allows normal operation.

4.4.19 Command N, Execute Next Instruction

This command causes the CPU to execute a single cycle and then halt. (Command N is used in single instruction cycle or single bus cycle operation only.) If the single bus cycle switch is set, a single bus cycle is executed for each command N. Upon completion of the instruction or bus cycle, the contents of the CPU address display register is printed on the system terminal. The address display multiplexer may be set to a specific position by typing the position number as a prefix to the command N. This command is illegal if issued when the processor is running.

Examples:

CON= N00174567	The processor executed a single instruction and the address display contained 174567 at completion.
CON= N00156240 1M20016701	The expand printout bit (Paragraph 4.3.2) caused the Next command to be automatically followed by a command M, display memory data.

4.5 MULTIPLE FUNCTION CPU COMMAND GROUP

Several of the most frequently used basic commands were combined to make this group of five multiple function CPU commands available (Table 4-4). They are useful, first, in their efficiency; fewer keystrokes are required for a given result. Second, the data display is in a much easier format to read. The commands in this group may be mixed in a command string with each other, but may not be mixed with the basic CPU commands. Appendix A.1.1 includes examples showing that syntax errors result from such mixing.

4.5.1 Command / (Slash), Open a 16-Bit Word Location

This command performs a load address and examine of the 16-bit word address specified by the octal value that must precede it. This command may be modified by adding another prefix, command $, to indicate a register examine instead (Paragraph 4.3.7). This command is illegal if issued when the CPU is running. Command / sets the memory data display multiplexer to position 1, data paths (Paragraph 4.4.4); the address display multiplexer is unaffected.

Examples:

CON= 1000/000137 <CR> CON=	(Open memory location 1000.)
CON= $6/000700 @ 00000700/016701	(Perform indirect reference using contents of register 6.)

Examples which indicate how command $ performs when in combination with either 16-bit words or 8-bit bytes are included in Paragraph 4.5.2.

Table 4-4 Summary of Multiple Function CPU Command Group

Multiple Function Command	Equivalent Basic Commands	Description	Paragraph Reference
n/	nL E	Open a 16-bit word location	4.5.1
n\	none	Open an 8-bit byte location	4.5.2
[n] <CR>	[n]D	Close an open location (can be used with basic commands to provide a new line, < NL>)	4.5.3
[n] <LF>	[n]D nL E	Close an open location, then open next sequential location and display its contents	4.5.4
@	[n]D nL E	Open an indirect location by using the contents of the currently open location	4.5.5

4.5.2 Command \ (Backslash), Open an 8-Bit Byte Location

The command \, available only in Microcode Version V02, performs a load address and examine of the 8-bit byte at the address specified by the octal value that must precede it. Successive line feeds are used to display successive 8-bit bytes. This sequence is shown in the octal/hexadecimal comparative examples that follow. Command \ may be modified by adding another prefix, command $, to specify that a register is to be opened (Paragraph 4.3.7). Command ' (single quote) or " (double quote) may be used to select octal or hexadecimal display format after a location has been opened as shown in the example in Paragraph 4.3.9. When a processor register is specified ($00 through $17) the first byte displayed is the low-order 8-bit byte of that register.

This command is illegal if issued when the CPU is running. Command \ sets the memory data display multiplexer to position 1 (data paths) described in Paragraph 4.4.4; the address display multiplexer is unaffected.

Comparative Examples:
For these examples, assume that the three consecutive words are as shown in Illustration 4-2.

OCTAL WORD CONTENTS	HIGH-ORDER BYTE				LOW-ORDER BYTE				HIGH ORDER BYTE EQUALS	LOW ORDER BYTE EQUALS
041101	0	1 0 0	0 0 1	0	0 1	0 0 0	0 0 1		B 102	A 101
042103	0	1 0 0	0 1 0	0	0 1	0 0 0	0 1 1		D 104	C 103
043105	0	1 0 0	0 1 1	0	0 1	0 0 0	1 0 1		F 106	E 105

MA-4317

Illustration 4-2

Use of commands / and \ with command $ to access processor registers:

16-Bit (/)

```
CON= $0/041101 <LF>
17777701/042103 <LF>
17777702/043105
```

8-Bit (\)

```
CON= $0\101 <LF>
17777700H\102 <LF>
17777701L\103 <LF>
17777701H\104
```

(Note that H or L address suffix indicates that byte is low-order or high-order.)

Use of commands / and \ to access memory data:

16-Bit (/)

```
CON= 1000/041101 <LF>
00001002/042103 <LF>
00001004/043105
```

8-Bit (\)

```
CON= 1000\101 <LF>
0000100\102 <LF>
00001002\103 <LF>
00001003\104
```

The previous examples include six-digit octal displays which represent two ASCII characters packed into a 16-bit word. The binary contents of the high-order bytes are not readily apparent in the octal displays. Further explanation and a translation table are provided in Appendix D, ASCII Character Set.

4.5.3 Command <CR>, Close Location

This command closes a previously opened location. It is recognized by the electronic console for closing a location only if the location was opened with command @, /, or <LF> (multiple function commands). Any data argument typed while the location is open is deposited in that location before it is closed. This command is always echoed as <NL> (<CR> <LF>) and may be used at any time to provide a new line.

Examples:

CON= **1002**/000137 **240** <CR> <NL>	240 (NOP) is deposited in location 1002.
CON=	
CON= **1002**/000137 <CR> <NL>	Location 1002 is opened and closed without depositing data. If no data is typed, no data is deposited. Note the Microcode Version V01 precaution concerning Delete in Paragraph 4.3.10.

4.5.4 Command <LF>, Open Sequential Location

When a location has been opened, this command causes any octal value typed to be deposited in that location, closes the location, opens the next sequential location, and prints the new address and its contents. This command is illegal if the location was not opened by a command @, /, or a previous command <LF>.

Example:

```
CON= 1000/000137 <LF>
00001002/002000 <LF>
00001004/012706
```

4.5.5 Command @, Open Indirect Location

The command @ may be used only after a 16-bit word location is opened by a command /. The contents of the currently open location are used as the address of the next location to be opened. When a location is open and octal data is typed, command @ causes the data to be deposited in the current location before being used as the address of the next location to be opened. Microcode Versions V01 and V02 do not respond identically to the command @ when an I/O page address is specified.

Example: (Microcode Version V01)

```
CON= 1012/002000 @
00002000/177742 @
17777742/004010
```

In this example bits 13, 14, and 15 of the contents of location 2000 are ones. As a result, in CPU instruction execution or electronic console command response, bits 16 through 21 are masked with ones and I/O page address 17777742 is referenced. This is consistent with the way locations are referenced by the CPU when the I/O page is specified.

Example: (Microcode Version V02)

```
CON= 1012/002000 @
00002000/177742 @
00177742/102742
```

Since Microcode Version V01 does not sense the status of bits 13, 14, and 15, and no masking of bits 16 through 21 is provided, the referenced address is 00177742, not the expected I/O page address 17777742.

To examine the CPU instruction execution path, you must use the following sequence of electronic console commands instead:

```
CON= 1021/002000 @
00002000/177742 <CR>
CON= 17777742/004010
```

4.6 SYSTEM PROGRAMMING CONSIDERATIONS

System programming is unaffected by installation of an electronic console with only two exceptions. The electronic console logic includes two peripheral devices that appear on the system's UNIBUS. One of these replaces the DL11-A serial line interface which is removed when the electronic console is installed on a system. The second device is the equivalent of a KW11-L line clock. This may be used, optionally, to replace a similar, pre-existing device on the system. Jumper W3 on the M8255 microprocessor module, if left in place, disables the M8255 clock and allows the existing system clock to continue to provide that function.

4.6.1 DL11-A

As described in the *DL11-A Technical Manual* (EK-DL11-TM), the DL11-A contains four registers which are addressed on the UNIBUS:

Receiver Status Register	17777560
Receiver Data Buffer	17777562
Transmitter Status Register	17777564
Transmitter Data Buffer	17777566

A receiver interrupt causes the interrupt PC and PSW to be from locations 60 and 62 respectively. A transmitter interrupt causes the interrupt PC and PSW to be from locations 64 and 66 respectively.

The operation of the DL11-A equivalent* electronic console option is identical to the actual DL11-A option. Three additional status bits appear in the transmitter status register (17777564) if switch five on DIP switch E19 on the 54-12781 multiplexer module is set to the OFF position. (This switch is normally ON if an LA36 is used as the system console terminal.) These bits are:

Bit 5	Remote active is set to one if the keyswitch is in REMOTE or REMOTE DISABLE.
Bit 4	Console state is set to one when the electronic console is in console or talk state.
Bit 3	Console present is always one.

* The electronic console provides DL11-A equivalent logic when used with DIGITAL terminals; VT100 must be operated at a transmission baud rate of 1200 or less.

CAUTION

Since bit state is determined by electronic console operation, programming that assumes the presence of a DL11-A option may behave unpredictably with the DL11-A equivalent in the electronic console.

4.6.2 KW11-L

The KW11-L equivalent option in the electronic console operates exactly as the KW11-L option described in the *KW11-L Technical Manual* (EK-KW11L-TM). Its control and status register is fixed at location 17777546, and a line clock interrupt causes the interrupt PC and PSW to be from locations 100 and 102 respectively. Because the KW11-L option is normally present as a system option, the KW11-L logic within the electronic console is usually disabled. This is accomplished by leaving M8255 jumper W3 in place. If the KW11-L option is not present, jumper W3 may be removed to enable equivalent logic.

CHAPTER 6
INSTALLATION

6.1 SCOPE

This chapter provides site and system preparation information, KY11-R installation and checkout procedures for DIGITAL Field Service personnel.

6.2 SITE AND SYSTEM PREPARATION

Paragraphs 6.2.1 through 6.2.5 describe KY11-R installation prerequisites you should examine and resolve before beginning an installation.

6.2.1 System Configuration Package

Prior to the installation of a KY11-R, the significant technical details about the customer system must be supplied to the DDC. These include such items as ECO status, option configuration, power supplies and controllers, cabling, baud rates, and the presence of non-DIGITAL equipment interfaced to the system. The System Configuration Charts, part of the Site Management Guide, are the most convenient source of these details. They should be photocopied and forwarded to the DDC.

When this system configuration package is completed at the branch office level, it is forwarded to the DDC. There, the engineering staff checks the package for technical accuracy and completeness; all details required by the host computer must be present. When the system configuration package is approved, the host computer data base is updated, making remote diagnosis possible for that system.

6.2.2 Interface To Common Carrier Network (Telephone Company, PTT, GPO)

All KY11-R installations depend on telephone lines for their remote diagnosis function. There are several possible telephone hardware configurations, all controlled by governmental regulations which vary from country to country. Paragraphs 6.2.2.1 through 6.2.2.4 identify the most important variables and provide guidelines for site preparation.

6.2.2.1 DAAs and Modems – The electronic console requires both a data access arrangement (DAA) and a modem. These may be separate units; however, the DAA and modem functions are often combined into a single unit referred to as a modem.

- A DAA is a data communications device approved for direct connection to a telephone line. Data to be transmitted is processed through a modem to the DAA. Data received from the telephone line by the DAA is coupled through a modem to on-site data processing equipment.

- A modem is a device that modulates data communications signals to be transmitted and demodulates received signals.

The vendor manual included with each DIGITAL-supplied DAA or modem provides excerpts of governmental regulations which are applicable to users of that equipment. Several excerpts that apply to KY11-R users are included in Chapter 5. The customer is ultimately responsible for compliance with these regulations; site personnel should be advised that specified actions may be required of them in the event of modem, DAA, or telephone line problems.

Modem repair is also subject to governmental regulation. A faulty modem or DAA connected to a telephone line must not be repaired, except by the manufacturer or an authorized agent. As a result, unit exchange is customary when a DIGITAL-supplied modem or DAA fails. It is important that both DIGITAL and customer personnel realize the telephone company must be notified if the modem or DAA is replaced by a unit with a different FCC registration number.

6.2.2.2 RJ11C Standard Voice Jack (USA) – The 30-15949 stand-alone modem or 30-17066 DIGITAL-supplied DAA must be connected to the telephone line through a telephone-company-supplied RJ11C data jack. All arrangements and costs associated with the installation and maintenance of the RJ11C are the customer's responsibility. FCC regulations require the customer to provide the telephone company certain information about the data communications equipment (modem or DAA) which will be connected to the RJ11C:

- Manufacturer's name
- Model number
- Registration number
- Ringer equivalence

When the District Console Allocation Coordinator determines which kit will be shipped for a particular system, the above information is communicated to the branch. The branch must then submit that information to the customer for use in ordering the RJ11C installation.

6.2.2.3 KY11-R Installation in Canada – The KY11-R incorporates a 54-12498 integral modem and must be connected through a CBT type, model 1001B or 1001D DAA supplied by the telephone company.

All arrangements and costs associated with the installation and maintenance of telephone company equipment are the customer's responsibility.

6.2.2.4 KY11-R Installation in Europe and the U.K. – The KY11-RE kit for installations in Europe and the U.K. does not include a modem. The KY11-RE remote port conforms to CCITT V.24 specifications; the console has BPO approval in the U.K., and FTZ approval in Germany.

Appendix G, Modem Operation Characteristics, includes information for Field Service personnel to use in troubleshooting modems, where permitted.

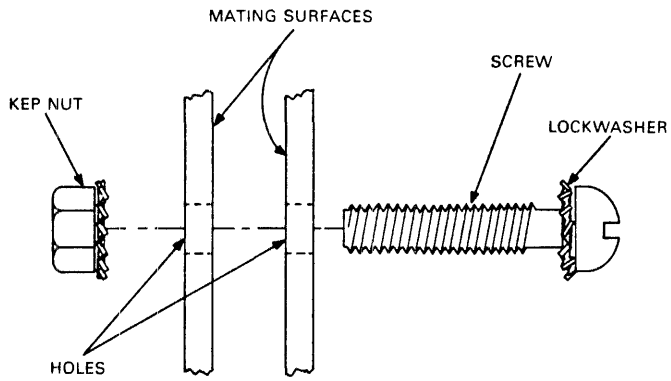
6.2.3 Static Discharge Precautions

System susceptibility to the effects of static discharge must be evaluated and reduced whenever an electronic console is installed. Paragraphs 6.2.3.1 through 6.2.3.6 are essential elements of a system review prior to installation.

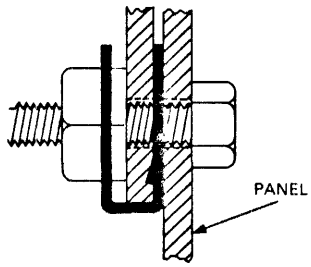
6.2.3.1 Power Cable Routing – Internal cable routing should not locate signal cables near any ac power wiring; a spacing of 6 inches minimum is desirable. Ideally, external power cables should not enter the system enclosure; however, if this is necessary, the internal routing should be very short and isolated from any signal cabling.

6.2.3.2 Power Controller Mounting – The power controller must be mounted to the system frame with hardware that ensures a good electrical connection. Because either or both of the mating surfaces may be painted, the mounting hardware must provide that bond. A machine screw, lockwasher, and kep nut combination (Figure 6-1) is acceptable. A U nut retainer (90-07786-00) is also recommended for this purpose. Note that the U nut retainer should be used only once, since the sharp tabs are bent or dulled by the first use. Do not use the -01 variant of the U nut retainer, since it does not have the necessary "digging" characteristics.

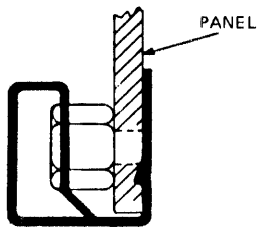
DIGITAL also recommends the installation of a ground wire from the power controller to the cabinet frame.



SCREW, LOCKWASHER, AND KEP NUT MOUNTING



RECOMMENDED ASSEMBLY USING U NUT RETAINER 90-07786-00



NOT-RECOMMENDED ASSEMBLY USING U NUT RETAINER 90-07786-01

MA-4552

Figure 6-1 Power Controller Mounting Hardware

6.2.3.3 Power For External Devices – The power controller ac receptacles are filtered sources used for devices within the system enclosure only. Since the LA36 and a stand-alone modem (or any other external device) are outside the system enclosure, they must not be powered from the system power controllers.

It is also important that both the system and its peripheral devices receive primary power from the same ac circuit, so that ground loops are not created.

6.2.3.4 EIA-Configured System Terminal – If the PDP-11/70 system terminal is configured for EIA operation using standard, non-filtered cables, step 22 of the installation procedure (Paragraph 6.3.3) may be applicable. In situations where static discharges to the system terminal are likely to occur, DIGITAL recommends that a BC03L-10 filtered cable be installed as shown in Figure 6-10. This cable is optional and therefore not included in the KY11-R kit.

6.2.3.5 Static Filter – A 12-14613 static filter must be installed whenever an electronic console is installed on a system with a 20 mA system terminal. Step 23 of the installation procedure, and Figures 6-8 and 6-9 indicate how the unit must be installed.

Initially, each branch office received a supply of static filters and 70-08519-6 extension cables in anticipation of KY11-R installations. Early versions of the KY11-R installation kits did not include the 74-14167 universal I/O panel on which the static filter is to be mounted. In a later arrangement, those parts were phased-in to the KY11-R kits. If you receive a kit without those parts, and they have not been previously installed, you should obtain them from the local supply and add them to the kit.

6.2.3.6 I/O Connector Panel Cover Plates – When static discharge to the system terminal is excessive, additional shielding may be desirable. Typically, the 74-14167 I/O connector panel has only two or three ports filled. Cover plates (74-14197) may be installed over the unused ports to provide additional shielding.

6.2.4 G727 Grant Continuity

Availability of a G727 module may be considered a pre-installation requirement, depending upon your evaluation of steps 2 through 4 of the installation procedure (Paragraph 6.3). The G727 is required if a slot (Section D) is vacated by removal of the M7800 (DL11-A), as described in step 3.

6.2.5 DAA Mounting Hardware

Early versions of the DIGITAL-supplied 30-17066 DAA did not include hardware for wall mounting of the unit. Step 32 of the installation procedure requires that two mounting screws with low profile heads be obtained locally. In addition, if the DAA will be mounted to a plaster or composition wall, screw anchors are required.

6.3 INSTALLATION PROCEDURE

This manual provides installation instructions for all variations of the KY11-R option. Before you begin disassembly of a customer's system, read the installation precautions in Paragraph 6.3.1 and the unpacking and inspection information in Paragraph 6.3.2. If you are installing a KY11-R for the first time, an advance reading of the entire installation procedure will be helpful. Installation requires the tools and equipment which you normally use in PDP-11 maintenance.

6.3.1 Installation Precautions

1. Under no circumstances should an electronic console kit be installed on a system other than the one designated by the District Console Allocation Coordinator.

2. Do not begin installation until the kit contents have been checked and all parts are available. (See also Caution in step 5 of the installation procedure.)

3. Do not begin installation until the required telephone equipment is installed.

4. Once KY11-R installation is started, system operation is not possible until installation is complete.

6.3.2 Unpacking and Inspection

Carefully open and remove the KY11-R components from the shipping container. Do not discard any packing material or containers; they are used to store (on-site) those system components which are removed. Inspect each kit component for possible damage. If any damage is evident, it should be reported to the branch office supervisor; if there is evidence of transportation damage, it should also be reported to the responsible carrier.

Determine that the kit is complete by verifying against Tables 6-1 and 6-2, which list KY11-R kit contents. Also, Figures 6-2 and 6-3 illustrate and identify the components by part number.

The option number printed on the carton may not reflect the kit variant. You must determine the kit variant before you proceed. The unique characteristics of each variant are reflected in the Modems section of Table 6-1. For example: the option number on the carton is KY11-R, and the kit includes a 54-12498 integral modem and a 30-17066 DAA; Table 6-1 indicates that the kit is actually a KY11-RC, which is the only kit containing both of those components.

CAUTION

Certain incompatibilities exist among the two (or three) modules used in the electronic console. Before proceeding, examine the modules in the installation kit to ensure that you have not received modules which are incompatible with each other.

1. **The 54-12781 and M8255 must both be -00 or -01 paired. (You cannot mix -00 and -01 modules.)**

2. **The 54-12781 and M8255 must both be -00 variants when used with the 54-12498 LA36 Integral Modem module (KY11-R and KY11-RC).**

If you are uncertain whether the boards are -00 or -01, perform step 5 d1, d2, d3, and/or step 7 of the installation procedure.

