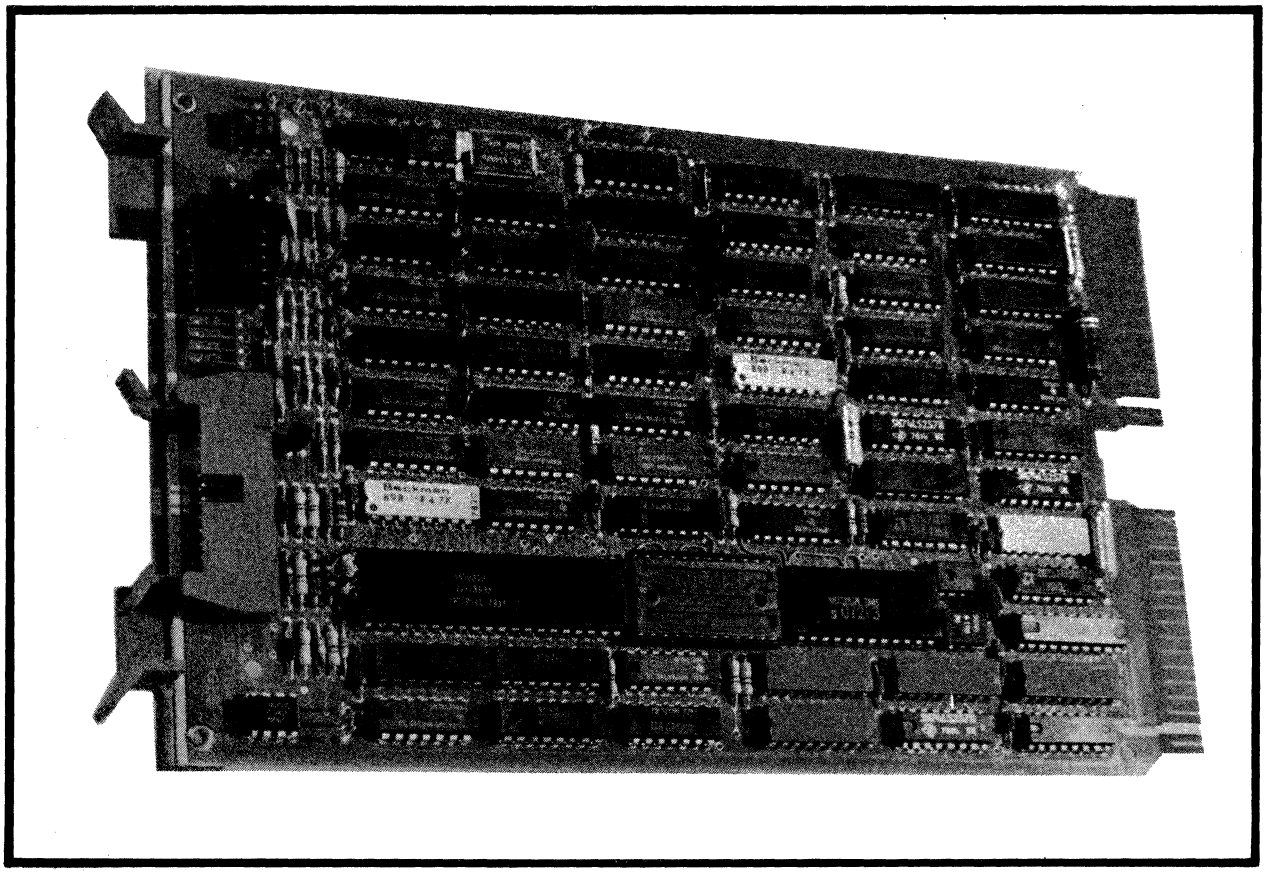
Accessories & Supplies Group
Merrimack, New Hampshire 03054

digital

M7142

serial video module user guide



EK-M7142-UG-001

M7142 Serial Video Module
User Guide

digital equipment corporation • merrimack, new hampshire

1st Edition, June 1979

Printed in U.S.A.

This document was set on DIGITAL's DECset-8000 computerized typesetting system.

CONTENTS

Page

PREFACE

CHAPTER 1 INTRODUCTION

1.1 GENERAL DESCRIPTION 1-1
1.2 MECHANICAL PACKAGING 1-1
1.3 ENVIRONMENTAL SPECIFICATIONS 1-1
1.4 OPTIONS 1-3
1.5 VIDEO CHARACTERISTICS 1-3

CHAPTER 2 INSTALLATION

2.1 SCOPE 2-1
2.2 UNPACKING AND INSPECTION 2-1
2.3 INTERFACE 2-1
2.3.1 Keyboard/M7142 Interface 2-1
2.3.2 Edge Connector 2-2
2.3.3 Video Output Connector 2-2
2.3.4 Communications Port Connector 2-3
2.4 INSTALLATION PROCEDURES 2-4
2.4.1 Jumper Configurations 2-4
2.4.2 Data Rates Selection 2-4
2.4.3 Attributes and Attribute Control Selection 2-6
2.4.4 Communications Selection 2-6
2.4.5 Parity Selection 2-7
2.4.6 Voltage Selection 2-7
2.4.7 Remote Initialize Selection 2-8
2.4.8 Module Mounting 2-8
2.5 CHECKOUT PROCEDURES 2-9

CHAPTER 3 PROGRAMMING

3.1 SCOPE 3-1
3.2 CONTROL/FUNCTION CHARACTERS 3-1
3.3 CURSOR ADDRESSING 3-1
3.4 OPTIONAL CHARACTER SET SELECTION 3-2
3.5 DATA FORMATS 3-2
3.6 ATTRIBUTES 3-2
3.6.1 Reverse Video Versus Forward Video 3-2
3.6.2 Reverse Video Attribute 3-2
3.6.3 Blink Attribute 3-4
3.6.4 Half Intensity 3-4

CHAPTER 4 APPLICATIONS

4.1 SCOPE 4-1
4.2 FULL FEATURE TERMINAL WITH BUILT-IN MONITOR 4-1
4.3 PROCESS CONTROL MONITOR 4-1
4.4 SECURITY APPLICATION 4-1
4.5 MULTIMONITOR APPLICATION 4-2

CONTENTS (Cont)

		Page
CHAPTER 5	**DIAGNOSTICS**	
5.1	SCOPE	5-1
5.2	REQUIREMENTS	5-1
5.3	LOADING PROCEDURE	5-2
5.4	STARTING PROCEDURE	5-2
5.5	OPERATING PROCEDURE	5-3
5.6	ERRORS	5-3
5.7	RESTRICTIONS	5-3
5.8	MISCELLANEOUS	5-3
5.9	PROGRAM DESCRIPTION (SCREEN)	5-3
APPENDIX A	**CUSTOM CHARACTER SET GENERATION**	

FIGURES

Figure No.	Title	Page
1-1	Port Interaction	1-2
1-2	Mechanical Packaging	1-2
1-3	Video Image	1-3
2-1	Connector Pin Number Location Diagram	2-1
2-2	Select RS423/20 mA Loop	2-3
2-3	Jumper and Wire Wrap Post Locations	2-5
3-1	ASCII Character Set	3-3
3-2	Attribute Selection Flow	3-3
3-3	Reverse Video and Blink Attribute	3-4
3-4	Forward and Reverse Video Displays	3-5
3-5	Forward Video with Blink Attribute	3-6
3-6	Half Intensity Wire Wrap Removal	3-7
4-1	Full Feature Terminal	4-1
4-2	Process Control Monitor	4-2
4-3	Blink Attribute and Alarm Status	4-2
4-4	Multilocation Tabular Data Display	4-3
5-1	Cursor Motion Test Display	5-4
A-1	ROM Address/ROM Content Relationship	A-1
A-2	Standard Character (ASCII 043_8)	A-3
A-3	New Character (ASCII 043_8)	A-3

TABLES

Table No.	Title	Page
2-1	Keyboard/M7142 Connector (J2)	2-2
2-2	M7142 Edge Connector	2-2
2-3	Video Output Connector (J1)	2-3
2-4	Communication Port Connector (J3)	2-4
2-5	Factory Installed Jumper Configurations	2-6
2-6	Data Rate Jumper Configurations	2-6
2-7	Attribute Jumper Configurations	2-7
2-8	Communications Jumper Configurations	2-7
2-9	Parity Jumper Configurations	2-8
2-10	Voltage Jumper Configurations	2-8
2-11	Remote Initialize Jumper Configurations	2-8

PREFACE

This manual describes DIGITAL's M7142 Serial Video Module. It includes descriptions, specifications, programming, and interfacing information on the M7142. The section on applications presents examples of how the M7142 can enhance present system operation.

CHAPTER 1
INTRODUCTION

1.1 GENERAL DESCRIPTION

The M7142 module forms an integral part of a terminal. The module accepts serial ASCII encoded data to be stored in a refresh memory to generate a display for a video monitor. The M7142 also accepts parallel data from a keyboard terminal (on strobe demand) to generate serial ASCII output.