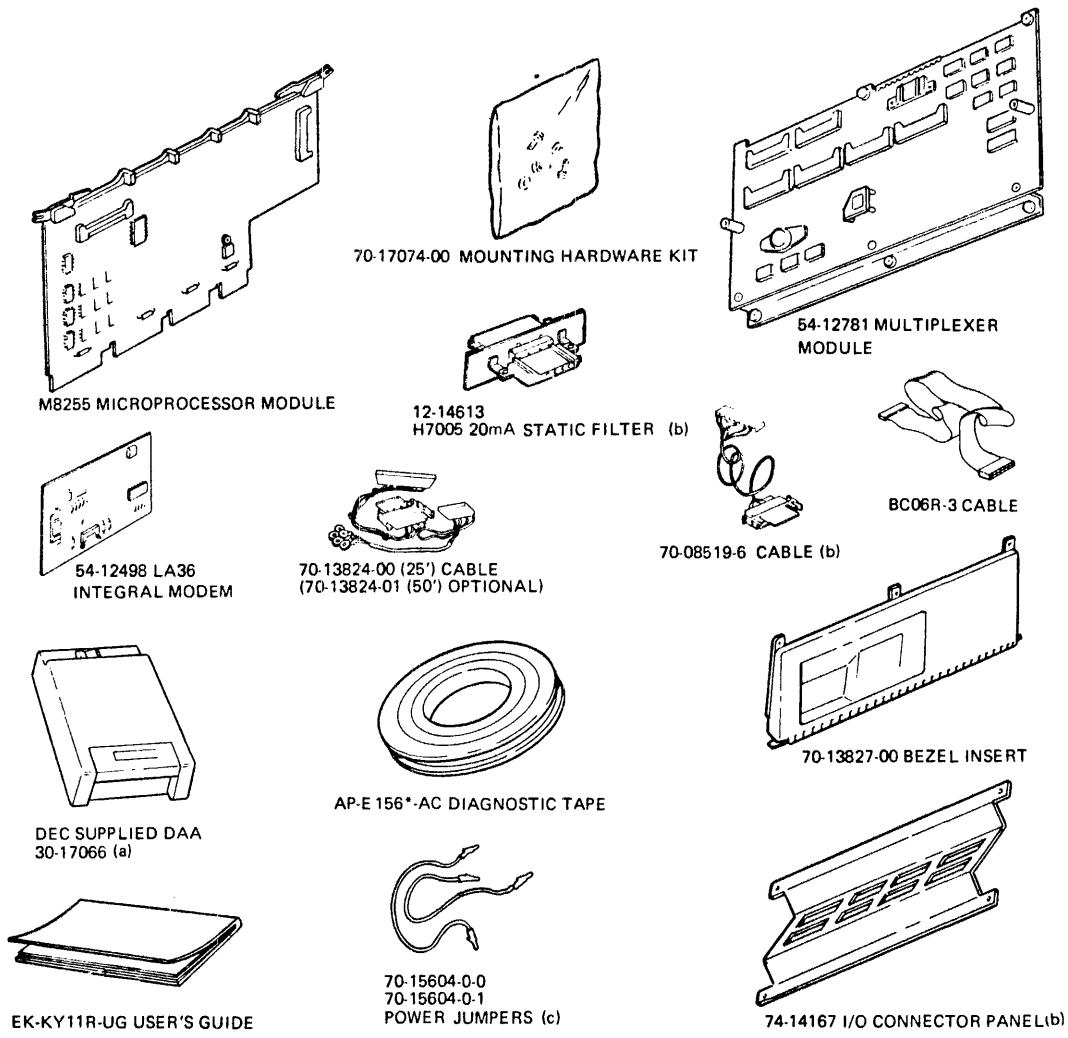
Table 6-1 KY11-R Installation Kit Contents

Part No.	Description	11/70 -R	11/70 -RB	11/70 -RC	11/70 -RE
Modules					
M8255-00	Microprocessor, CS Rev ≤E (Microcode V01 only)	1	–	1	–
		or		or	
M8255-00	Microprocessor, CS Rev ≥H (Microcode V02 only)	1	1	1	–
M8255-01	Microprocessor, CS Rev ≥J (Microcode V02 only)	–	–	–	1
54-12781-00	Multiplexer, any CS revision	1	–	1	–
		or		or	
54-12781-00	Multiplexer, CS Rev ≥H	1	1	1	–
54-12781-01	Multiplexer, CS Rev ≥J	–	–	–	1
Modems					
30-15949	Stand-Alone	–	1	–	–
54-12498	LA36 Integral	1	–	1	–
30-17066	DIGITAL-supplied DAA	–	–	1	–
Cables					
BC03L-10	EIA Rev ≥D (J6 on 5412781 to I/O panel)	–	1	–	1
BC05D-25	EIA (I/O panel to modem)	–	1	–	1
BC06R-3	Ribbon (J4 on 54-12781 to J1 on M8255)	1	1	1	1
70-08519-6	(J5 on 54-12781 to static filter)	1*	1	1*	1
70-13824-00	25 ft. (J6 on 54-12781; J1 and J2 on 54-12498; to DAA)	1	–	–	1
70-13824-01	50 ft. (J6 on 54-12781; J1 and J2 on 54-12498; to DAA)	†	–	†	–
70-15604-00	Power jumper (blue, 14 AWG, 23 in)	1‡	1‡	1‡	1‡
70-15604-01	Power jumper (gray, 14 AWG, 18.5 in)	1‡	1‡	1‡	1‡
12-14613	20 mA static filter	1*	1	1*	1
Mechanical					
70-13827-0-0	11/70 bezel insert	1	1	1	1
74-14167	I/O connector panel, eight port	1*	1	1*	1
70-17074-00	Mounting hardware kit	1§	–	1§	–
70-17074-02	Mounting hardware kit	–	1§	–	1§
Software					
AP-E156*-AC	Diagnostic Tape (XXDP-TMDP)	1	1	1	1
EK-KY11R-UG	User Guide	1	1	1	1

* Must be added at DIGITAL branch office if not in kit.
† Optional
‡ Included in 70-17074 mounting hardware kit.
§ Mounting hardware is itemized in Table 6.2.

Table 6-2 KY11-R Mounting Hardware Kit Contents

Part Number	Description	11/70 -R	11/70 -RB	11/70 -RC	11/70 -RE
90-06020-01	Phillips pan head screw, 6-32 × 0.25 in	2	2	2	2
90-06022-01	Phillips pan head screw, 6-32 × 0.38 in	7	7	7	7
90-06024-01	Phillips pan head screw, 6-32 × 0.50 in	5	7	5	7
90-06074-01	Phillips pan head screw, 10-32 × 0.62 in	4	4	4	4
90-06028-03	Phillips truss head screw, 6-32 × 1.0 in	3	3	3	3
90-06633-00	Lockwasher, internal tooth, No. 6	6	8	6	8
90-06658-00	Flat washer No. 6	10	6	10	6
90-06799	Spacer, 0.31 in	3	3	3	3
90-07649	Lockwasher, external tooth, No. 6	5	5	5	5
90-07651	Lockwasher, No. 10	4	4	4	4
90-07786-00	U nut retainer 10-32	4	4	4	4
90-09525-01	Self-Tap screw 6-32 × 3/8 in	4	–	4	–
90-09670-03	Plastic standoff 3/8 in	4	–	4	–
70-15604-00	Power jumper, blue, 23 in	1	1	1	1
70-15604-01	Power jumper, gray, 18.5 in	1	1	1	1
70-17074-00	Mounting hardware kit	X	–	X	–
70-17074-02	Mounting hardware kit	–	X	–	X



(a) SUPPLIED BY TELEPHONE COMPANY IN KY11-R
(b) SUPPLIED BY BRANCH OFFICE IF NOT IN KIT
(c) INCLUDED IN 70-17074 MOUNTING HARDWARE KIT

MA-4553

Figure 6-2 KY11-R/KY11-RC Installation Kit

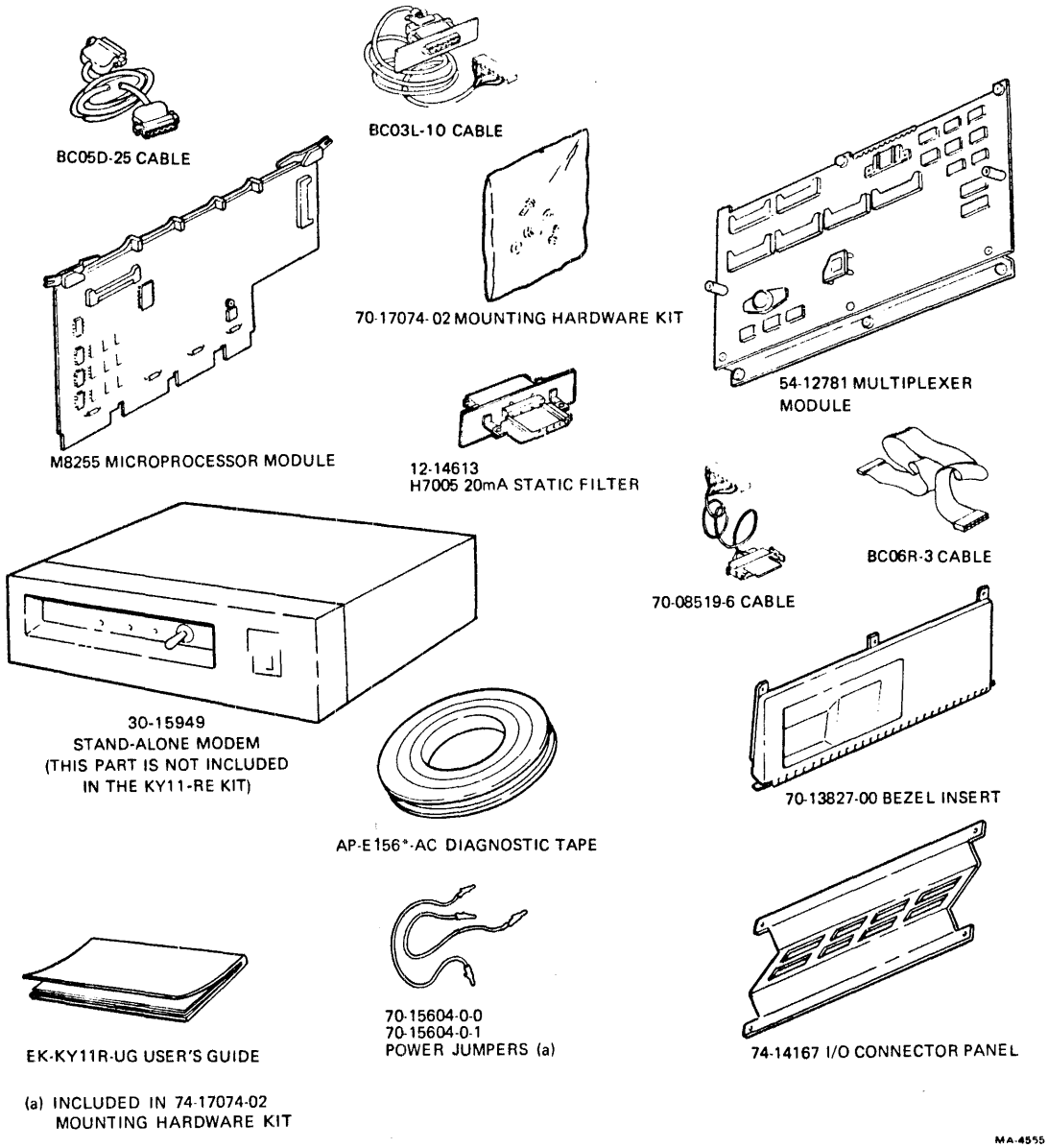


Figure 6-3 KY11-RB/KY11-RE Installation Kit

6.3.3 Step-By-Step Installation Instructions

This installation procedure provides instructions for the installation of KY11-R variants -R, -RB, -RC, and -RE. There is a header associated with each instruction to identify the variants to which it applies. When an instruction header includes the variant being installed, the instruction must be performed. Conversely, if an instruction header does not include the variant being installed, the instruction should be bypassed.

The text for each step references any figures or tables that are either necessary or helpful in the implementation of that instruction.

Instruction Step 1

-R	-RB	-RC	-RE

Remove cabinet panels and doors as required to make the CPU accessible from both the front and the rear.

Disconnect primary power from the system by turning the circuit breaker to OFF.

Extend the CPU on its slides to the maximum forward position.

Remove the module cover panel (left cover).

Remove the wiretrough cover.

Loosen the clamps that secure the ribbon cable bundle at the rear of the CPU box.

Instruction Step 2

-R	-RB	-RC	-RE

Refer to Figure 6-4.

Remove the M7800 (DL11-A) or M7856 (DL11-W) from the SPC slot (usually slot 40).

Disconnect the cable that connects to the system terminal and pull it up and back out of the wiretrough.

If the module removed is an M7856, use Figure 6-4 to determine the enabled or disabled state of the Real-Time Clock option on the board.

Instruction Step 3

-R	-RB	-RC	-RE

Slot 40 of the 11/70 backplane must be made available for the M8255 microprocessor module. Rearrange options as necessary to make that slot available. The slot previously occupied by the M7800 or M7856 (removed in step 2) may or may not have been slot 40; if not, the vacated slot may be re-used as required. The usual rules for the arrangement of NPR devices on the UNIBUS, bus priority, and Grant continuity must be observed.

The M8255 microprocessor module will be installed in a later step.

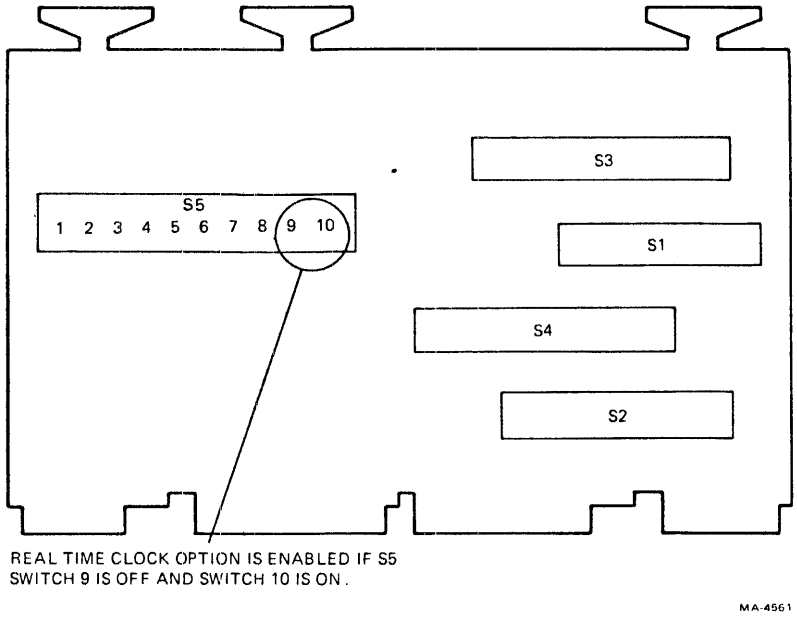


Figure 6-4 M7856 Switch Layout

Instruction Step 4

-R	-RB	-RC	-RE

Grant continuity is interrupted by the removal of the M7800 or M7856 in step 2. Continuity must be restored in one of the following ways:

a. If the module was removed from 11/70 slot 40, the M8255 will be inserted there in step 6 and restore continuity.

*b. If a slot other than slot 40 was vacated by the module removal, a G727 Grant Continuity card must be installed in position D of that slot.

*c. If a slot other than slot 40 was vacated by relocation of an option that provided Grant continuity, a G727 Grant Continuity card must be installed in position D of that slot.

Instruction Step 5

-R	-RB	-RC	-RE

Refer to Figure 6-5 and Tables 6-3 and 6-4.

---

* If rearrangement of modules requires corresponding changes to NPG jumpering, those changes should be done at this step.

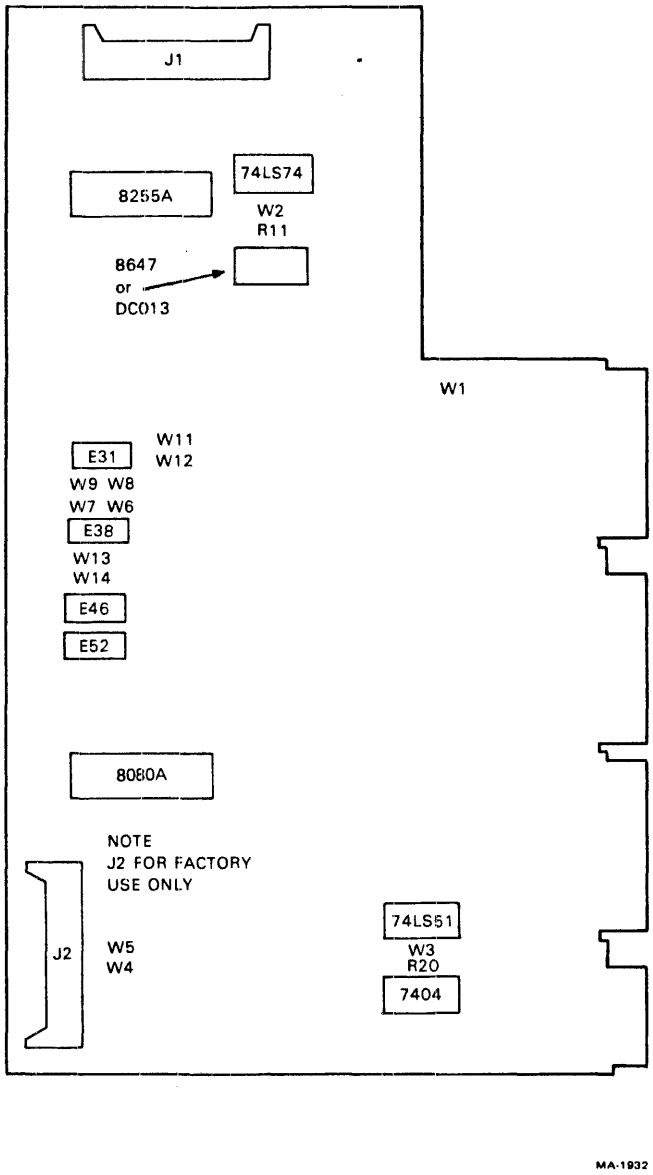


Figure 6-5 M8255 Jumper Layout

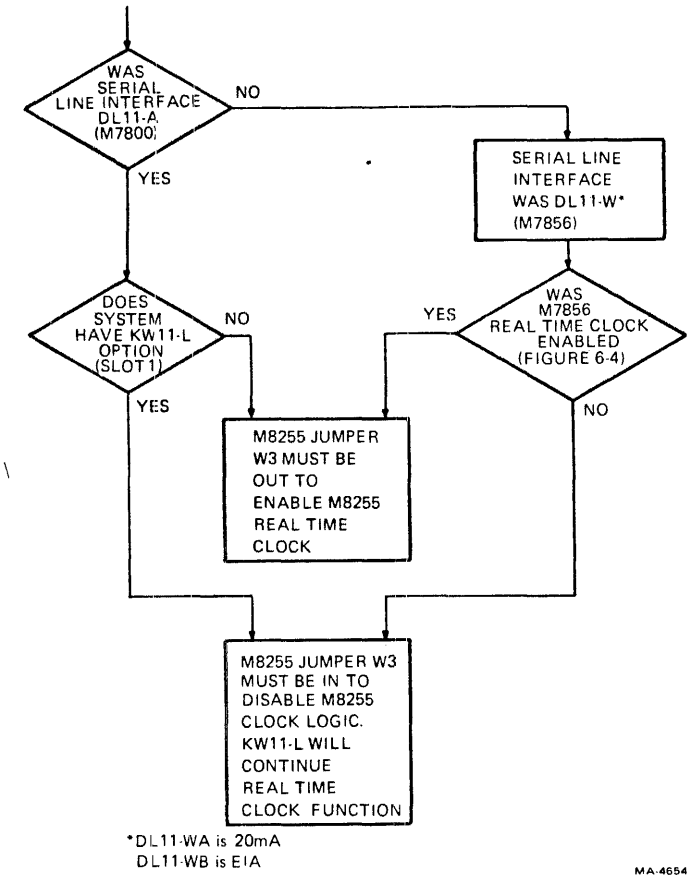
Table 6-3 M8255 Jumper Description And Configuration

Jumper	Jumpers Installed At Factory For ROM Configuration 1Kx8*	2Kx8*	Description	IN/OUT State
W1	-	-	Factory use only	Always IN
W2	-	-	Steal Grant L	OUT on CS Rev F and earlier to disable IN on CS Rev H to enable
W3	-	-	KW11-L option	IN to disable KW11-L equivalent logic OUT to enable KW11-L equivalent logic
W4	IN	OUT		
W5	OUT	IN		
W6	IN	OUT		
W7	OUT	IN		
W8	IN	OUT		
W9	OUT	IN		
W10	-	-	There is no W10	
W11	IN	OUT		
W12	OUT	IN		
W13	IN	OUT		
W14	OUT	IN		

* Reference Table 6-4 and instructions in step 5 to determine the 1Kx8 or 2Kx8 configuration of the M8255.

Table 6-4 M8255 ROM/PROM Configuration

M8255 Variant	Microcode Version	ROM or PROM	In ROM Location E52	E46	E38	E31
-00	V01	1Kx8 UV EPROM (with windows)	007B7	008B7	009B7	010B7
-00	V01	2Kx8 Masked ROM (without windows)	013E2	-	014E2	-
-00	V02	2Kx8 UV EPROM or Masked ROM	175E2	176E2	177E2	178E2
-01	V02	2Kx8 UV EPROM (with windows)	075E2	077E2	076E2	121E2



Step 5 Diagram

The purpose of step 5 is to confirm that the M8255 jumpers were properly configured at the factory. You should find all jumpers in their correct IN or OUT state; only W3 should be altered in the field if system/option configuration requires.

a. Use Table 6-3 and Figure 6-5 to examine the M8255 and determine that jumper W1 (for factory use only) is IN.

b. Use Table 6-3 and Figure 6-5 to examine the M8255 and determine that jumper W2 (Steal Grant) is IN or OUT as noted. The DC013 replaced the 8647 IC at M8255 CS revision H; as a result the Steal Grant feature can be enabled, and NPR latency problems are not increased by addition of the KY11-R when the 11/70 UNIBUS is heavily loaded. Steal Grant must be disabled on M8255s earlier than CS revision H.

c. The electronic console requires a real-time, line frequency clock on the system. That function is usually provided by a KW11-L or DL11-W. If neither is present, the M8255 has real-time clock logic which may be enabled to provide the function.

NOTE

The M8255 real-time clock logic must be disabled if another clock is operative on the system.

The status of M8255 jumper W3 determines the enabled or disabled state of the real-time clock logic on the board.

Use Table 6-3, Figure 6-5, and the Step 5 Diagram to determine that M8255 jumper W3 is IN or OUT as noted; alter it if necessary.

d. Table 6-3 indicates the IN or OUT requirements for M8255 jumpers W4 through W14; Figure 6-5 shows the locations of those jumpers. Before you can use Table 6-3 to determine if W4 through W14 jumpering is correct, you must determine the ROM configuration of the board. The procedure is as follows:

Procedure		**Example**
(1)	Examine the M8255 and (using Figure 6-5) determine the location of the ROMs on the board (locations E52, E46, E38, and E31).	
(2)	Note the numbers printed on the ROMs and locate that number series in Table 6-4.	Assume the board has a 175E2, 176E2, 177E2, and 178E2 series of ROMs in locations E52, E46, E38, and E31 respectively.
(3)	From the ROM/PROM column of Table 6-4, note the corresponding 1Kx8 or 2Kx8 configuration. The -00 or -01 board variant is also shown.	The third row down in Table 6-4 is the appropriate reference for the 17xE2 ROM series. You have now identified the board as a -00 variant, the microcode as V02, and the ROM configuration as 2Kx8.
(4)	Return to Table 6-3 and (using the 1Kx8 or 2Kx8 column) ensure that jumpers W4 through W14 are IN or OUT as required.	The 2Kx8 column in Table 6-3 indicates that jumper W4 should be OUT, W5 IN, and so on.

CAUTION

The -01 variant of the M8255 is intended for Microcode Version V02 in the U.K. and Europe. It must always be paired with a -01 variant of the 54-12781 multiplexer module. Also, the -01 variants are incompatible with the 54-12498 LA36 Integral Modem module. Step 7 provides the details required for 54-12781 identification.

Instruction Step 6

-R	-RB	-RC	-RE

Refer to Figure 6-6.

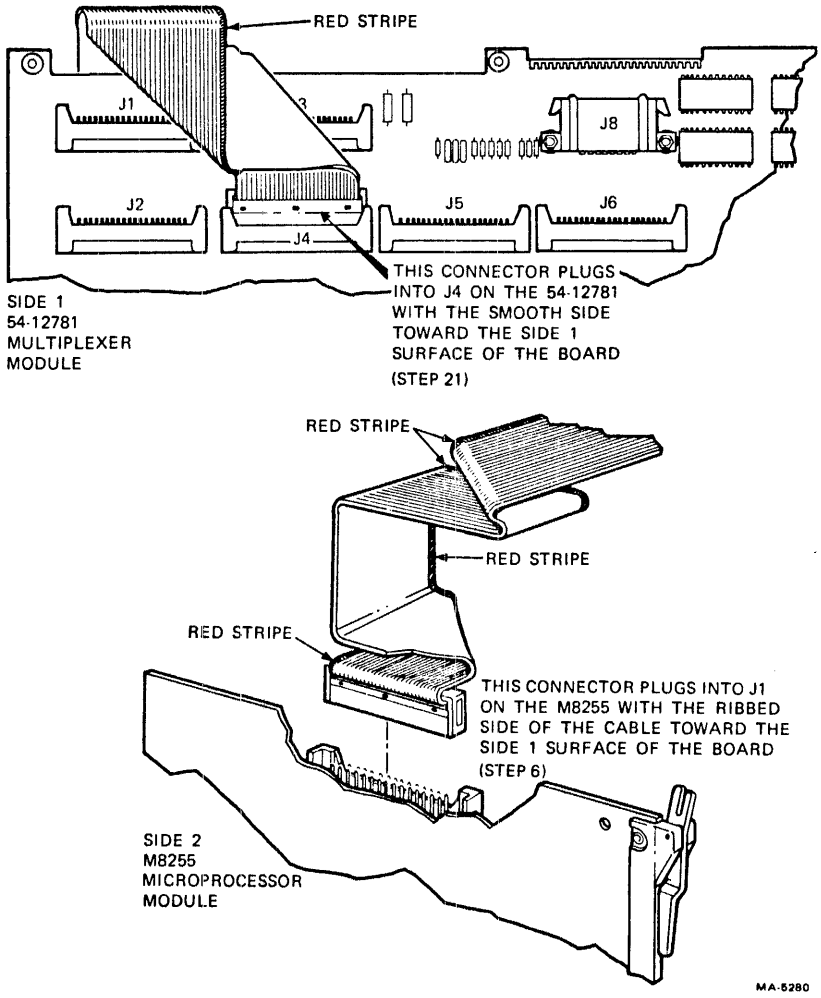


Figure 6-6 BC06R-3 Cable Configuration

Fold the BC06R-3 cable into the configuration shown in Figure 6-6, without attaching it to either board.

Dress the BC06R-3 cable on top of the other ribbon cables in the wiretrough, the ribbed side up and the red stripe toward the backplane. At a point above slot 40, guide the cable downward around the ribbon cable bundle. Plug the connector into J1 on the M8255 with the ribbed side down (toward the side 1 surface of the board) and insert the module into slot 40. Temporary removal of modules from adjacent slots may simplify the procedure.

Instruction Step 7

-R	-RB	-RC	-RE

Refer to Figure 6-7.

The purpose of step 7 is to confirm that the 54-12781 jumpers were properly configured at the factory. You should find all jumpers in their correct IN or OUT state.

a. Use Figure 6-7 to examine the 54-12781 and determine that jumpers W1 through W12 are IN or OUT as indicated.

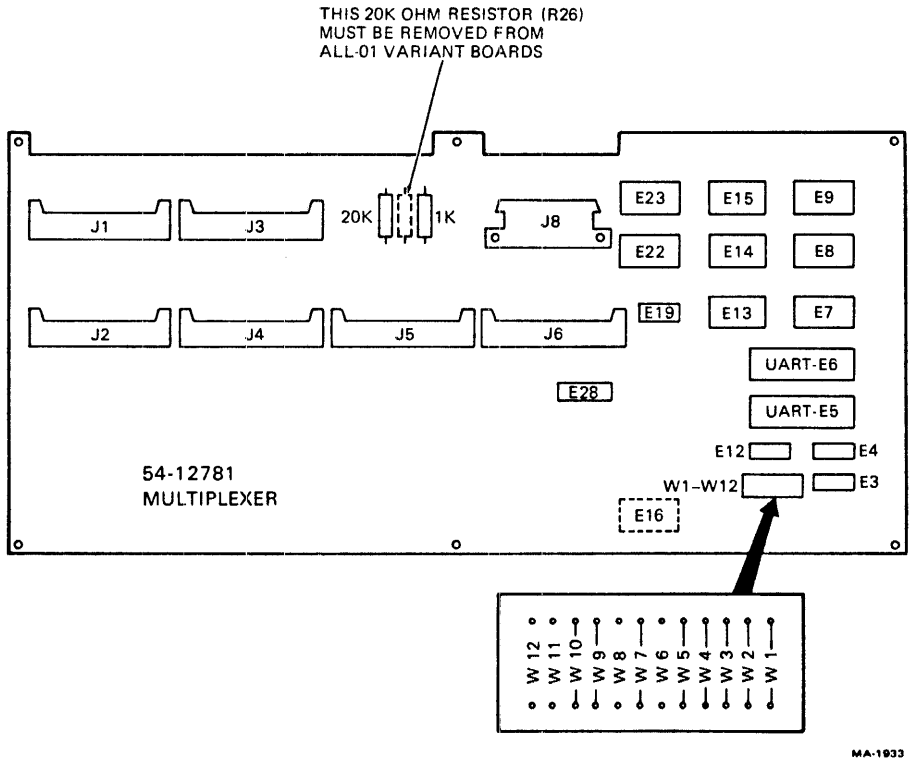


Figure 6-7 54-12781 Jumper Configuration and Layout

b. The Caution note at step 5 indicates that the M8255 and 54-12781 must be -00 or -01 paired. You can determine the 54-12781 variant as follows:

(1) Use Figure 6-7 to determine location E16.

(2) If the board is a 54-12781-00, there won't be any chip at E16.

(3) If the board is a 54-12781-01, there will be a 1489L chip at E16.

c. If the board is a -01 variant, make sure the 20K ohm resistor R26 is removed from the board. It must not be present on any -01 variant board.

Instruction Step 8

-R	-RB	-RC	-RE

Refer to Figure 6-7 and Tables 6-5, 6-6, and 6-7.

Use the tables above and set DIP switches E3, E19, and E28 on the 54-12781 multiplexer module to select baud rate, system terminal fill characters, and 20 mA loop options. Each of the referenced tables indicates the usual LA36 settings. The setting of DIP switch E28 (Table 6-7) is of no consequence if the terminal is wired for EIA operation.

If the system terminal is an LA120, the baud rate must be selected in accordance with Table 6-5. The LA120 must be operated at a baud rate of 1200 or lower. Table 6-6 indicates the settings normally used for LA120; Table 6-7 is not applicable to LA120 or other EIA terminals.

Table 6-5 Baud Rate Selection
54-12781 DIP Switch E3

Baud Rate	Transmit: Receive:	S1	S2	S3	S4	S5	S6	S7	S8
110		ON	OFF	ON	ON	OFF	ON	ON	ON
300*		OFF	ON	OFF	OFF	ON	ON	OFF	ON
600		ON	OFF	ON	OFF	OFF	ON	OFF	ON
1200		OFF	OFF	OFF	OFF	OFF	ON	OFF	ON
1800		ON	ON	ON	ON	ON	OFF	ON	OFF
2000†		OFF	ON	OFF	ON	ON	OFF	ON	OFF
2400		ON	OFF	ON	ON	OFF	OFF	ON	OFF
3600†		OFF	OFF	OFF	ON	OFF	OFF	ON	OFF
4800		ON	ON	ON	OFF	ON	OFF	OFF	OFF
7200		OFF	ON	OFF	OFF	ON	OFF	OFF	OFF
9600		ON	OFF	ON	OFF	OFF	OFF	OFF	OFF
INVALID		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

* Standard switch settings for LA36 (300 Baud)
† Not compatible with LA120

Table 6-6 System Terminal Fill Character Selection 54-12781 DIP Switch E19

Switch	Setting	Function
S1	N/A	Unused.
S2	N/A	Unused.
S3	OFF	Four fills after LF (VT05).
	ON	No fills after LF.
S4	OFF	Eight fills after CR.
	ON	No fills after CR.
S5	OFF	Gate electronic console status bits into transmitter control and status register.
	ON	Suppress electronic console status bits.
S6,7,8	OFF	Reserved for future use.
Usual switch settings for LA34, LA36, LA38, LA120: S3 = ON, S4 = ON, S5 = ON.		

Table 6-7 Console Terminal 20 mA Loop Option Selection 54-12781 DIP Switch E28

	Transmitter Switches					Receiver Switches				
Mode	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Active*	ON	OFF	ON	OFF	ON	ON	OFF	ON	OFF	ON
Passive	OFF	ON	OFF	ON	OFF	OFF	ON	OFF	ON	OFF

* Standard LA36 switch setting, active mode

Instruction Step 9

-R		-RC	

Refer to Figure 6-8.

Attach the four plastic standoffs (90-09670-03) to side 2 of the 54-12498 integral modem module with four 6-32 × 3/8 inch self-tapping screws (90-09525-01) and No. 6 flat washers (90-06658-00) from side 1 of the board.

Snap the 54-12498 integral modem module onto side 2 of the 54-12781 multiplexer module.

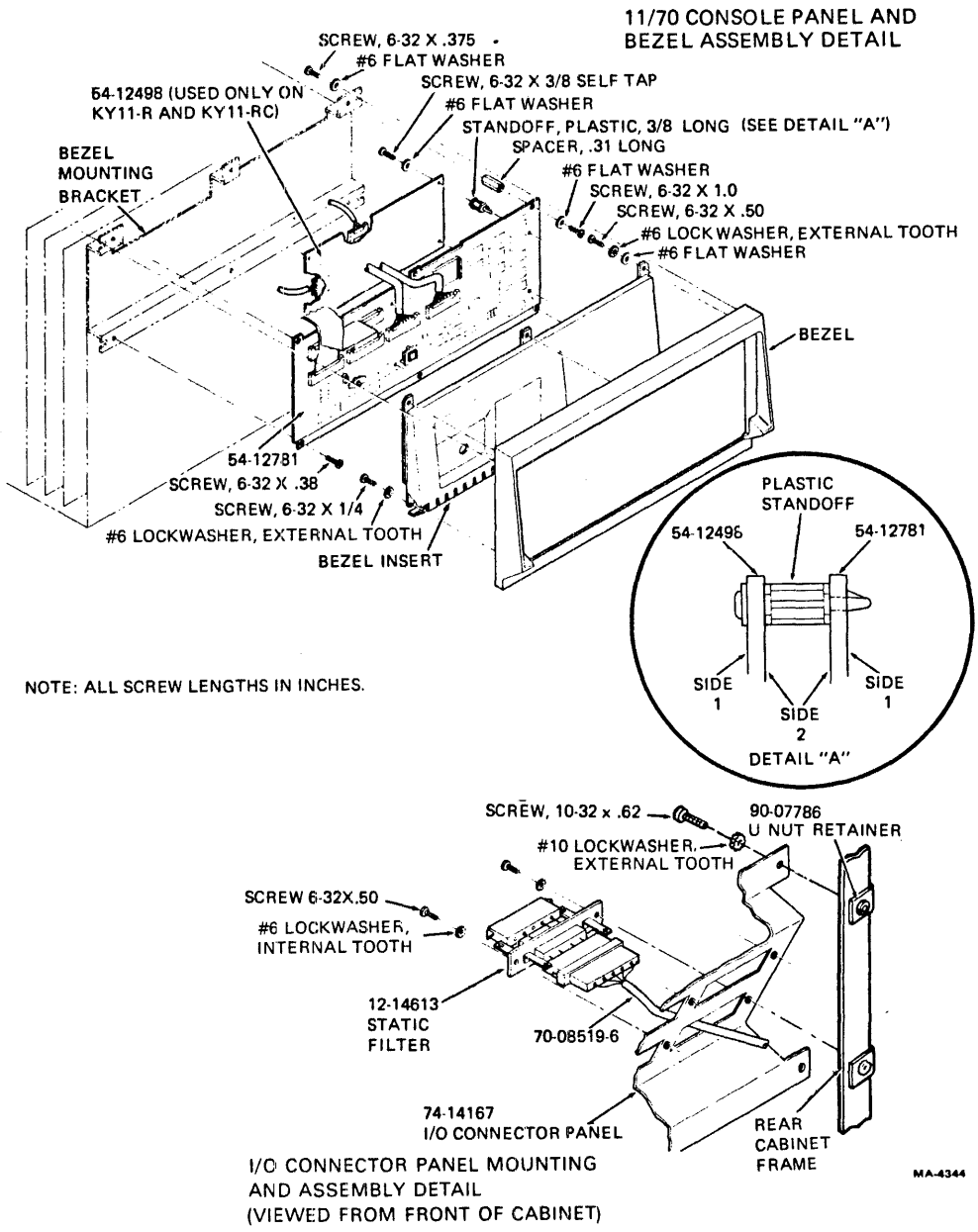


Figure 6-8 KY11-R/KY11-RC Mechanical Assembly

Instruction Step 10

-R	-RB	-RC	-RE

Refer to Figure 6-8 and 6-9.

Remove the four 6-32 screws and No. 6 flat washers that secure the bezel to the bezel mounting bracket. Remove the bezel.

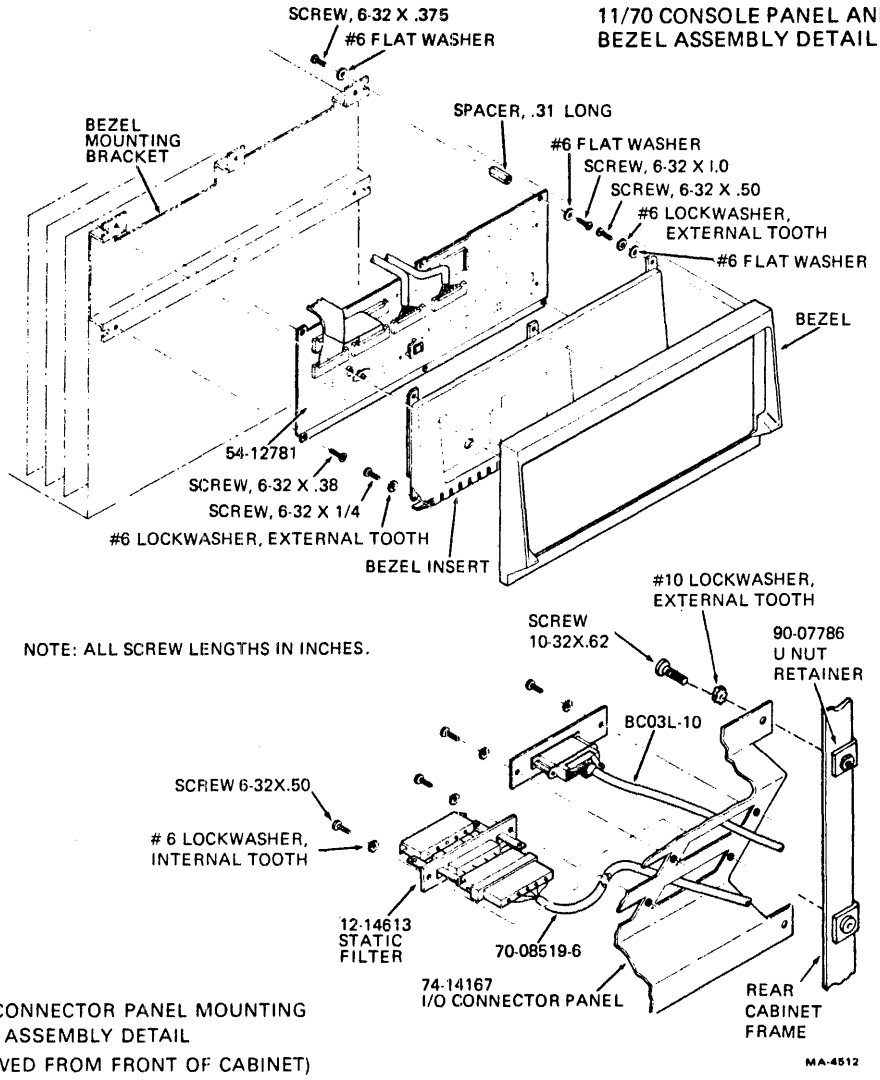
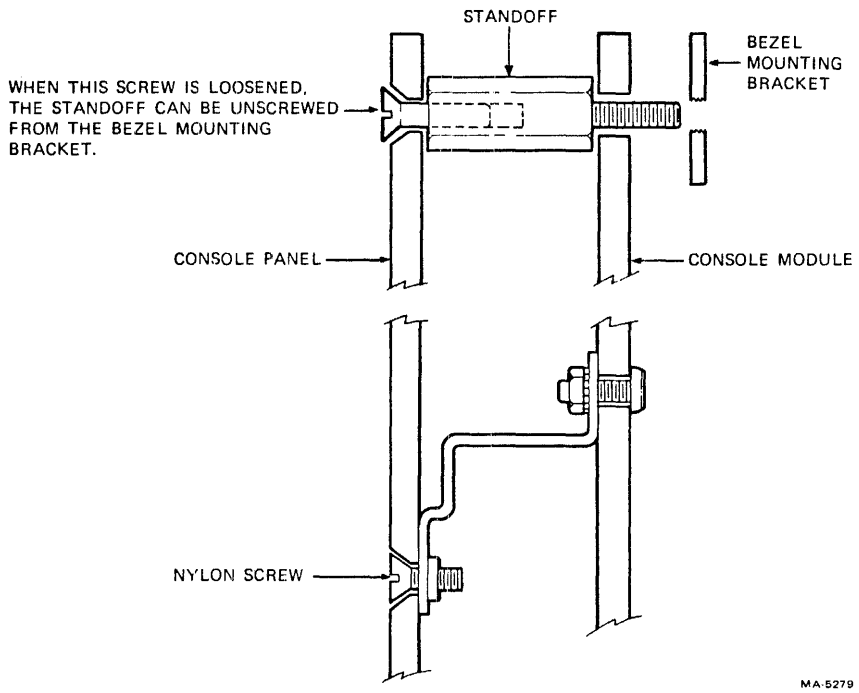


Figure 6-9 KY11-RB/KY11-RE Mechanical Assembly

Instruction Step 11

-R	-RB	-RC	-RE

Loosen (do not remove) the three 6-32 flat head nylon screws from the male/female standoffs that secure the upper edges of the indicator panel and console module to the bezel mounting bracket. The Step 11 Illustration shows the hardware involved.



Step 11 Illustration

Instruction Step 12

-R	-RB	-RC	-RE

Disconnect the four cables connected to the console module; three ribbon cables to Berg connectors J1, J2, J3; and power connector P1 to Mate-N-Lok J1. If the Berg connectors have latches, it may be advisable to separate the indicator panel from the console module to make them accessible.

Instruction Step 13

-R	-RB	-RC	-RE

Unscrew the three male/female standoffs from the bezel mounting bracket.

Tighten the three flat head nylon screws that were loosened in step 11.

Instruction Step 14

-R	-RB	-RC	-RE

Dismount the console module and indicator panel as a complete assembly.

Remove the three 6-32 screws that secure the lower edge of the console module assembly to the bezel mounting bracket.

Instruction Step 15

-R		-RC	

Refer to Figures 6-10 and 6-11.

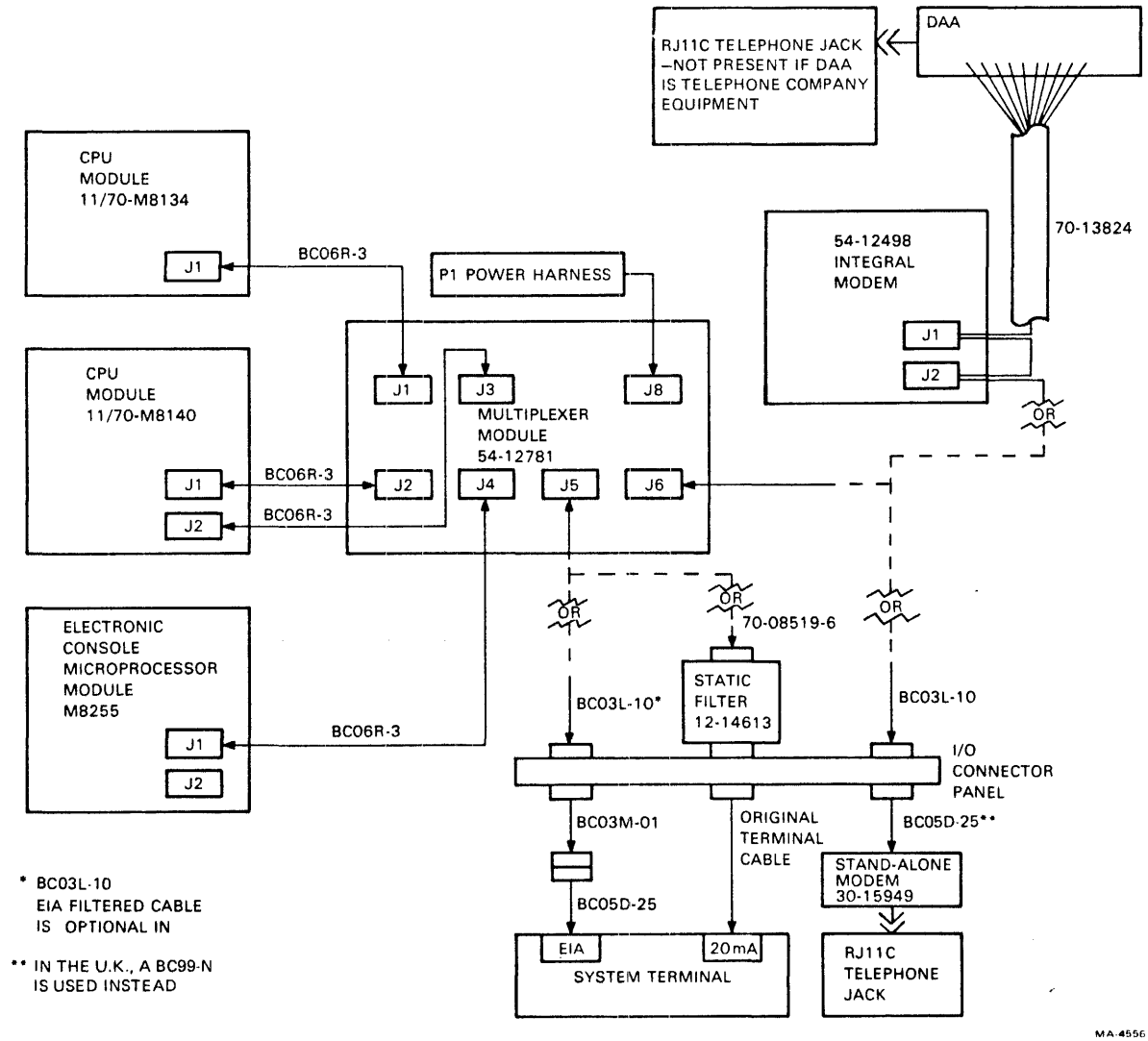


Figure 6-10 KY11-R Cabling Diagram

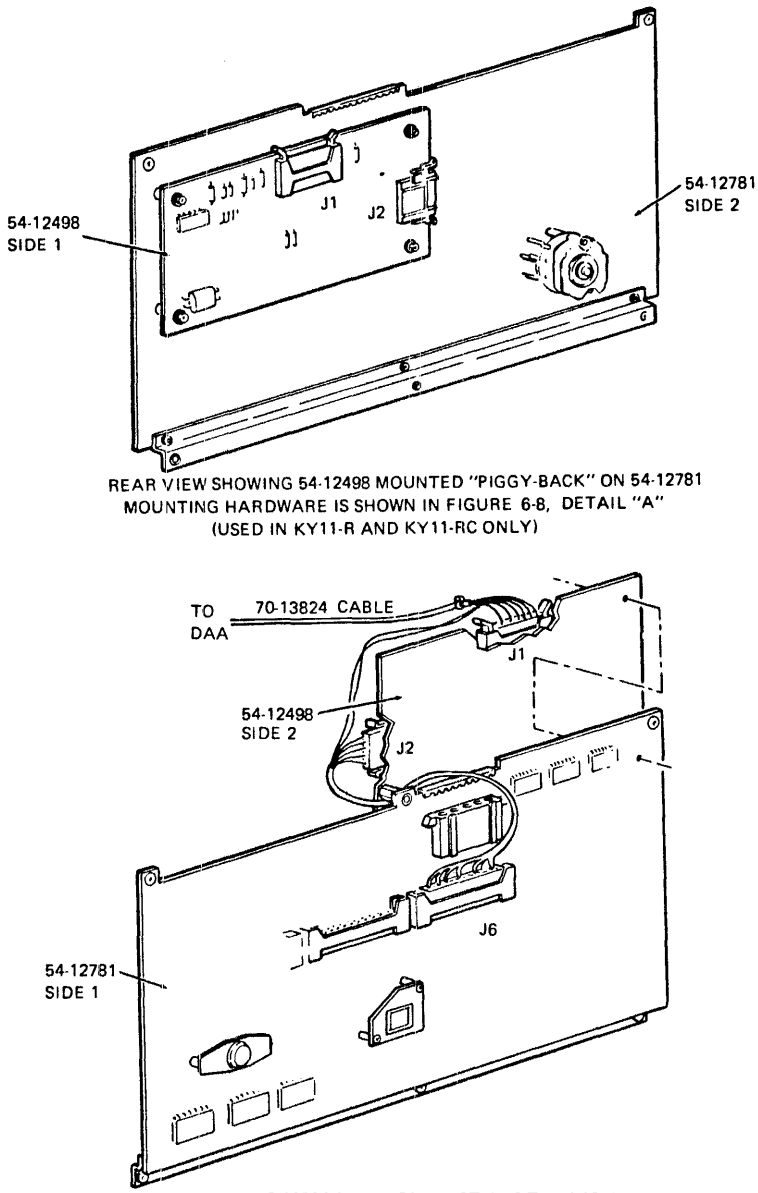


Figure 6-11 54-12498 Integral Modem Mounting and Cabling

Dress the ring terminal end of the 70-13824 cable through the CPU wiretrough, down and out the rear of the cabinet. (Note ac power cable precaution from Paragraph 6.2.3.1).

Plug two of the three connectors at the other end of the cable into J1 and J2 on the 54-12498 integral modem module, leaving the third connector disconnected. Observe the "THIS SIDE UP" warning labels. "UP" means away from the side 1 surface of the board.

Instruction Step 16

-R	-RB	-RC	-RE

Refer to Figures 6-8 and 6-9.

Mount the 54-12781 multiplexer module along its lower edge, using three 6-32 × 0.38 inch screws (90-06022-01) to secure it to the bezel mounting bracket.

Instruction Step 17

-R	-RB	-RC	-RE

Refer to Figures 6-8, 6-9, and 6-11.

Secure the upper edge of the 54-12781 multiplexer module to the bezel mounting bracket, using three 6-32 × 1.0 inch screws (90-06028-03), No. 6 flat washers (90-06658), and 0.31 inch spacers (90-06799). The spacers separate side 2 of the board from the bracket.

When installing KY11-R or KY11-RC, dress the remaining connector of the 70-13824 cable (step 15) under the center spacer and forward over the caterpillar insulation, which is on the board above J8.

Instruction Step 18

-R	-RB	-RC	-RE

Before attaching any cable to the 54-12781 multiplexer module, perform a continuity check to ensure there is no connection between logic reference ground and frame ground. J8 pins 2, 6, and 7 and the etch to which they are connected are suitable logic reference ground points. Refer to the Step 18 Illustration. Measure to the bezel mounting bracket, or other chassis or frame member.

Instruction Step 19

-R	-RB	-RC	-RE

Turn the keyswitch fully counterclockwise to the OFF position and remove the key.

Instruction Step 20

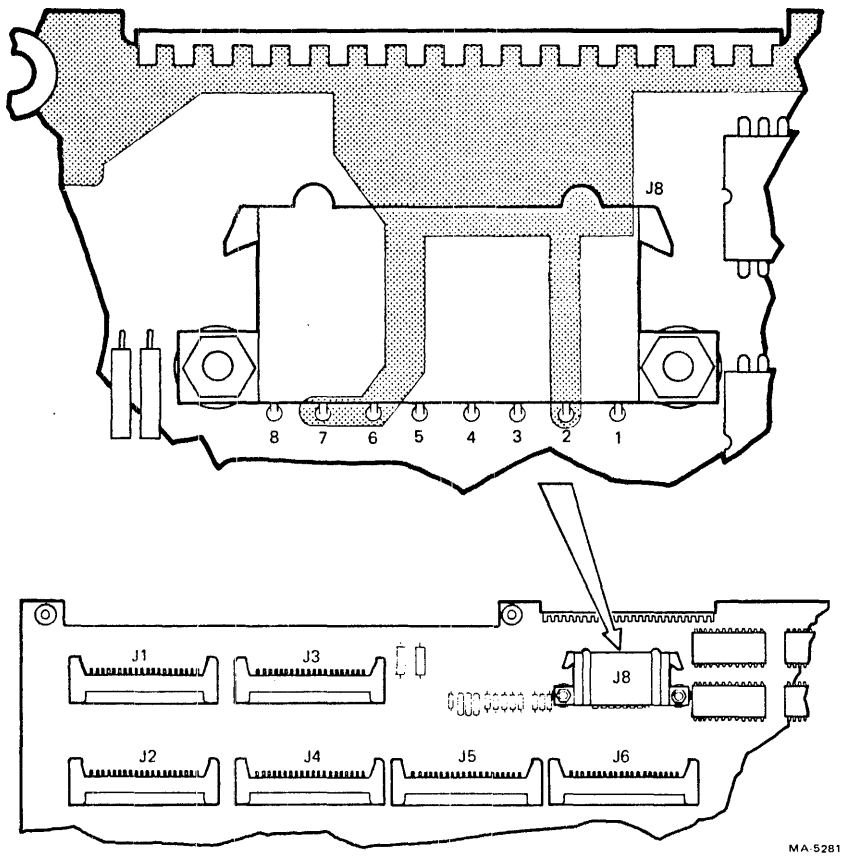
-R	-RB	-RC	-RE

Refer to Figures 6-8 and 6-9.

Mount the 74-14167 universal I/O connector panel if one has not been previously installed. It should be mounted near the power controller and at the bottom of the cabinet; however, since it must not interfere with other equipment or the movement of the CPU on its slides, the panel may be installed in any other suitable location.

Attach the four U nut retainers (90-07786-00) to the cabinet frame.

Secure the panel, using four 10-32 × 0.62 inch screws (90-06074-01) and No. 10 lockwashers (90-07651).



Step 18 Illustration

Instruction Step 21

-R	-RB	-RC	-RE

Refer to Figures 6-6 and 6-10.

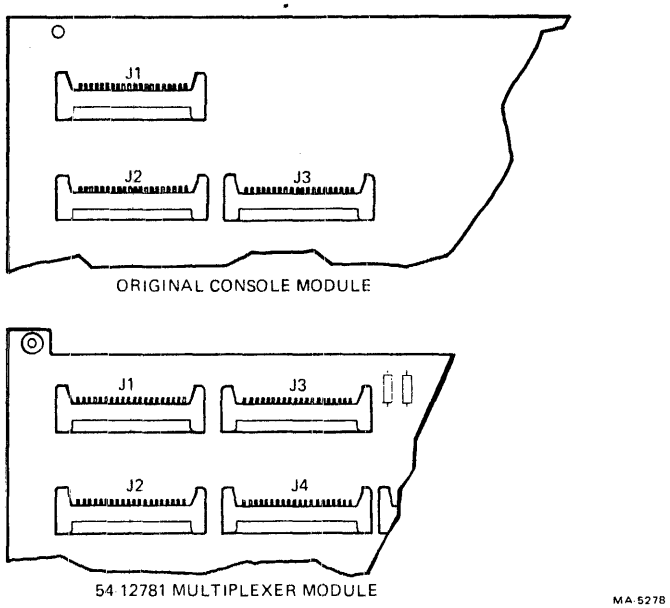
Reconnect the cables disconnected from the original console module. They plug into the 54-12781 multiplexer module at J1, J2, and J3*; power harness plug P1 plugs into J8.

Plug the BC06R-3 cable from the M8255, installed in step 6, into J4 with the smooth side down (toward the side 1 surface of the board).

---

* Note that on the original console module connector J3 was located as shown in the Step 21 Illustration.

On the 54-12781 multiplexer module, J3 is in a different location as shown at the right in the Step 21 Illustration. The cable which was plugged into J3 (and which may be tagged J3) must be slightly refolded so it can be plugged into the new J3 location.



Step 21 Illustration

Instruction Step 22

-R	-RB	-RC	-RE

Refer to Figure 6-10.

If the system terminal is configured for EIA operation, DIGITAL recommends the use of an optional BC03L-10 filtered cable. Connect the cable to J5 on the 54-12781 multiplexer module; dress it through the wiretrough, down to the I/O connector panel, and secure it there. Connect the terminal to the BC03L-10 at the I/O connector panel, using a BC03M null modem cable alone, or in series with a BC05D extension cable.

Instruction Step 23

-R	-RB	-RC	-RE

Refer to Figures 6-8, 6-9, and 6-10.

If the system terminal is configured for 20 mA operation, and a 12-14613 static filter has not been previously installed, mount the filter onto the 74-14167 I/O connector panel, using two 6-32 × 0.50 inch screws (90-06024-01) and No. 6 internal-tooth lockwashers (90-06633).

Instruction Step 24

-R	-RB	-RC	-RE

Refer to Figure 6-10.

Plug the 70-08519-6 cable into J5 on the 54-12781 multiplexer module, dress it through the CPU wiretrough and down to the I/O connector panel.

Plug the cable into the 12-14613 static filter mounted in step 23.

Instruction Step 25

-R	-RB	-RC	-RE

Refer to Figure 6-10.

Plug the system terminal cable into the 12-14613 static filter mounted in step 23.

Instruction Step 26

-R		-RC	

Refer to Figures 6-10 and 6-11.

Plug the remaining connector on the 70-13824 cable (steps 15 and 17) into J6 on the 54-12781 multiplexer module.

Reinstall the wiretrough cover.

Instruction Step 27

-R	-RB	-RC	-RE

Refer to Figure 6-10.

Thread the Berg connector end of the BC03L-10 modem cable through the I/O connector panel as shown in Figure 6-9. Dress the cable (away from any ac power wiring) up to the CPU box, through the wiretrough, to the 54-12781 multiplexer module; plug the Berg connector into J6.

Secure the Amphenol connector to the I/O connector panel, using two 6-32 x 0.50 inch screws (90-06024-01) and No. 6 internal-tooth lockwashers (90-06633).

Reinstall the wiretrough cover.

Instruction Step 28

	-RB		-RE *

Refer to Figure 6-10.

Plug the BC05D-25* modem cable into the Amphenol connector installed in step 27, dress it out of the cabinet and run it to the modem location.

Plug the cable into the modem.

Instruction Step 29

-R	-RB	-RC	-RE

Jumpers C40A1 to C40B1 on the 11/70 backplane must be removed to enable NPG to the M8255 microprocessor module. On later backplanes these may be upper wraps, and removal will be routine. On earlier backplanes the following steps apply:

a. Remove C40B1 (upper wrap) to C41A1.

b. Remove C40B1 (lower wrap) and carefully cut away from C40A1.

c. Replace C40B1 to C41A1 removed in step (a) above.

Instruction Step 30

-R	-RB	-RC	-RE

Refer to Figure 6-12.

FCO 11/70-S0012 must be implemented to provide ±15 V to the electronic console. The FCO is totally accomplished by the installation of two power jumpers included in the option installation kit. Note, as you proceed, that the FCO may already be implemented.

a. Install one 70-15604-00 blue power jumper (23 inches) from P1 console power connector pin 5 to backplane connector P5, pin 5.

b. Install one 70-15604-01 grey power jumper (18-1/2 inches) from P1 console power connector pin 1 to backplane connector P3, pin 3.

c. Secure the two jumpers to the existing wire bundle with tie wraps (90-07032) as required.

* In the U.K., a BC99-N should be installed instead of the BC05D-25.

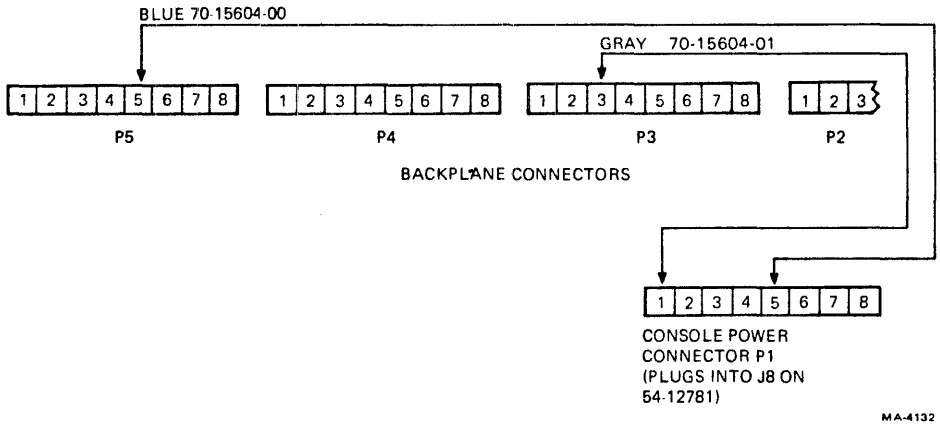


Figure 6-12 Power Jumper Installation

Instruction Step 31

-R		-RC	

Refer to Figure 6-10 and Tables 6-8, 6-9, and 6-10.

Connect the 70-13824 cable ring terminals to the DAA, using Table 6-8 to identify which wire goes to which terminal. Note that the voltage supply leads connected to +V and -V must be from the KY11-R, not from any other source.

Instruction Step 32

-R		-RC	

Refer to Figure 6-10.

If the DAA is DIGITAL-supplied 30-17066, the kit includes a vendor manual that specifies installation procedures. Early versions of this DAA kit did not include mounting hardware; it must be obtained locally. The vendor procedure should be performed at this time; however, there are additional details which must be observed with respect to the locally obtained mounting hardware:

a. The DAA must be mounted vertically to a wall or other stationary structure.

b. If the unit is mounted to a plaster or composition wall, plastic or other suitable screw anchors should be used.

c. The two mounting screws must have low profile heads to eliminate any possibility of contact with the DAA circuit board.

Plug the I/O (analog interface) cable from the DAA into the RJ11C telephone jack.

Table 6-8 Interconnection of 54-12498 Integral Modem to DAA

54-12498 Modem J2 Pin No.	DAA Terminal Designation	Signal Name	Wire Color
11	-V	-12 volts	Grey
3	SH	Switchhook Status	Blue
9	+V	+12 volts	Brown
8	SH1	SH Return	Black
2	DA	Data	Red
-	CTT	Not used	-
1	OH	Off Hook	Green
7	RI	Ring Indication	Yellow
5	DT	Data Transmit	Violet
6	DR	Data Receive	Orange

Table 6-9 Interconnection of 54-12781 Multiplexer to 54-12498 Integral Modem

54-12781 Multiplexer J6 Pin No.	Signal Name	70-13824 Cable Wire Color	54-12498 Integral Modem J1 Pin No.	J2 Pin No.
A	Ground	Blue	1	-
M	Receive Data	White	2	-
H	Transmit Data	Violet	4	-
TT	+5 Volts	Orange	5	-
CC	+12 Volts	Yellow	6	-
HH	-12 Volts	Black	7	-
KK	Data Terminal Ready	Brown	8	-
UU	Ground	Green	-	4
AA	Clear to Send	Red	-	15

Table 6-10 Interconnection of 54-12781 Multiplexer to Modem

54-12781 Multiplexer J6 Pin No.	BC03L-10 Cable Connector Pin No.	EIA (RS-232C) Signal Name	EIA (Abbr.)	EIA Cir.
VV	1	Protective Ground	GND	AA
VV	7	Signal Ground	GND	AB
F	2	Transmit Data	TxD	BA
J	3	Receive Data	RxD	BB
V	4	Request to Send	RTS	CA
T	5	Clear to Send	CTS	CB
Z	6	Data Set Ready	DSR	CC
DD	20	Data Terminal Ready	DTR	CD
X	22	Ring Indicator	RI	CE
BB	8	Carrier Detect	CD	CF
C	25	Force Busy*	FB	CN

* Not used

Instruction Step 33

	-RB		-RE

Refer to Figure 6-10, and Tables 6-10 and 6-11.

Plug the modem into ac power. (Note precaution in Paragraph 6.2.3.3.) Connect the I/O (analog interface) cable to the RJ11C telephone jack (does not apply to -RE). If the modem is not DIGITAL-supplied (30-15949), use Table 6-10 to identify pin connections for the required signals from the BC03L-10, BC05D-25, or BC99-N cable. Table 6-11 indicates the required states of selectable options.

Instruction Step 34

-R	-RB	-RC	-RE

By this step, all electronic console hardware is installed except the bezel.

Review all elements of the installation to determine that all components are properly installed.

Verify that all electrical and mechanical connections are secure; it is possible that some were disturbed during the installation.

Instruction Step 35

-R	-RB	-RC	-RE

If you wish to perform an operational test of the electronic console before attaching the bezel and other superficial components, proceed to step 39. Steps 36, 37, and 38 may be performed following the test.

Instruction Step 36

-R	-RB	-RC	-RE

Refer to Figure 6-8 and 6-9.

Mount the bezel insert (70-13827) to the bezel removed in step 10.

Along the upper edge use three 6-32 × 0.50 inch screws (90-06024-01), No. 6 external-tooth lockwashers (90-07649), and No. 6 flat washers (90-06658).

Secure the two lower corners, using two 6-32 × 0.25 inch screws (90-06020-01) and No. 6 external-tooth lockwashers (90-07649).

Table 6-11 Selectable Modem Options

Description	Predetermined State On State	Off State	Condition
Originate/Answer	X	-	-
Automatic/Answer	X	-	-
Data Set Ready (CC) in Analog Loop	X	-	-
Loss of Carrier Disconnect (LCD)	X	-	-
Abort Timer (ABT): Allows data set disconnects when handshaking does not take place. Delay time: 17.0 sec (min) 30.0 sec (max)	X	-	-
Receive Space Disconnect (RSD)	-	X	-
Send Space Disconnect (Immediate)	-	X	-
Transmit Reversals in Manual Analog Loop	-	X	-
Answer Mode Indication (CE)	-	X	-
Early Data Set Ready (CC) Indication: Causes Data Set Ready (CC) to be asserted when the "modem" is connected to the switched network rather than when the called station's carrier is detected.	X	-	-
Make Busy (CN Circuit)	-	X	-
Fail-safe state of CN	-	X	-
Common Ringer	-	X	-
RTS Control	-	-	DTE mode
DTR Control	-	-	DTE mode
Analog Loop	-	-	DTE mode
Disconnect (Unattended)	-	-	DTE mode
CB-CF (COM/SEP)	-	-	Separate
Grounding AA/AB COM/SEP	-	-	Common
Remote Telephone Operation (REM OPR)	-	-	Remote

This table is an excerpt from DIGITAL Purchase Specification A-PS-3015949, Revision A. It lists selectable modem options and indicates their states as required by the electronic console.

Instruction Step 37

-R	-RB	-RC	-RE

Refer to Figures 6-8 and 6-9.

Mount the bezel to the bezel mounting bracket, using four 6-32 × 0.38 inch screws (90-06022-01) and No. 6 internal-tooth lockwashers (90-06633).

As the bezel is positioned for mounting, determine that there is clearance for operation of the power-fail/restart (RUN 1, HALT, RUN 0) and lamp test switches. Slight vertical or horizontal adjustment of the bezel, bezel insert, or 54-12781 multiplexer module may be required.

Instruction Step 38

-R	-RB	-RC	-RE

Replace the CPU module cover panel (left cover).

Reposition and tighten the clamps for the ribbon cable bundle at the rear of the CPU box.

Replace any other panels and doors that were removed.

Instruction Step 39

-R	-RB	-RC	-RE

Apply primary system power by turning the circuit breaker to ON. Leave the electronic console key-switch in the OFF position.

Instruction Step 40

	-RB		-RE

Determine that modem power is on.

Table 6-12 is a summary of steps 41 through 47, which test the DAA, modem, and electronic console remote port. An overview of those steps will be helpful as you proceed.

Instruction Step 41

-R		-RC	

Refer to Table 6-12.

This step tests the DAA without power. The DAA receives its power from the electronic console; with the keyswitch in the OFF position, the DAA should be inoperative.

From another telephone, dial the number of the dedicated line. You will hear the ringing signal, but there will be no answer.

Hang up.

If you don't hear a ringing signal, a telephone circuit fault is probable.

Table 6-12 DAA or Modem Test Sequence

Instruction Step No.	KY11-R Variant Affected -R	-RB	-RC	-RE	Keyswitch Position	Unit Tested and Expected Results DAA With Test Switch	DAA Without Test Switch	Stand-Alone Modem
41	X	-	X	-	OFF	Dial the number; there will be no answer.	Dial the number; there will be no answer.	Not tested.
43	X	-	X	-	LOCAL	-	-	-
44	X	-	X	-	LOCAL	Set switch to NORMAL dial the number; there will be no answer.	Dial the number; there will be no answer.	Not tested.
	-	X	-	X	LOCAL	Not tested.	Not tested.	Set switch to NORMAL; dial the number; there will be no answer.
45	-	X	-	X	LOCAL	Set switch to TEST*; dial the number;	Not tested.	Set switch to TEST*; dial
46	X	-	-	-		carrier tone will be heard; CARRIER indicator will not light.		the number; carrier tone will be heard; CARRIER indicator will not light.
47	X	X	X	X	REMOTE	Set switch to NORMAL; dial the number; carrier tone will be heard.	Dial the number; carrier tone will be heard.	Set switch to NORMAL; dial the number; carrier tone will be heard.

* See Note at step 44.

Instruction Step 42

-R	-RB	-RC	-RE

This step is required only if the system terminal is an LA120. The specified communication features of the LA120 must be "set up" as follows:

a. The transmission baud rate must be 1200 or lower.

b. Buffer Control, B, must be set to 1, large buffer.

c. Local Echo, E, must be set to 0, off.

d. Modem, M, must be set to 1, full duplex, no modem.

e. Parity and Data Bits, P, may be set to any one of the five positions (1, 2, 3, 4, or 8) which ignore parity received.

f. Auto XON/XOFF, X, must be set to 1, enabled.

Instruction Step 43

-R	-RB	-RC	-RE

Refer to Table 6-12.

Turn the keyswitch to the LOCAL position; this brings power up. All panel indicators except CARRIER are turned on momentarily; then, except for POWER, they are turned off. The POWER indicator remains on, and in Microcode Version V02 will be blinking to indicate that the CPU is halted. The self-test message V000377 will be printed on the system terminal.

Type **<CTRL/P>** to enter console state. A CON= prompt will be printed at the left margin.

If system response to power-up is not as described above, see Paragraph 6.4.

Instruction Step 44

-R	-RB	-RC	-RE

Refer to Table 6-12.

If the DAA or modem has a NORMAL/TEST switch, select the NORMAL position. (See Note below.)

From another telephone, dial the number of the dedicated line. You will hear the ringing signal, but there will be no answer.

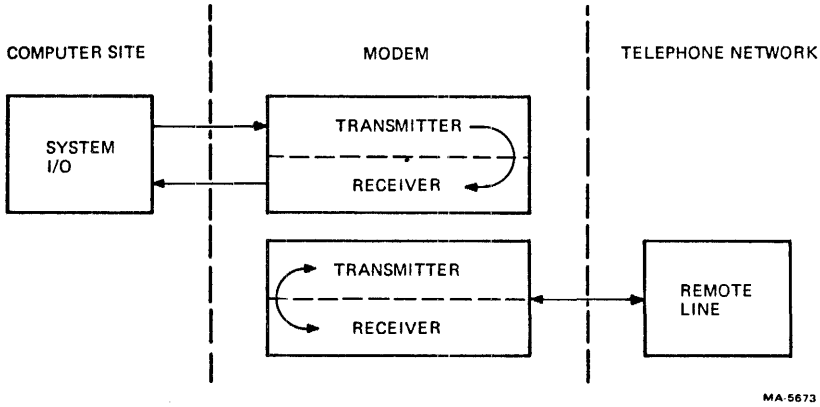
Hang up.

If you do not hear a ringing signal, a telephone circuit fault is probable.

NOTE

There may not be a switch labeled NORMAL/TEST; however, a switch (or switches) may serve that purpose. Typical modem test loops are illustrated by the Step 44 Diagram.

Specific instructions for selecting "normal" or "test" operation may be found in the vendor manual shipped with each DIGITAL-supplied DAA or modem.



Step 44 Diagram

Instruction Step 45

	-RB		-RE

Refer to Table 6-12.

If the DAA or modem has a NORMAL/TEST* switch, select the TEST position.

From another telephone, dial the number of the dedicated line. The call will be answered and you will hear a carrier tone. The electronic console CARRIER indicator will not light.

Hang up.

Instruction Step 46

-R			

Refer to Table 6-12.

If the DAA or modem has a NORMAL/TEST* switch, select the TEST position.

From another telephone, dial the number of the dedicated line. The call will be answered and you will hear a carrier tone. The electronic console CARRIER indicator will not light.

Hang up.

* See Note in step 44.

Instruction Step 47

-R	-RB	-RC	-RE

Refer to Table 6-12.

Turn the keyswitch to REMOTE.

If the DAA or modem has a NORMAL/TEST* switch, select the NORMAL position.

From another telephone, dial the number of the dedicated line. The call will be answered and you will hear a carrier tone.

If you simulate a carrier signal (by whistling into the telephone for example) the electronic console will detect the signal and the CARRIER indicator will light.

Hang up.

Instruction Step 48

-R	-RB	-RC	-RE

Return the keyswitch to the LOCAL position.

Instruction Step 49

-R	-RB	-RC	-RE

Set the power-fail restart (HALT, RUN 1, RUN 0) switch to the HALT position.

Instruction Step 50

-R	-RB	-RC	-RE

If installation verification will be performed by DDC, further manual testing is not required. DDC personnel will provide instructions for test preparation. The procedure for contacting the DDC is documented in Chapter 5.

A manual test procedure follows, however, for use when required.

---

* See Note in step 44.

Instruction Step 51

-R	-RB	-RC	-RE

All original hardware removed during KY11-R installation must be saved; it will be needed if the customer decides to have the KY11-R removed. Use the KY11-R shipping container and packing materials for storage purposes. After packing, the container should be clearly marked "DO NOT DISCARD". Advise the customer of the contents and their possible use if the electronic console is removed at some future date.

6.4 ELECTRONIC CONSOLE CHECKOUT PROCEDURE

You can use this test procedure immediately after installing the electronic console, after performing corrective maintenance, or whenever a basic test is appropriate.

Each step of this procedure includes operator action, expected normal system response, and failure keys. Use the failure keys referenced in each of these tests if the system response is abnormal, to determine which components are involved in that test. An abnormal response indicates system failure. If you observe any deviation from the system's normal response to a test, turn to the referenced failure key(s) in Chapter 7.

Figure 6-13 shows an example of the failure key format. Each failure key shows the active signals and components for the test by using bold lines and shading.

TEST 1 POWER, KEYSWITCH, LAMPS; AND ELECTRONIC CONSOLE SELF-TEST

Action
Power down; set system terminal on-line.
Set power-fail restart switch to HALT.
Turn keyswitch to LOCAL DISABLE.

Expected Response
REMOTE, FAULT, and TEST indicators should be turned on momentarily, then turned off. POWER and DISABLE indicators should be turned on (blinking in Microcode Version V02). Terminal message V000377 indicates successful self-test.

Action	Expected Response
1. Turn keyswitch to LOCAL.	DISABLE indicator should be turned off.
2. Turn keyswitch to REMOTE DISABLE.	REMOTE and DISABLE indicators should be turned on.
3. Turn keyswitch to REMOTE.	DISABLE indicator should be turned off.
4. Turn keyswitch to LOCAL.	REMOTE indicator should be turned off.
5. Press LAMP TEST pushbutton.	ALL indicators should be turned on.

Failure Key: 1

TEST 2 ELECTRONIC CONSOLE BASIC OPERATION

Action
Enter console state.

Expected Response
<CTRL/P>^P<Bell><NL>
CON=

Failure Key: 4

Action
Type command V to initiate an electronic console self-test.

Expected Response
CON= V000377
CON=

Failure Key: 3

TEST 3 SWITCH REGISTER LOGIC

Action
Enter alternate ones and zeros pattern in switch register by typing 12525252W. Next, type the command R to read back that same pattern. Reverse the pattern test by typing 05252525W and the command R. The data entered and read should be identical.

Expected Response
CON= 12525252W$_{\Delta}$ R 12525252 <CR> <NL>
CON= 05252525W$_{\Delta}$ R 05252525 <CR> <NL>
CON=

Failure Key: 5

TEST 4 LOAD ADDRESS AND ADDRESS REGISTER DISPLAY

Action
Type 05252525L to have address 05252525 loaded into the CPU address register. Type A to have the contents of the CPU address register displayed.

Expected Response
CON= 05252525L$_{\Delta}$ 3A05252525 <CR> <NL>
CON=
Note that the address display multiplexer position is printed after you type the command A.

Failure Key: 6

TEST 5 LOAD ADDRESS AND DATA DISPLAY

Action
Type 1000/ to have the value 1000 loaded into the CPU address register and the contents of location 1000 printed.

Expected Response
CON= 1000/nnnnnn

Failure Key: 7

TEST 6 SEQUENTIAL ADDRESS LOADING AND DEPOSIT

Action
This exercise loads a program used in subsequent tests. Type 013737 < LF> and continue through 774 <CR> . This program reads the contents of the switch register and writes that value into the data display register. In an electronic-console-equipped system, reading from 177570 is reading from the switch register and writing to 177570 is writing to the data display register.

Expected Response
CON= 1000/nnnnnn 013737 <LF >
1002/nnnnnn 177570 <LF>
1004/nnnnnn 177570 <LF>
1006/nnnnnn 774 <CR> <NL>

Failure Key: 8

TEST 7 START FUNCTION

Action
Type 1000S (start instruction execution at address 1000).

Expected Response
CON= 1000S R05252525
The program loaded in Test 6 should begin running. The POWER indicator should be on (not blinking). The R prompt system response will be printed only with Microcode Version V02. It indicates the contents of the switch register, entered in Test 4.

Failure Key: 9

TEST 8 HALT FUNCTION

Action
The program started in Test 7 is running. When you type H, the program will halt; the address at which it halted and the CPU status will be printed. With Microcode Version V02, the POWER indicator will begin to blink which means the CPU is in a halted state.

Expected Response
CON= 1000S R05252525 H00011006/T44410 <CR>
CON=

Failure Key: 10

TEST 9 DATA DISPLAY MULTIPLEXER FUNCTION

Action
Type **C** to have CPU instruction execution continue. Microcode Version V02 will force the R prompt, reading the contents of the switch register entered in Test 4.

Type **2M** to have the data display multiplexer set to position 2, (display register) and the contents of the display register printed. The result obtained from using command M while the CPU is running is usually invalid; in this test program, however, the display register contents are stable because of continuous writing of the switch register value into the display register.

Type **125252W** to have the opposite alternate bit pattern entered into the switch register. Since the program is running, that new value is being written into the display register. Note that only the 16 low-order bits of the switch register contents are exercised by the 16-bit display register. The digit following the M indicates parity (Figure 4-4).

Type **M** to have the contents of the display register printed again, now equal to the 125252 switch register contents.

Type command **H** to have the program halt. In Microcode Version V02, the POWER indicator should be on when the program is running and blinking when it is not.

Expected Response
CON= C$_{\Delta}$ R05252525 2M_0052525 <CR> <NL>
CON= 125252W$_{\Delta}$ M_0125252 <CR> <NL>
CON= H00001004/T44410 <CR> <NL>
CON=

Failure Key: 11

TEST 10 RUN/HALT DETECTION LOGIC

Action
Type **1000S** to start program instruction execution at address 1000. Microcode Version V02 forces the R prompt.

Type **100S** (start program instruction execution at address 100), an illegal command when issued while the CPU is running. The expected result of this test is a RUN ERROR.

Type **H** to have the program halt; the address at which it halted and CPU status are printed.

Type command **U** to have the UNIBUS status printed.

Expected Response
CON= 1000S R00125252 100S
?RUN ER
CON= H00001006/T44410 <CR>
CON= U00000000 <CR>
CON=

Failure Key: 12

TEST 11 SINGLE BUS CYCLE FUNCTION

Action
Type **1000 LIJ** to load address 1000, initialize the system, and set single bus cycle.

Type the **N** command three times to have three single bus cycles executed, with the contents of the CPU address register displayed after each cycle.

Type **C** (continue program instruction execution) to clear single bus cycle and assert the signal CONTINUE to the CPU. Because the CPU has not completed execution of the last instruction, the expected result of this test is a CPU response time-out, indicated by the printed "#" symbol.

Expected Response
CON= 1000L_Δ I_Δ J_Δ N00001000 <CR> <NL>
CON= N00001002 N00002200 <CR> <NL>
CON= C# <CR> <NL>
CON=

Failure Key: 13

TEST 12 DL11 INTERRUPT

Refer to Figure 6-14.

Action
Load the test program, using the following procedure:

Type **1000/** ; the system responds by printing the contents of location 1000.

Type **12706 <LF>** to deposit 12706 into location 1000, open location 1002, and display its contents.

Type **1000 <LF>** to deposit 1000 into location 1002, open location 1004, and display its contents. Continue these steps until all instructions are entered.

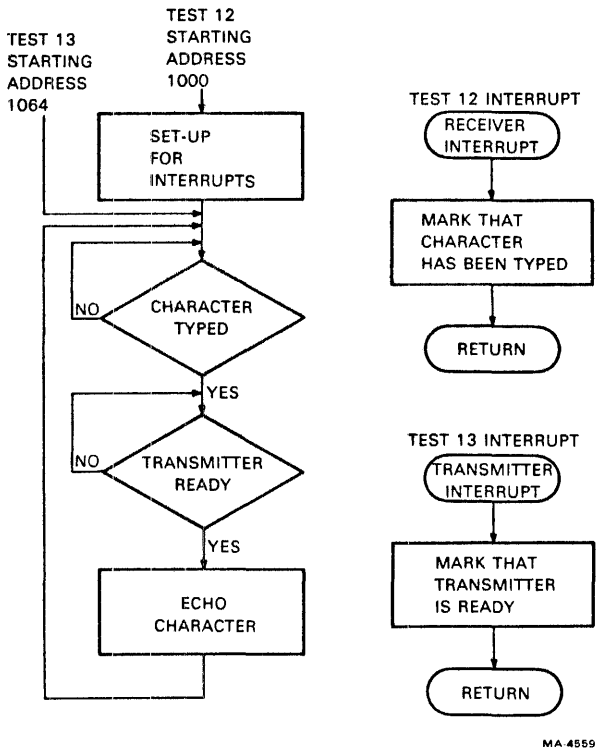


Figure 6-14 Flow Diagram (Tests 12 and 13)

Expected Response
The contents of the current location will be displayed after that location is typed (indicated by the nnnnnn shown in the first column below).

Type the instructions shown in second column and follow each with a line feed.

1000/nnnnnn	**12706**	<LF>	MOV	#1000,SP
001002/	**1000**			
001004/	**12737**		MOV	#1122,@#60
001006/	**1122**			
001010/	**60**			
001012/	**12737**		MOV	#340,@#62
001014/	**340**			
001016/	**62**			
001020/	**12737**		MOV	#1132,@#64
001022/	**1132**			
001024/	**64**			
001026/	**12737**		MOV	#340,@#66
001030/	**340**			
001032/	**66**			
001034/	**5037**		CLR	@#1142
001036/	**1142**			

```
001040/   12737                    MOV   #200,@#1144
001042/     200
001044/    1144
001046/   12737                    MOV   #100,@#177560
001050/     100
001052/  177560
001054/   12737                    MOV   #100,@#177564
001056/     100
001060/  177564
001062/     230                    SPL   0
001064/  105737                    TSTB  @#1142
001066/    1142
001070/  100375                    BPL   1064
001072/  105737                    TSTB  @#1144
001074/    1144
001076/  100375                    BPL   1072
001100/    5037                    CLR   @#1142
001102/    1142
001104/    5037                    CLR   @#1144
001106/    1144
001110/   13737                    MOV   @#177562,@#177566
001112/  177562
001114/  177566
001116/     137                    JMP   @#1064
001120/    1064
001122/   52737                    BIS   #200,@#1142
001124/     200
001126/    1142
001130/       2                    RTI
001132/   52737                    BIS   #200,@#1144
001134/     200
001136/    1144
001140/       2          <CR>      RTI
```

Action

Type 1000G to start instruction execution. (Microcode Version V02 prints an R followed by the switch register setting.)

This program tests the DL11, and its interrupt function in particular, by echoing characters typed on the system terminal keyboard. The program is diagrammed in Figure 6-14.

The program begins running, waiting for an interrupt from the system terminal keyboard.

Type each character of the alphabet, observing that each character is properly echoed.

When all characters have been tested, type <CTRL/P> to return to console state.

Type H to halt the program and <CR> to return to the CON= prompt.

Expected Response
—XYZ <CTRL/P> ^P <BELL><NL>
CON= H 00001072/T14410 <CR>
CON=

Failure Key: 14

TEST 13 DL11 READY BIT
Refer to Figure 6-14.

Action
Change the contents of locations 1066 and 1074 as indicated below to modify the program used in Test 12. That modified program, using a different starting address, is used to test the DL11, and its ready bit (logic) function in particular. The program is diagrammed in Figure 6-14. Type **1064G** to start the program running.

Expected Response
CON= **1066**/001142 **177560** <CR> <NL>
CON= **1074**/001144 **177564** <CR> <NL>
CON= **1064G**

Action
Microcode Version V02 will print an R, followed by the switch register setting.

Type **each character of the alphabet**, observing that each character is properly echoed.

When all characters have been tested, type <CTRL/P> to return to console state.

Type H to halt the program and <CR> to return to the CON= prompt.

Expected Response
—XYZ <CTRL/P> ^P <BELL><NL>
CON= H 00001072/T14410 <CR>
CON=

Failure Key: 14

TEST 14 KW11-L INTERRUPT
Refer to Figure 6-15.

Action
Load the following program which is diagrammed in Figure 6-15.

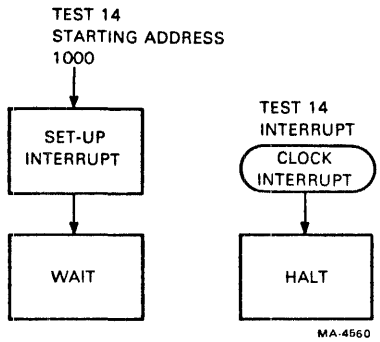


Figure 6-15 Flow Diagram (Test 14)

Expected Response

1000/012706	**12706**	<LF>	MOV	#700,SP
0001002/001000	**700**	<LF>		
0001004/012737	**12737**	<LF>	MOV	#200@#177546
0001006/001122	**100**	<LF>		
0001010/000060	**177546**	<LF>		
0001012/012737	**1**	<CR>	WAIT	
CON= **100**/nnnnnn	**102**	<LF>		
0000102/nnnnnn	**0**	<CR>		
CON=				

Action

Type **1000G** to start instruction execution. (Microcode Version V02 prints an R followed by the switch register setting.)

The command **G** initializes the system and initiates instruction execution. The program sets up the stack pointer, sets the interrupt enable bit in the clock status register, then waits for the next clock interrupt. When the interrupt is received, the program halts.

Expected Response

CON= **1000G** R00125252 <NL>
*H00000104/T14410 <CTRL/P> ^P<BELL><NL>
CON=

6.5 CPU DIAGNOSTIC EXERCISE

Running CPU diagnostic DEKBB provides not only a further verification of proper electronic console installation, but an opportunity to experience its operation. In the following sequence, the operator performs the steps printed in red.

<CTRL/P>	^P<BELL><NL>	(Select console state)
CON= **0W**	<CR>	(Write zeros to the switch register)
CON= **Z**		(Select program I/O state)

```
<CTRL/C>                ^C                      (Return to monitor)

.RΔEKBBC1.BIC                                   (Run DEKBB-C)

MAINDEC-11-DEKBB-C PDP11/70 CPU DIAGNOSTIC PART 2
LOOK AT THE CONSOLE LIGHTS
THE DATA LIGHTS SHOULD READ 166667
THE ADDRESS LIGHTS SHOULD READ 035642
CHANGE SWITCH 7 TO CONTINUE

<CTRL/P> ^P<BELL><NL>                           (Select console state)

CON= 1M30166667         <CR>                    [Set memory data display to DATA
                                                PATHS (1); read contents]

CON= 3A 00035642        <CR>                    [Set address display to CONSOLE
                                                PHYSICAL (3); read contents]

CON= 200W               <CR>                    (Write 200 to the switch register;
                                                change bit 7 contents to 1)

CON= Z                                          (Select program I/O state)

LOOK AT THE CONSOLE LIGHTS
THE DATA LIGHTS SHOULD READ 166667
THE ADDRESS LIGHTS SHOULD READ 035722
TYPE A CHARACTER TO CONTINUE

<CTRL/P> ^P<BELL><NL>                           (Select console state)

CON= 1M20166667         <CR>                    (Read memory display contents)

CON= 3A00035722         <CR>                    (Read address display contents)

CON= Z                                          (Select program I/O state)

X                                               (Type any character; it is not echoed)

END PASS  #    1    TOTAL ERRORS SINCE LAST REPORT    0

<CTRL/P> ^P<BELL><NL>                           (Select console state)

CON= H00013722/T14410                           (Halt)
```

6.6 OPERATOR'S REFERENCE SUMMARY

Site personnel are required to learn and use new bootstrapping and problem-reporting procedures when an electronic console is installed. The Operator's Reference Summary (Appendix F) may be used to document those procedures. DIGITAL recommends that the form be filled out jointly by Field Service and site personnel.

The details are system specific, and the appendix provides instructions for filling out the form. The Bootstrap Procedures (Appendix B) may be helpful when the bootstrapping portion of the form is prepared. The form may be filled out and left in the manual; a photocopy should be made available to the system operator and/or posted in an appropriate location.

6.7 INSTALLATION ACKNOWLEDGEMENT

The PDP-11/70 Remote Diagnosis Installation Acknowledgement form (Figure 6-16) must be signed by the customer upon completion of the installation. The purpose of this form is to document the customer's acknowledgement that the electronic console option is, and will remain, the property of DIGITAL. The form should be forwarded to the DDC immediately following installation.

6.8 KY11-R REMOVAL

You can remove a KY11-R option from a system by following the installation procedure in reverse order, thus restoring the system to its original configuration. As noted in step 51 of the installation procedure, the original system hardware should have been packed in the KY11-R shipping container and stored on-site.

Removal should begin with step 1, in which primary power is removed and the unit made accessible; then continue, in reverse, with step 38. Steps 39 through 50 are essentially testing the KY11-R and are of no consequence in the removal procedure. Several installation steps require explanatory notes when used in reverse for removal.

Step	Note
36	There is no need to remove FCO 11/70-S0012.
23	Can be ignored.
22	Can be ignored.
14	Separation of the indicator panel from the console module facilitates connection of the ribbon cables to J1, J2, and J3.
10	Can be ignored.
9	Can be ignored.
8	Can be ignored.
3	The DL11-W (M7876) real-time clock must be enabled if the M8255 was providing the real-time clock function.

CHAPTER 7
TROUBLESHOOTING

7.1 ELECTRONIC CONSOLE TROUBLESHOOTING

Electronic console field maintenance is limited to the following service procedures:

1. Replacement of the 54-12781 multiplexer module

2. Replacement of the M8255 microprocessor module

3. Replacement of the 54-12498 integral modem module (KY11-R only)

NOTE

Certain incompatibilities exist among the two (or three) modules used in the electronic console.

The 54-12781 and M8255 must both be -00 or -01 paired (You cannot mix -00 and -01 modules.)

The 54-12781 and M8255 must both be the -00 variant when used with the 54-12498 LA36 Integral Modem module (KY11-R and KY11-RC).

Steps 5 and 7 of the installation procedure provide the details required for board identification.

4. Repair or replacement of interconnecting cables (See Figures 6-10 and 6-11.)

5. Minimal troubleshooting of DAA or modem operation as documented in the vendor manual supplied with each installation kit (except KY11-RE). Steps 43 through 47 of the installation procedure (Paragraph 6.3.3) may also be used to evaluate DAA or modem operation.

Governmental regulations typically prohibit internal repairs or changes to such equipment, except by the manufacturer or an authorized agent.

Modem Operation Characteristics (Appendix G) are included in this manual to help Field Service personnel troubleshoot modems where permitted.

Failure of a non-DIGITAL-supplied modem or DAA should be reported to the telephone company or responsible governmental authority.

A faulty DIGITAL-supplied modem or DAA should be returned through Field Service Logistics channels for vendor repair.

CAUTION

If a DIGITAL-supplied modem or DAA is to be replaced with a different model, the telephone company must be notified as defined in the vendor manual. (Also see Paragraph 6.2.2 through 6.2.2.4).

7.2 FAILURE KEYS

The series of failure keys that follow (Figures 7-1 through 7-14) is intended for use in conjunction with the electronic console checkout procedure (Paragraph 6.4). A limited area of logic is exercised at Test 1, and failure key 1 illustrates the hardware being tested. As the checkout procedure and the failure keys progress, additional areas of logic are tested and illustrated. Virtually all of the locally accessible electronic console logic is tested by these exercises and illustrated in the failure keys.

Tables 7-1 and 7-2 provide specific failure indications and suggested causes.

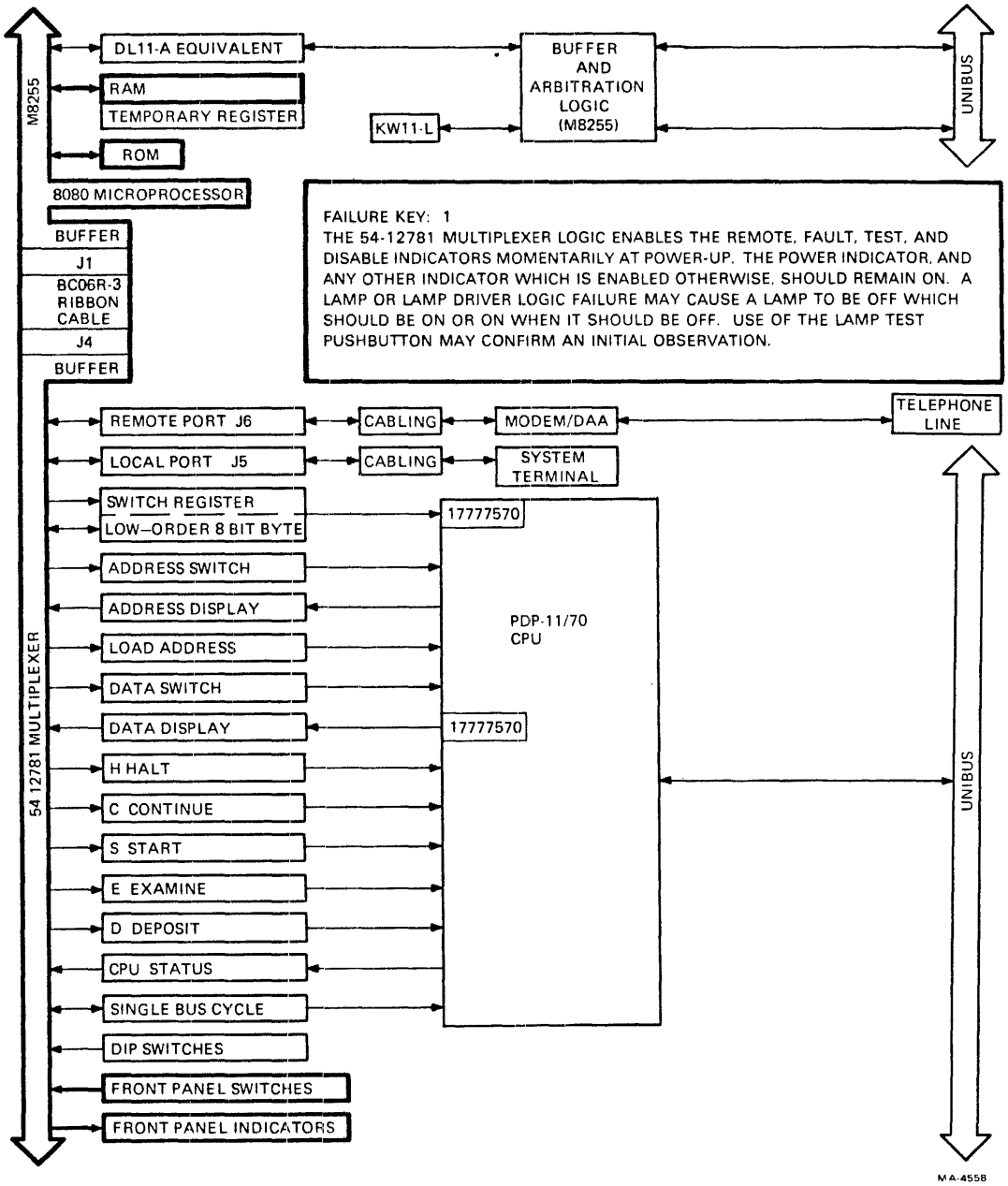


Figure 7-1 Failure Key 1

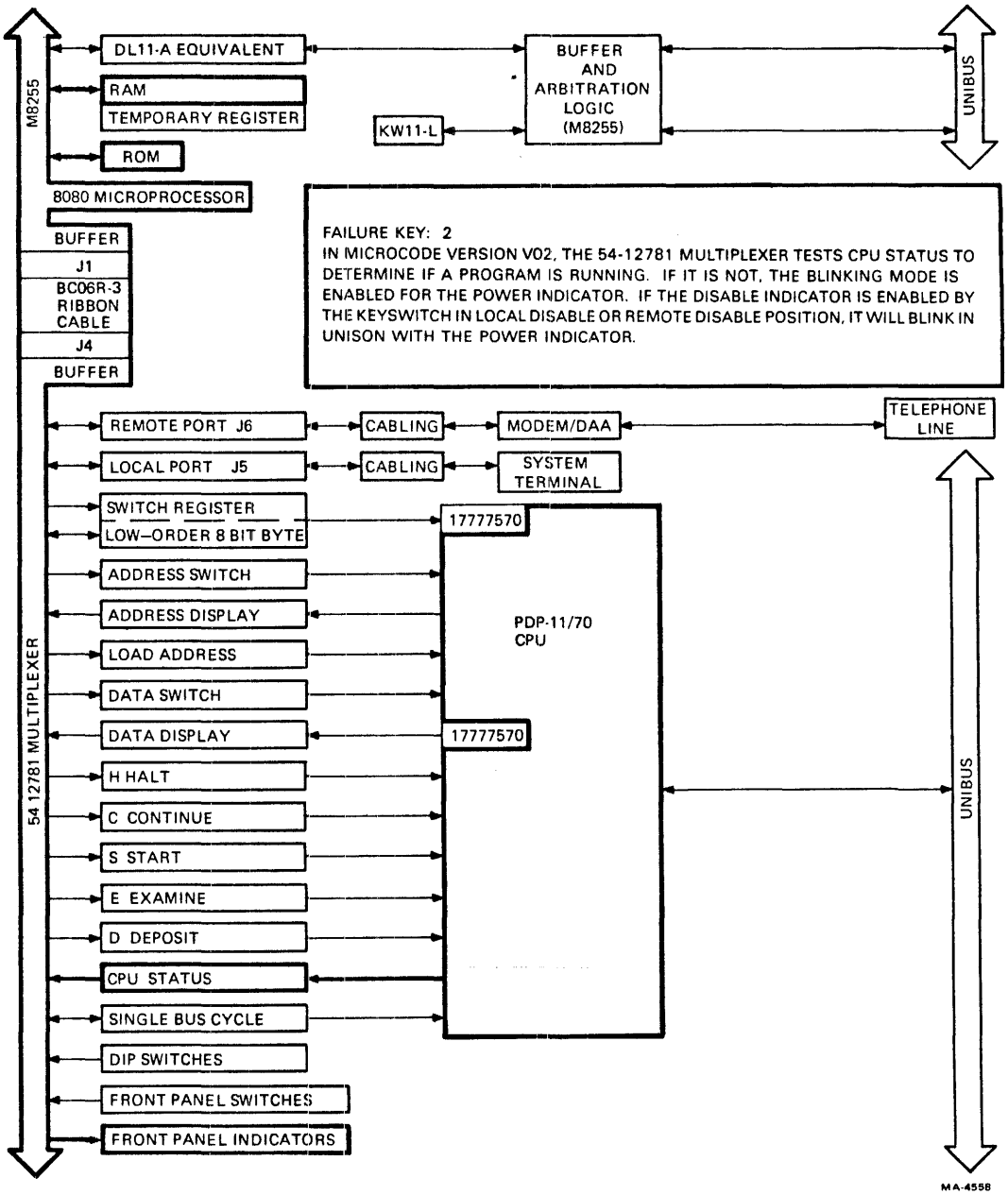


Figure 7-2 Failure Key 2

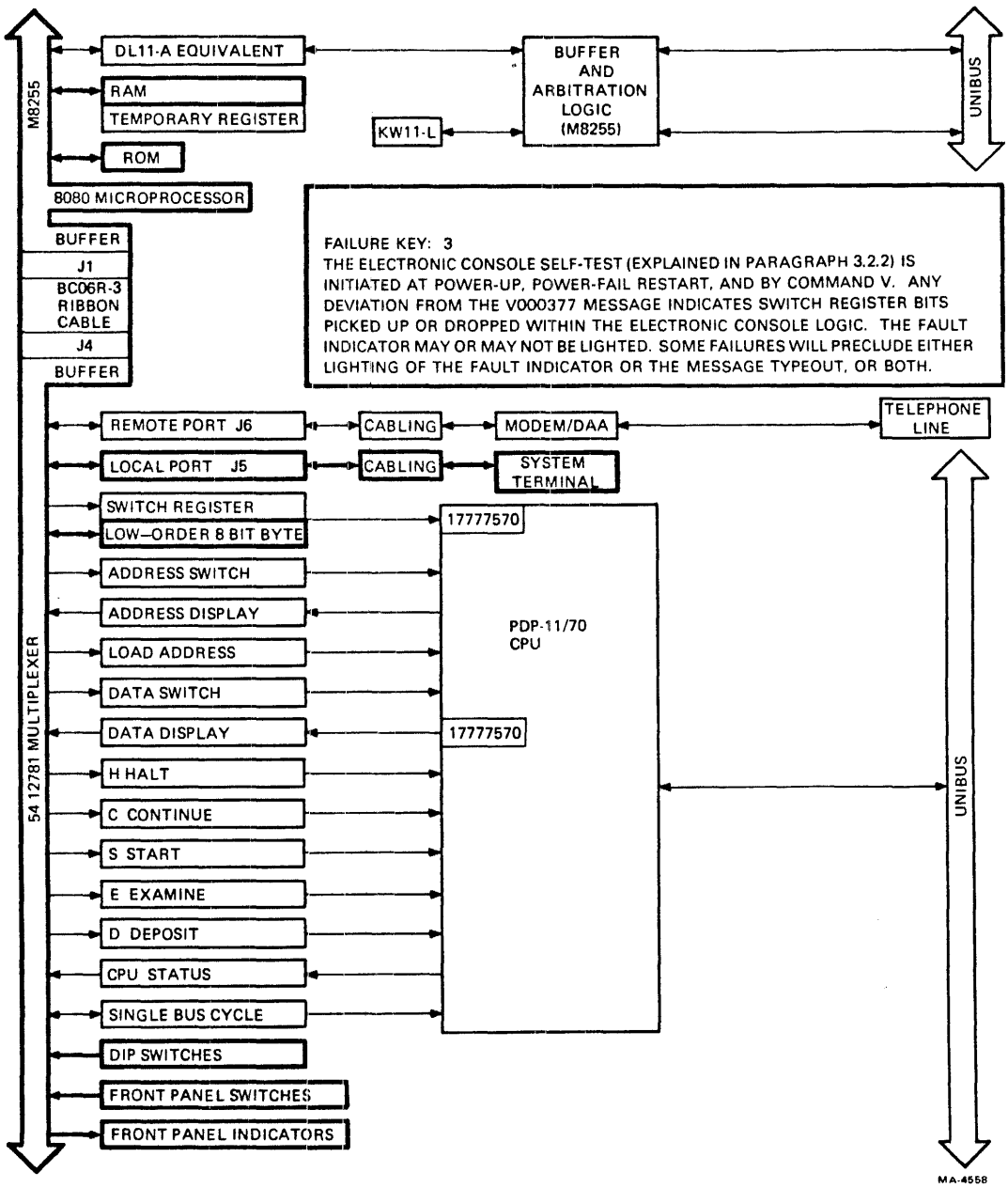


Figure 7-3 Failure Key 3

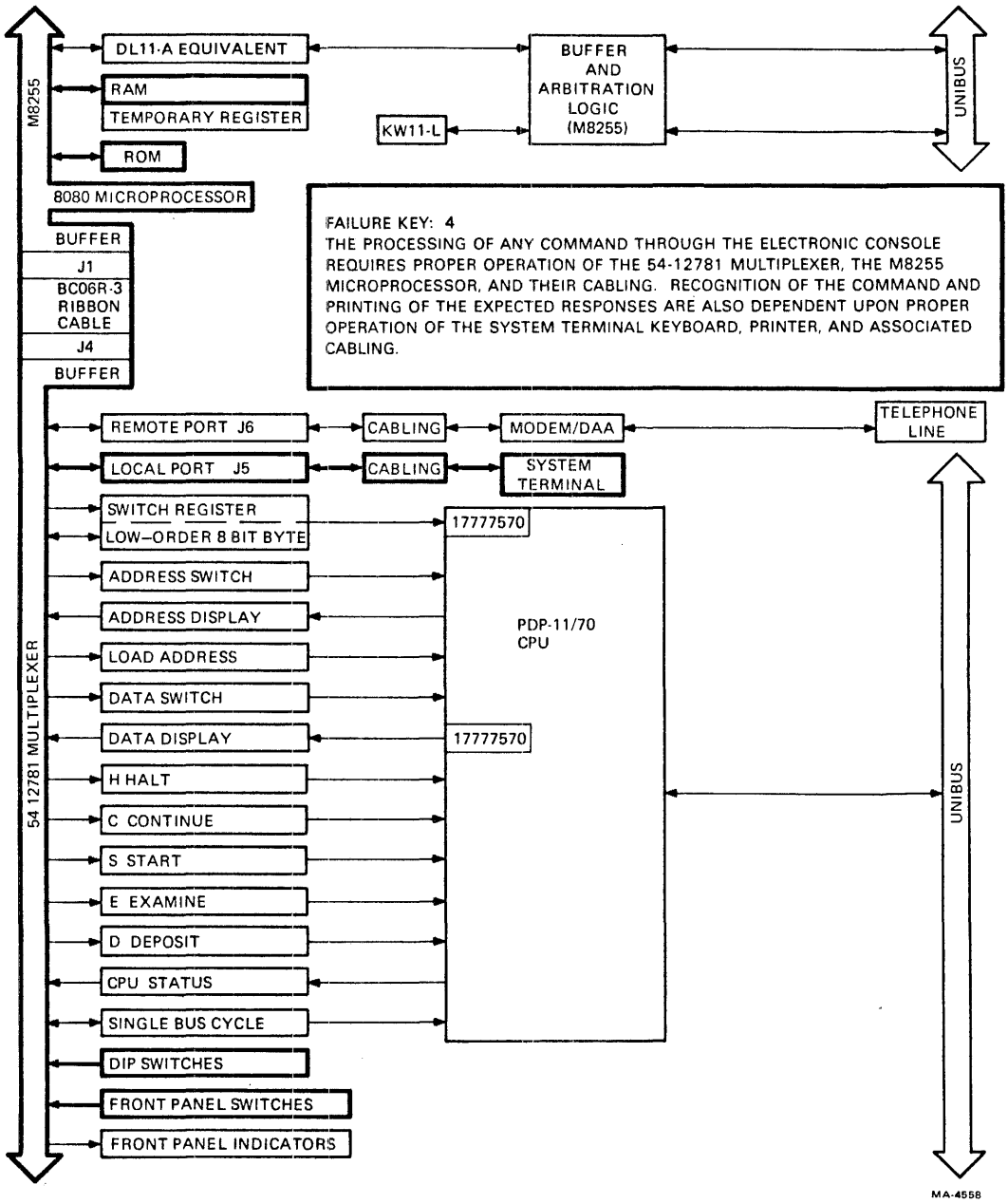


Figure 7-4 Failure Key 4

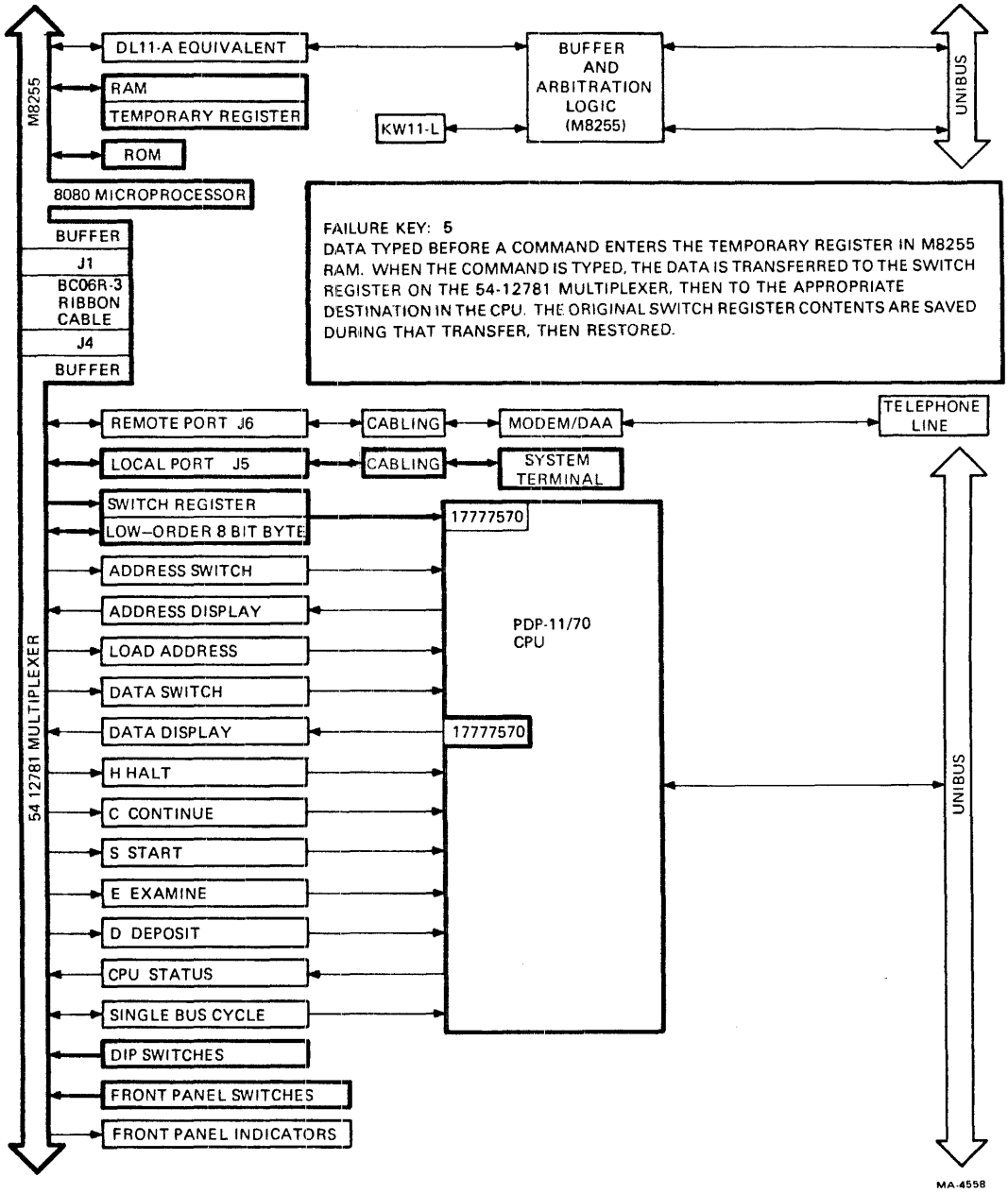


Figure 7-5 Failure Key 5

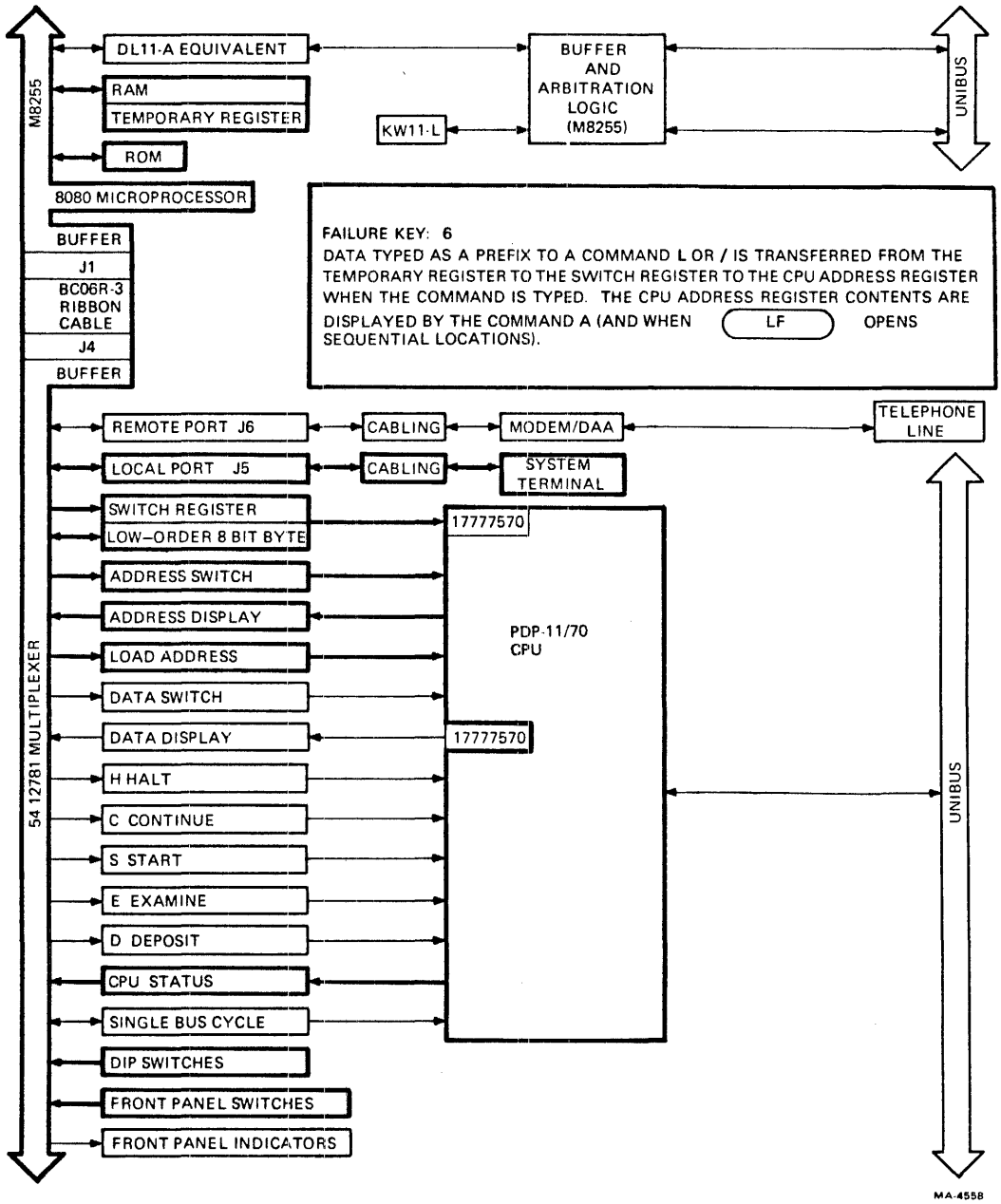


Figure 7-6 Failure Key 6

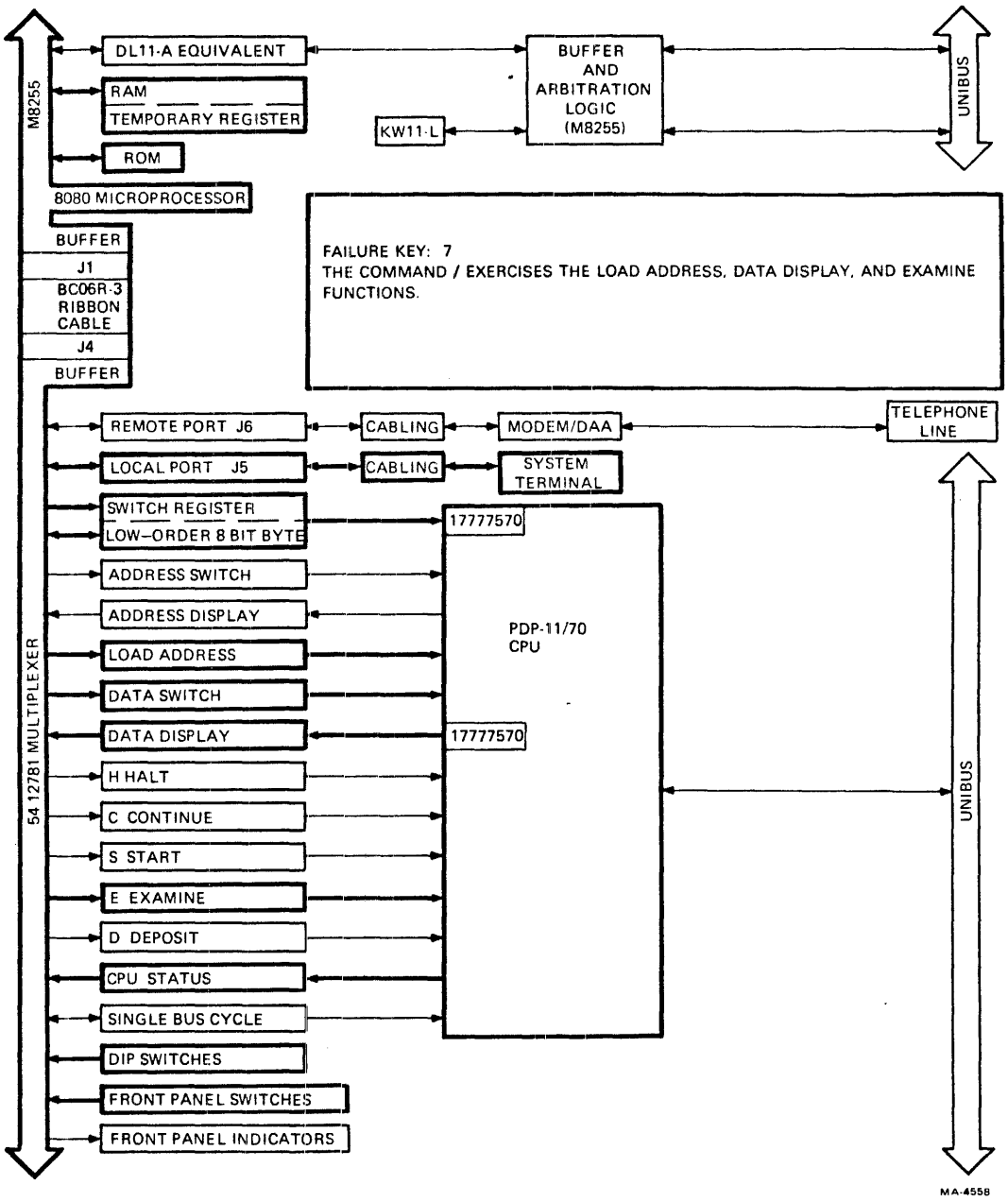


Figure 7-7 Failure Key 7

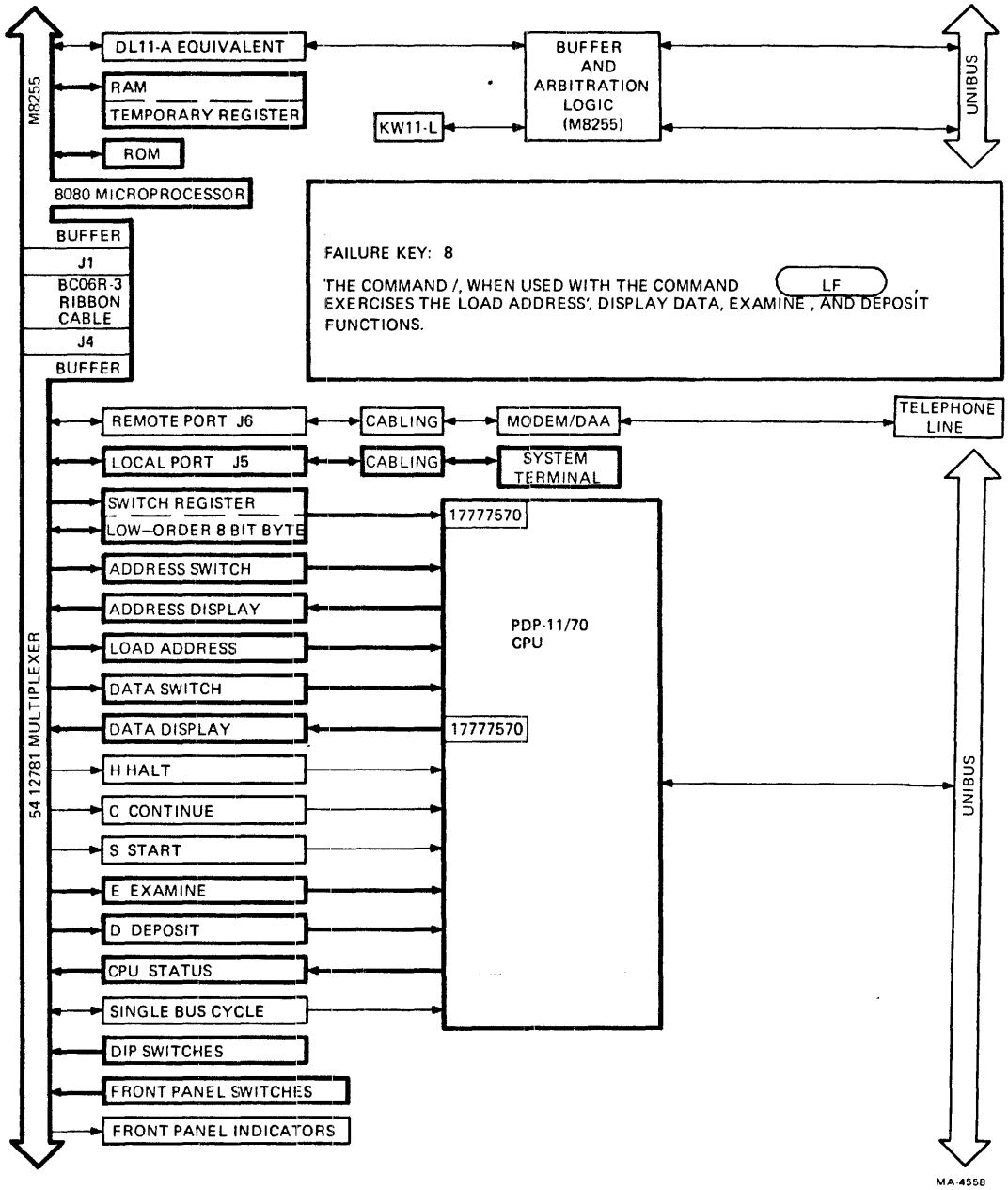


Figure 7-8 Failure Key 8

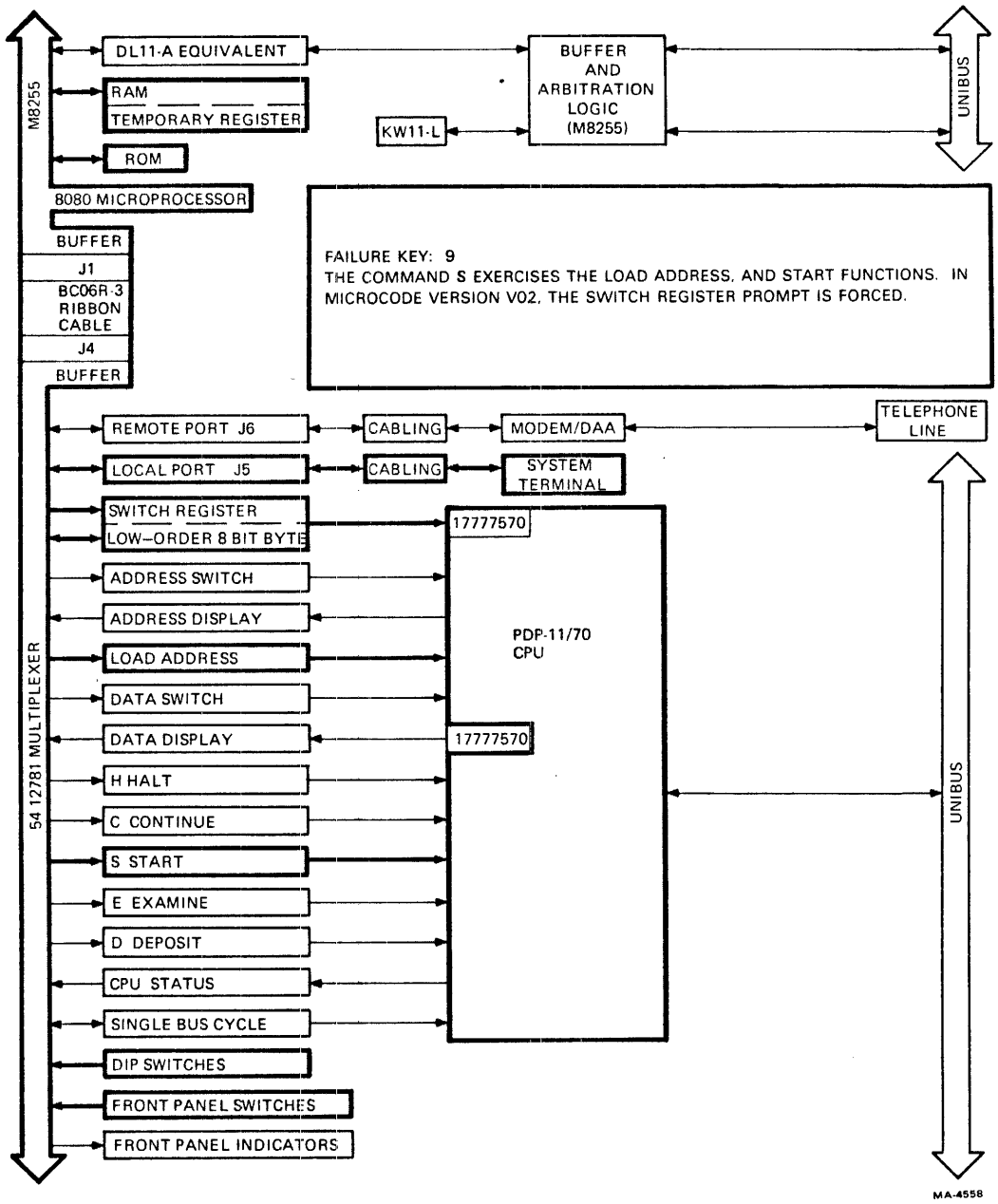


Figure 7-9 Failure Key 9

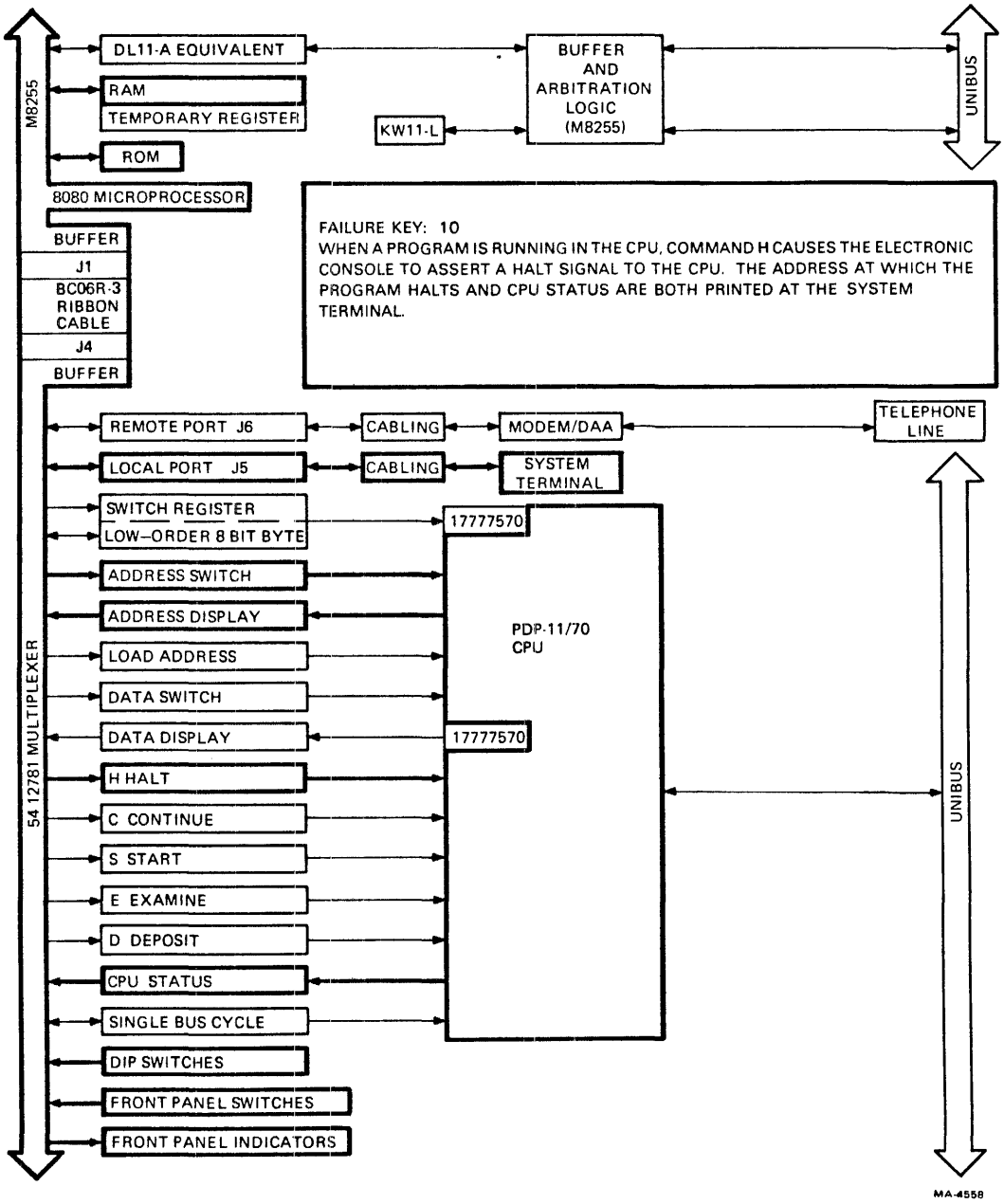


Figure 7-10 Failure Key 10

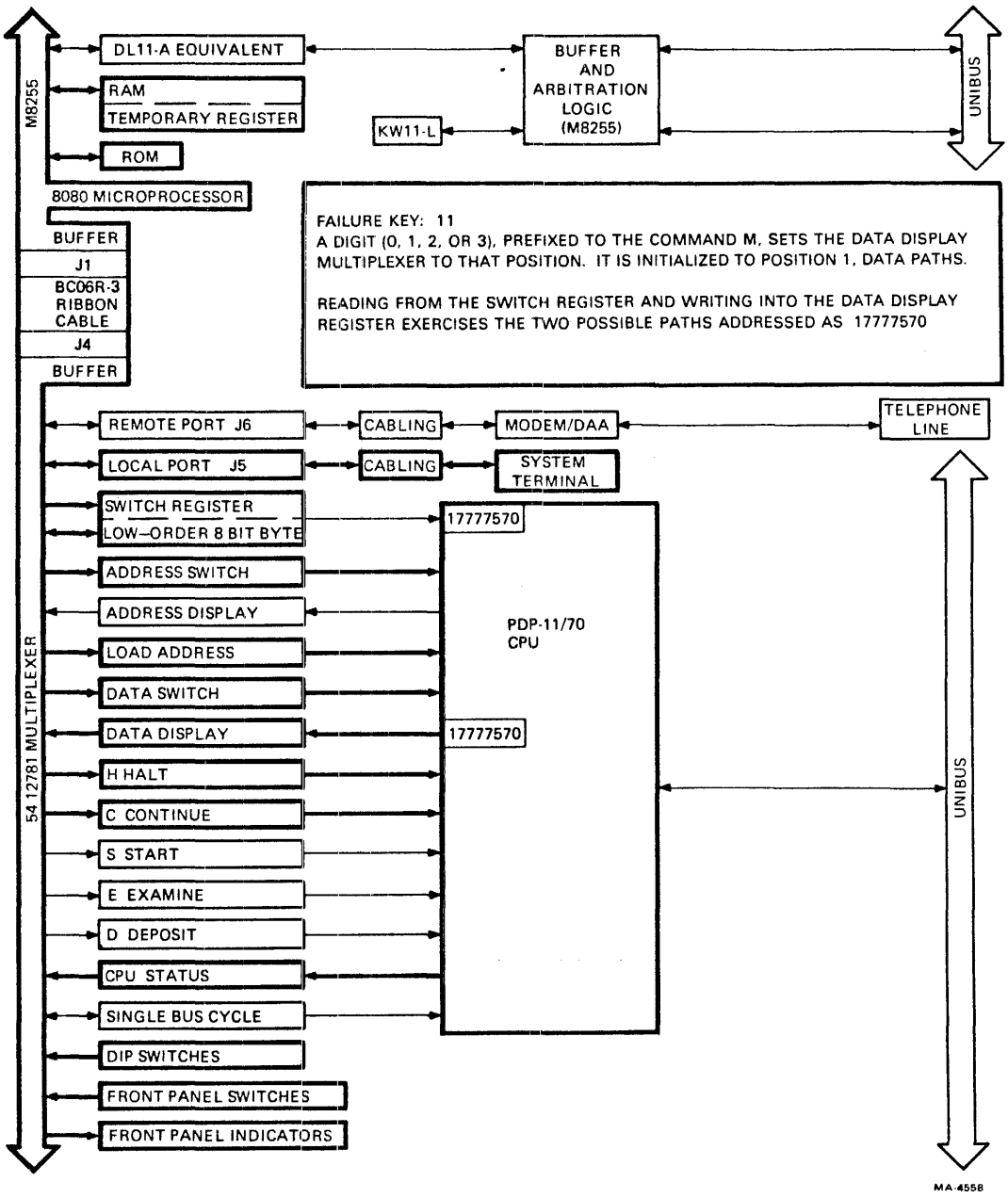


Figure 7-11 Failure Key 11

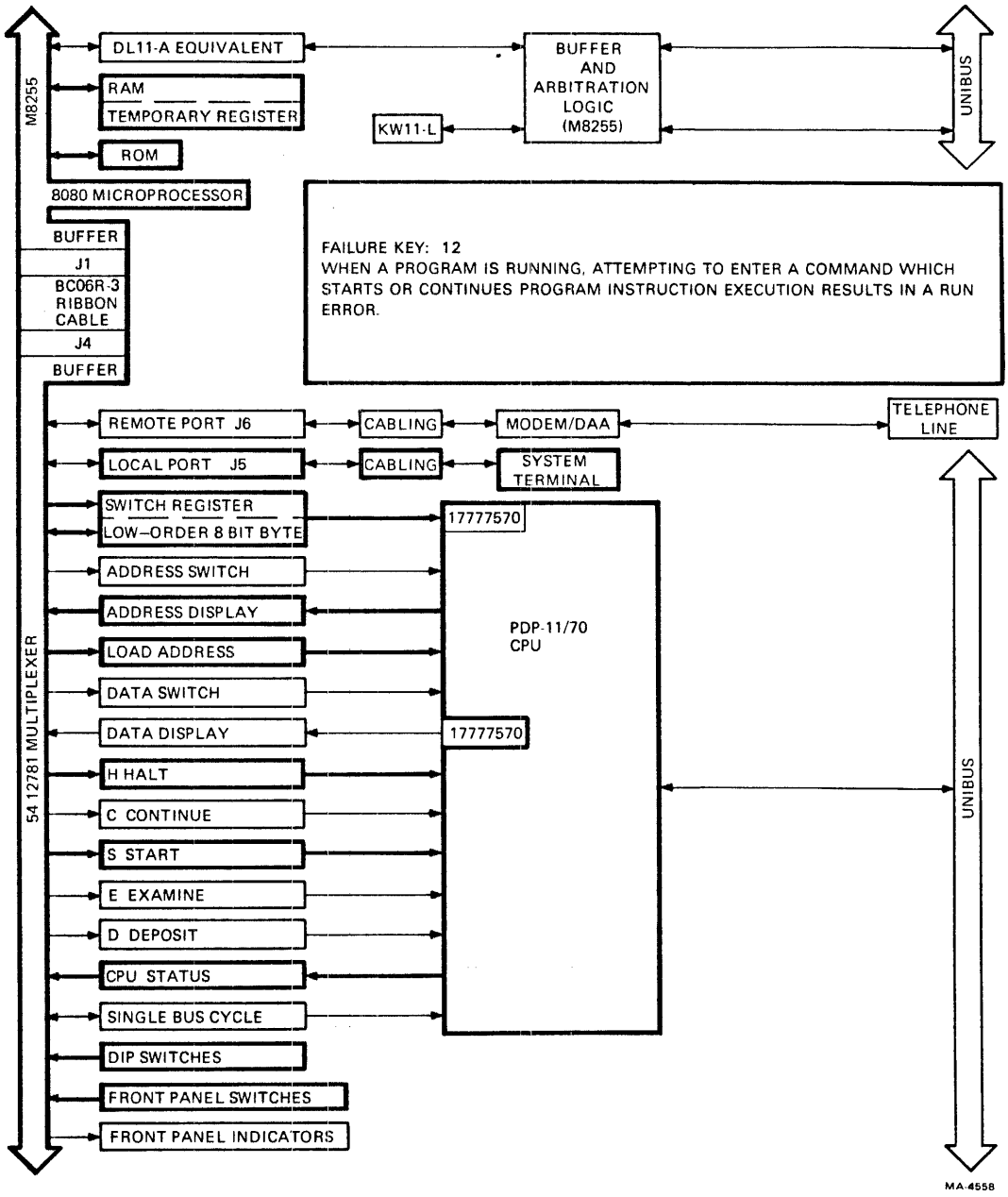


Figure 7-12 Failure Key 12

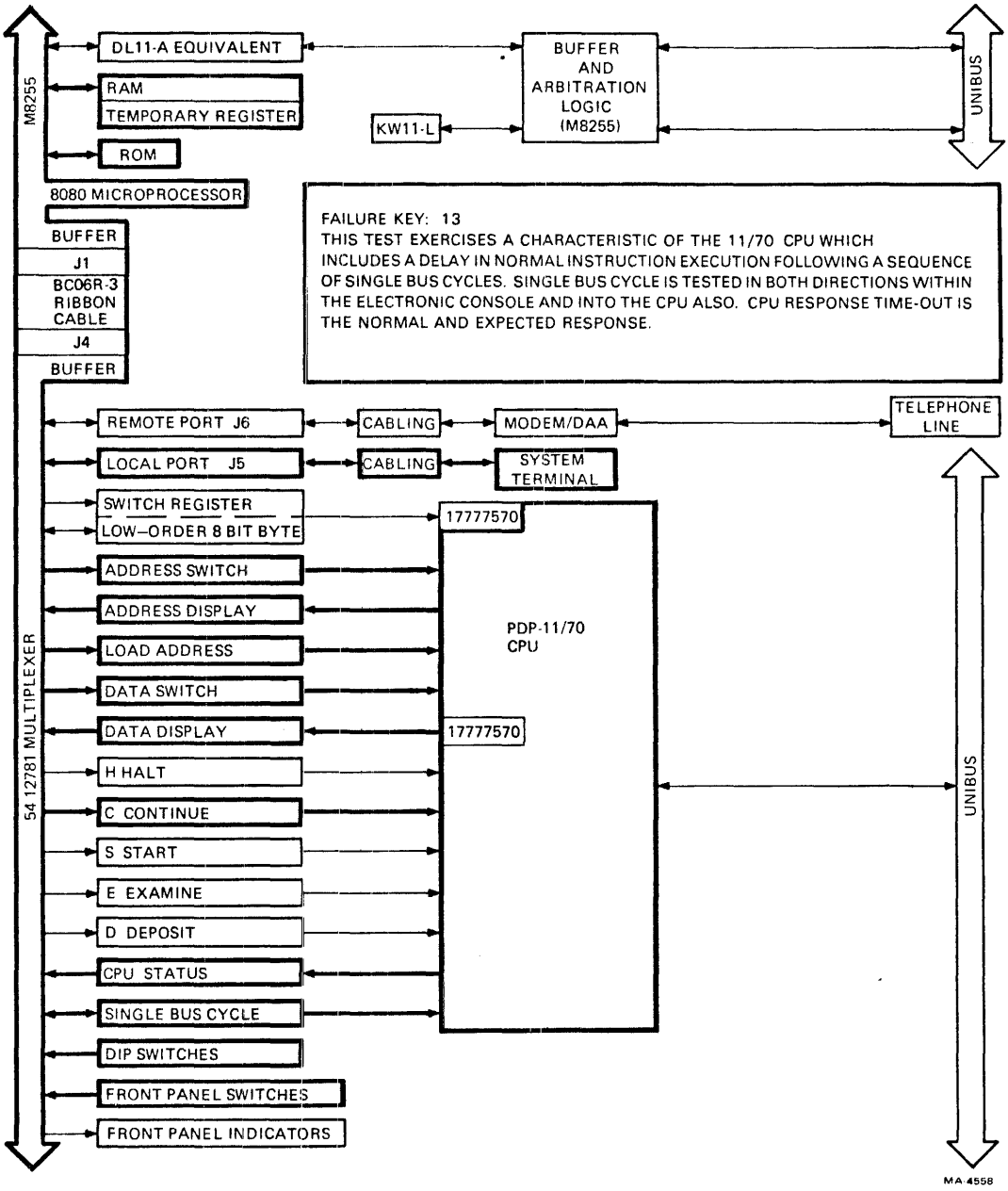


Figure 7-13 Failure Key 13

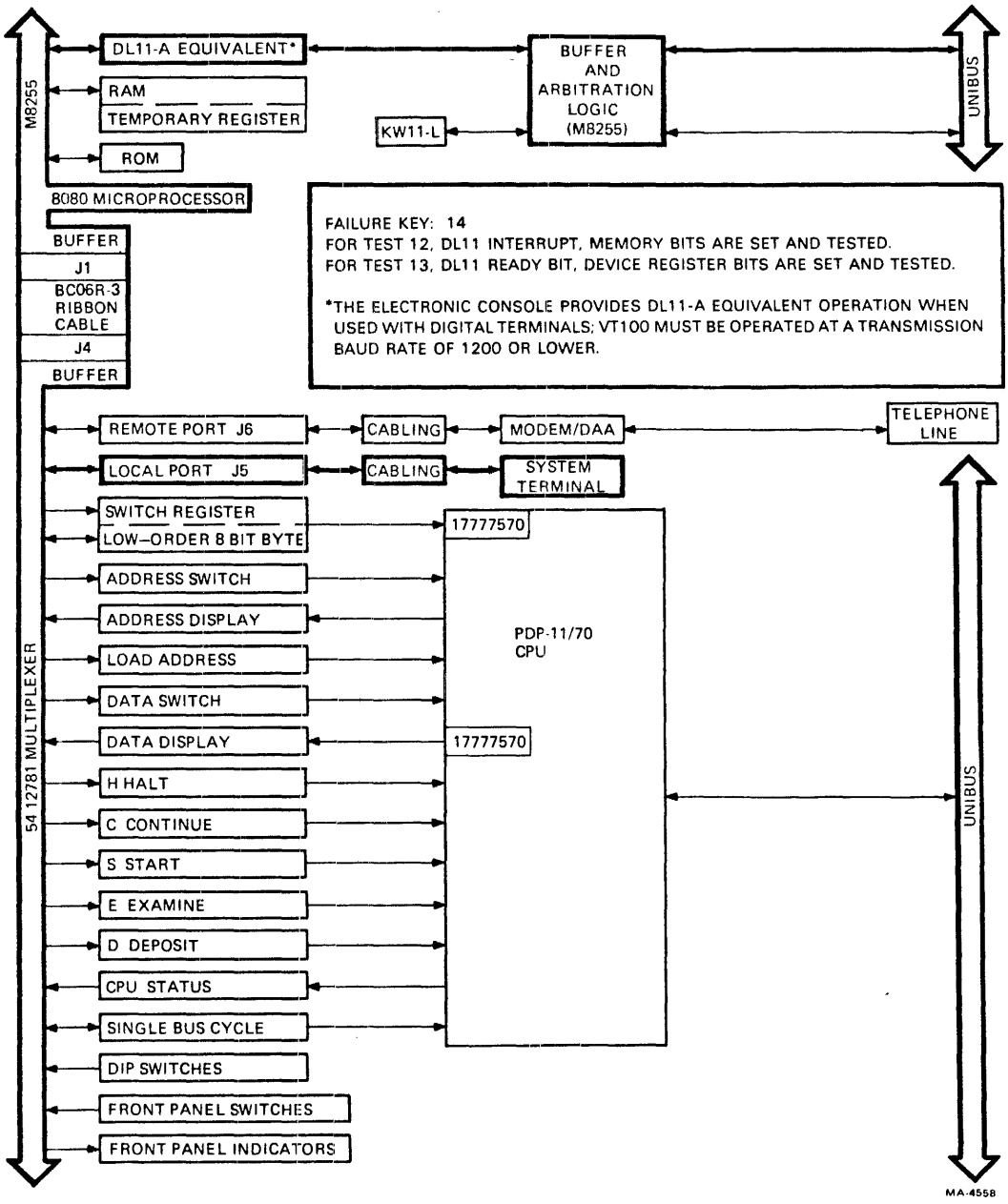


Figure 7-14 Failure Key 14

Table 7-1 Troubleshooting Chart (Local)

Symptom	Probable Cause	Remedy
Turn console keyswitch from OFF to LOCAL or LOCAL DISABLE. All lights but CARRIER come on and stay on.	M8255 console board Cable from J1 of M8255 to J4 of 54-12781	Replace M8255. Replace 54-12781 multiplexer board. Check cable hookup and connector seating.
FAULT light stays on after power up and all other lights go out.	M8255 console board Console board cables	Replace M8255 board. Replace 54-12781 multiplexer board. Check cable in connector J4.
Console prints nothing. FAULT light is not on.	Console cable at J5	Check cables from J5 of 54-12781 to the terminal. Check baud rate switches on the 54-12781 multiplexer board.
Console prints V, but then prints CON ER.	M8255 board cables	Replace M8255 board. Check cable J1 of the M8255 board to J4 of 54-12781 multiplexer board.
Console prints V000377 but still gives a fault.	LTC on M8255 No LTC slot	Replace M8255 board. Check for LTC from H7420.
Console prints out too many characters (for example, V0000003777).	M8255 board	Replace M8255 board.
Console prints out wrong characters (for example, V000375 or V001377). FAULT light is not on.	Console board M8255 board	Replace 54-12781 multiplexer board. Replace M8255 board.
Console prints strings of V000377.	M8255 board	Replace M8255 board.
Characters print out on terminal correctly, but there is no activity from the keyboard.	Multiplexer board	Replace 54-12781 multiplexer board.
Console will not accept some or any console commands, although they echo back correctly.	M8255 board +5 voltage level	Replace M8255 board. Check the +5 V on the M8255 board.
A "#" synbol printed on console when executing any command to CPU (for example, 200G#, H#, or 1000L#).	Cables loose or pins broken	Check J1, J2, J3 on the 54-12781 and CPU boards (M8140 and M8134). Replace M8140 in CPU. Replace M8134 in CPU.
FAULT light comes on after a few minutes of operation.	Multiplexer board	Replace 54-12781 multiplexer board.
Garbled characters printed on console when typing on the keyboard; receives characters correctly.	Multiplexer board ±15 V power	Replace 54-12781 multiplexer board.
Fails RUN 1-HALT-RUN 0 power-up.	Multiplexer board M8255 board	Replace 54-12781 multiplexer board. Replace M8255 board.

Table 7-1 Troubleshooting Chart (Local) (Cont)

Symptom	Probable Cause	Remedy
Prints H after typing N for single-step operation.	CPU Multiplexer board	Replace M8140 board. Replace 54-12781 multiplexer board. Replace M8255 board.
Occasional *H printed on console terminal; CPU is hung; no address printed after the H.	Static eliminator Grounding M8255 board	Bad or no static filter. Check for equipment (rack to rack) and earth grounds. Replace M8255 board.

Table 7-2 Troubleshooting Chart (Remote)

Symptom	Probable Cause	Remedy
DAA does not answer when dialed in test mode.	±12 V Wiring to DAA	Replace 54-12781. Check for ±15V. Check connections to DAA. Have DAA checked.
DAA busy in test mode.	Called once DAA Phone line	Turn switch to LOCAL and to TEST. Have DAA checked. Have phone line checked.
DAA answers in test mode, but not on-line.	Keyswitch Modem cable LA36 modem	Put keyswitch in REMOTE or REMOTE DISABLE. Check and reseat cables. Replace 54-12498 modem.
DAA answers in test mode, but goes busy when on-line.	Wrong DAA cables to DAA Modem cable LA36 modem	Check for 1001D label. Check connections to DAA. Check cable for seating. Replace 54-12498 modem.
DAA answers on-line, but no carrier.	LA36 modem Modem cable	Replace 54-12498 modem. Check modem cable.
DDC unable to connect; carrier not received from remote console.	DAA Multiplexer board LA36 modem Voltages	Check if in test mode DAA. Replace 54-12781 console. Replace 54-12498 modem. Check ± 12 V.
DDC connects but unable to establish protocol; console has CARRIER light on for short time.	LA36 modem Cable M8255 board	Replace 54-12498 modem. Check seating of J6. Replace M8255 board.
DDC connects but unable to establish protocol; console does not have CARRIER light on.	LA36 modem Cable	Replace 54-12498 modem. Check J6.
No local control of console; talk mode between DDC and remote terminal does not function.	Console UART Console E-17	Replace 54-12781 multiplexer board.
Unable to down-line load any programs to remote console.	M8255 board CPU	Replace M8255 board. Check NPR circuitry.

APPENDIX A
CONSOLE AND ERROR MESSAGES

A.1 ERROR MESSAGES

The messages described in this section are system-generated as a result of incorrectly entered commands, or faults detected by the logic.

A.1.1 ?SYN ER , Syntax Error

This error message is generated whenever the electronic console detects any command that does not conform to the required format.

[[<OPTIONAL VALUE><SEPARATOR>]<ARGUMENT>]<COMMAND>[<RESPONSE>]<ACKNOWLEDGEMENT>

Paragraph 4.2 describes this format in greater detail.

The syntax error message also results from an attempt to mix commands from the multiple function command group with basic CPU commands.

Example: Attempted use of the basic command D to deposit data into a location opened by a command / (slash) – from the multiple function CPU command group – causes a syntax error message.

```
CON= 1000/041101 041102D
?SYN ER
CON=
```

Example: If a location has been opened and examined by the basic commands L and E, an attempt to open the next sequential address using the command <LF> (from the multiple function CPU command group) causes a syntax error message.

```
CON= 1000L_Δ E041101 <LF>
?SYN ER
CON=
```

A.1.2 ?RUN ER , Illegal (If CPU Is Running) Command Error

Certain CPU commands are illegal if issued when the processor is in the run state. The console echoes the illegal command and prints an error message. This applies to the following commands.

Commands	Command Category
<CTRL/D> , L, /, \	Load address
C, G, P, S	Start or continue instruction execution
D	Deposit data
I	Initialize system
V	Electronic console self-test

A.1.3 ?ER/T14411, Memory Reference Error

Any command that references memory may result in an address or parity error. The illegal command is terminated immediately, and an error message which includes CPU status is printed. The two low-order bits of the CPU status response define whether address or parity error (or both) have occurred (Figure 4-5).

CON= 17777200/?ER/T14411 Attempt to reference nonexistent memory.

A.1.4 ?CON ER, Console Logic Fault

FAULT is turned on whenever the electronic console detects an internal error condition. If the logic required to do so remains operative, the ?CON ER message will be printed on the terminal. The console performs error checking on internal bus activity continuously, and a self-check routine is invoked at power-on or by command V. A fault may be detected at power-on when all indicators, except CARRIER (but including FAULT), are on at the same time. If the logic by which the indicators are turned off is inoperative, they may all remain on.

A.1.5 + , Serial Line Error

This error message is generated when the electronic console detects a bit format error in the serial line logic. A loose connection or typing too fast are typical causes of this error condition.

A.2 CONSOLE MESSAGES

The messages described in the following paragraphs display electronic console or CPU status and/or test results.

A.2.1 # , CPU Response Time-out

A CPU command typed at the system terminal is processed through the electronic console to the CPU. The CPU response is processed through the electronic console back to the terminal. If, after forwarding a command to the CPU, the electronic console does not receive a CPU response within the maximum 100 msec allowed, it will abort the command and print the # symbol followed by the CON= prompt.

For example, if the single bus cycle switch is on and a CPU command such as load address is issued, the time-out symbol will be printed. The operator would clear the single bus cycle switch by typing a command K, then reissue the command that failed.

Example:

```
CON=2001 #
CON=
```

A.2.2 *H , Programmed Halt

If the CPU executes a programmed halt, the console prints a halt message including a <BELL>, the halt address, and the CPU status. The serial line multiplexer is left in the state it was in prior to the halt (console or program I/O). A programmed halt message is printed with an asterisk (*) prefix to distinguish it from an electronic console command H (halt). See Paragraph 4.4.13.

A.2.3 ?CAR ER , Carrier Lost

Upon detection of carrier lost, the console will print a message on the system terminal and initialize the remote line protocol in preparation for reconnection. This message may be incidental to a DDC test session.

The DDC may initiate a diagnostic session, disconnect during the period of testing, then reconnect to evaluate results and continue the session. If the carrier lost message is printed, and CARRIER goes off, but TEST stays on, the DDC is using that test procedure.

A.2.4 V000377 Successful Completion of Self-Test

During power-up initialization the electronic console forces a command V, which initiates a self-test. As described in Paragraph 3.2.2, the message indicates either successful or unsuccessful completion of segments of the self-test routine. If this message is printed with any bit error indicating a failure (such as V001377), FAULT will also be on. An unsolicited V000377 message on the system terminal is evidence that a power failure occurred; the message indicates that a successful self-test occurred when power came back on.

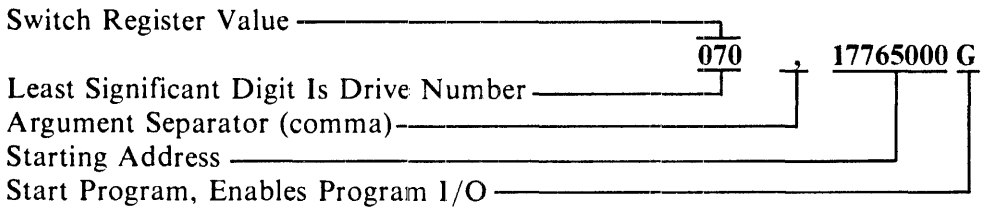
APPENDIX B
BOOTSTRAP PROCEDURES

System-specific bootstrap details are provided in the Operator's Reference Summary (Appendix F).

B.1 M9301 BOOTSTRAP

1. Type <CTRL/P> H to enter console state and halt whatever program may be running.

2. From Table B-1, determine the appropriate command string for the device on which the source medium is loaded. Enter the command string, using the example below as a guide. (The example assumes RP04, drive 0.)




```
<CTRL/P> ^P <BELL>
CON= H00153304/T14410 70,17765000G R00000070 <NL>
RSTS V06B 02 BUBU (DB0)
```

The R prompt (read switch register, Microcode Version V02 only) is printed to remind the operator that the switch register must now be set to the predetermined value which the CPU expects in a power-fail (power-going-down) situation (in this example, all ones).

3. Type <CTRL/P> to enter the console state.

4. Type 17777777W, which will write all ones to the switch register.

5. As a verification that the entry was made correctly, type the command R, which results in a printout of the switch register setting.

6. Type the command Z, which selects the program I/O state and returns the terminal to program control.

```
<CTRL/P> ^P <BELL>
CON= 17777777W_AR17777777 Z <NL>
(Output, if any, is under program control.)
```

Table B-1 M9301 Command String Definition

M9301 Variant	Device	Command String: Switch Register Setting*	Separator	Starting Address	Go
-YC	TM11	010	,	17765000	G
-YC	TC11	020	,	17765000	G
-YC	RK05	030	,	17765000	G
-YC	RP02, RP03	040	,	17765000	G
-YH	RK06, RK07	050	,	17765000	G
-YC	TU16	060	,	17765000	G
-YC	RP04, 05, 06, RM03	070	,	17765000	G
-YC	RS04	100	,	17765000	G
-YC	RX01	110	,	17765000	G
-YH	PC11	120	,	17765000	G

* Note that the least significant digit of the switch register setting is the drive number.

B.2 BM873 AND MR11-DB BOOTSTRAPS

Table B-2 provides BM873-YA, BM873-YB, and MR11-DB bootstrap command string definitions. The switch register value is (except in four instances) assumed to be zero and is not required in the command string. In those four instances (when the drive number is other than zero), the drive number must be entered as the switch register value.

Table B-2 BM873 and MR11-DB Command String Definition

Device	BM873-YA Starting Address	BM873-YB Switch Register Setting (Drive Number)	Separator	BM873-YB Starting Address	MR11-DB (M792-YD) (M792-YE)
KL11	773210 G	0 assumed		773510 G	-
PC11	773312 G	0 assumed		773620 G	-
RC11	773144 G	0 assumed		773212 G	773220 G
RF11	773000 G	0 assumed		773136 G	773100 G
RK11	773010 G	0 assumed		773030 G	773110 G
RK11	-	1 through 7	,	773032 G	-
RP11	773100 G	0 assumed		773350 G	773154 G
RP11	-	1 through 7	,	773352 G	-
RS04	-	0 assumed		773000 G	-
RS04	-	1 through 7	,	773002 G	-
TA11	773230 G	0 assumed		773524 G	-
TA11	-	1 through 7	,	773526 G	-
TC11	773030 G	0 assumed		773070 G	773120 G
TM11	773050 G	0 assumed		773110 G	773136 G
TI16	-	0 assumed		773150 G	-

Command String Example 1:

Assume KL11 and BM873-YA bootstrap.
<CTRL/P> ^P <BELL>
CON= 773210G <NL>
RSTS V06B 02 BUBU (DK)

Command String Example 2:

Assume RK11, BM873-YB, and drive 4.
<CTRL/P> ^P <BELL>
CON= 4,773032G <NL>
RSTS V06B 02 BUBU (DK0)

B.3 M9312 BOOTSTRAP

System-specific M9312 bootstrap details are provided by the Operator's Reference Summary (Appendix F) when appropriate. The *M9312 Technical Manual* (EK-M9312-TM) provides M9312 ROM configuration details which are beyond the scope of this appendix.

APPENDIX E
MICROCODE DIFFERENCES

Microcode Version V02 was introduced at CS revision H of the M8255 microprocessor module. The functional differences between Microcode Versions V01 and V02 are noted throughout this manual. Table E-1 itemizes those features in which differences exist and indicates the operational consequences in summary form. The table includes references to the paragraphs of this manual in which the feature is discussed in depth.

Table E-1 Microcode Version V01/V02 Differences

Item	Differences	
POWER Indicator	V01	On indicates that power is on.
	V02	• On indicates that power is on and program is running.
See Paragraph 2.5		• Blinking indicates that power is on and program has halted.
DISABLE Indicator	V01	On indicates that keyswitch is in LOCAL DISABLE or REMOTE DISABLE.
	V02	• On indicates that keyswitch is in LOCAL DISABLE or REMOTE DISABLE and program is running.
See Paragraph 2.6		• Blinking indicates that keyswitch is in LOCAL DISABLE or REMOTE DISABLE and program has halted.
TEST Indicator	V01	• On indicates that DDC is testing.
		• Disabled in REMOTE DISABLE.
See Paragraph 2.9	V02	On indicates that DDC is testing.
Logic Verification Message (following error detection)	V01	Will attempt to print message, then *may* attempt to print console error message and turn on FAULT.
	V02	Will attempt to print message, then *will always* attempt to print console error message and turn on FAULT.
See Paragraph 3.2.2.1		
Automatic setting of Program I/O State to Prevent Print Buffer Overflow	V01	Not available
	V02	Absence of keyboard activity for twenty seconds while in console state causes automatic setting of program I/O state.
See Paragraph 3.4		

Table E-1 Microcode Version V01/V02 Differences (Cont)

Item	Differences	
Read Switch Register Prompt (a reminder to set switch register to power-fail value) See Paragraphs 4.4.5, 4.4.16	V01	Not available.
	V02	R prompt follows any command that initiates or continues program instruction execution.
Delete Display Format	V01	A backslash is echoed with each character as it is deleted.
  See Paragraph 4.3.10	V02	A backslash is echoed with first character deleted, but is not repeated as other characters are deleted; a final backslash is printed when a new character, delimiter, or command is typed
Effect of Delete on Temporary Input Register Data Transfer	V01	Typing first character enables register contents transfer even if all typed-in characters are deleted, leaving all zeros.
  See Paragraph 4.3.10	V02	Logic counts characters typed-in and deleted; if no characters remain in the register, no transfer occurs.
Command @ Response to I/O Page Indirect Addressing See Paragraph 4.5.5	V01	Not consistent with CPU instruction execution.
	V02	Bits 16 through 21 are masked with ones to provide access to I/O page; consistent with CPU instruction execution.
Command $ Masks Address to Open a Register	V01	Used to modify commands <CTRL/D>, L, and /. Mask forces all bits except six low-order bits to become ones.
  See Paragraph 4.3.7	V02	Used to modify commands <CTRL/D>, L, /, \, G, and S. Only bits above most significant octal digit are masked to become ones.
Command ' (single quote)	V01	Not available.
See Paragraph 4.3.8	V02	Selects octal data display format.
Command " (double quote)	V01	Not available.
See Paragraph 4.3.9	V02	Selects hexadecimal data display format.
Command \ (Backslash)	V01	Not available.
See Paragraph 4.5.2	V02	Opens 8-bit byte location.
M8255 Microprocessor Module (CS Revision)	V01	CS Revision E
	V02	CS Revision H