Interaction with the M7142 is accomplished via four ports (see Figure 1-1):

- Communication Port – Data from the communication input port is sorted to form two internal streams of data: control characters, e.g., LF, CR, VT (see Chapter 3) are fed to the control logic; data is fed to the data storage memory.

  Data storage memory is continuously scanned and the contents are used to generate a video output for an external monitor.

- Keyboard Port – The keyboard port operates independent from the rest of the module. It translates parallel ASCII data to serial data to drive the communications output port.

- Video Port – The video port provides a data path to the external monitor for data display.

- Power Port – Power input is dependent upon the option used (see Section 1.4).

1.2 MECHANICAL PACKAGING

The M7142 is an extended-length, double-height, single-width board. Mounting holes are provided for stand-off mounting via handle rivets and two holes located near the module fingers (see Figure 1-2).

1.3 ENVIRONMENTAL SPECIFICATIONS

The M7142 module operates under the following conditions:

- Environment must conform to:

  Temperature 5°C to 60°C
  Humidity 10% to 95% (no condensation)

- Power dissipation is based on circuit requirements of 1.8 amps maximum. If only 5 Vdc is used, power dissipation does not exceed 9 watts. An additional 2 watts (normal) is dissipated when the ±HV (nominal 12 volts) is enabled.

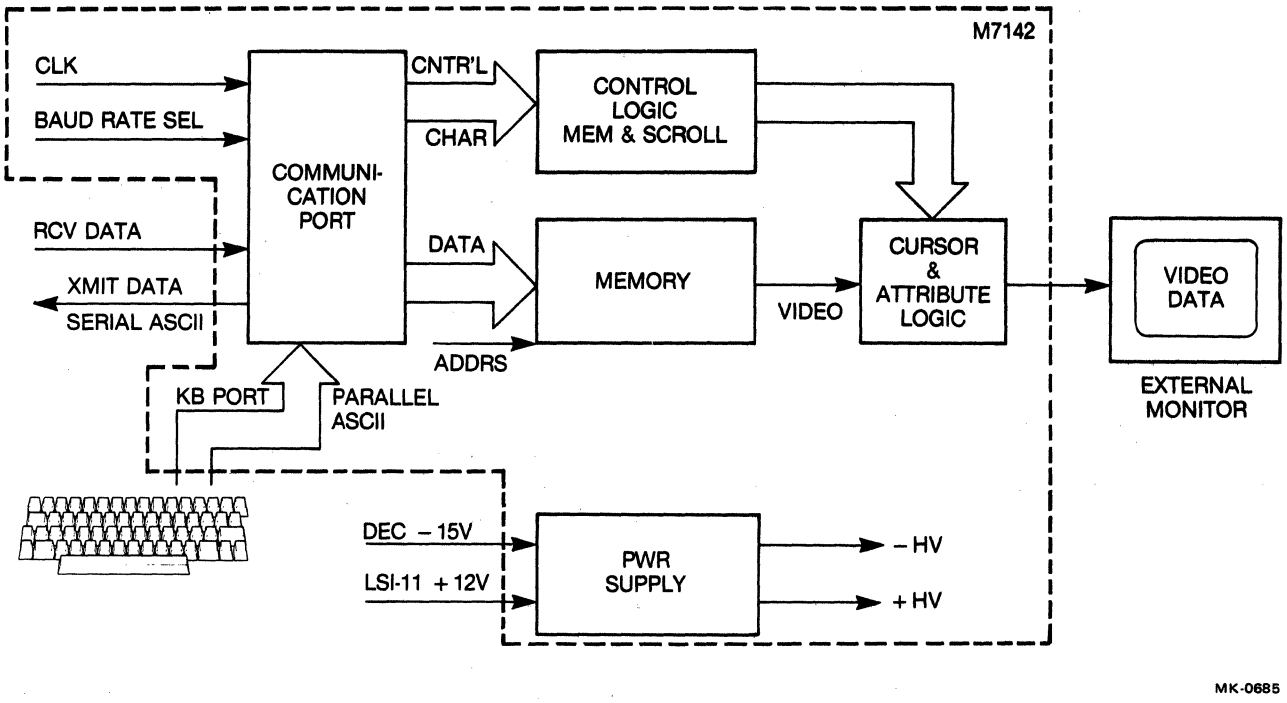


Figure 1-1 Port Interaction

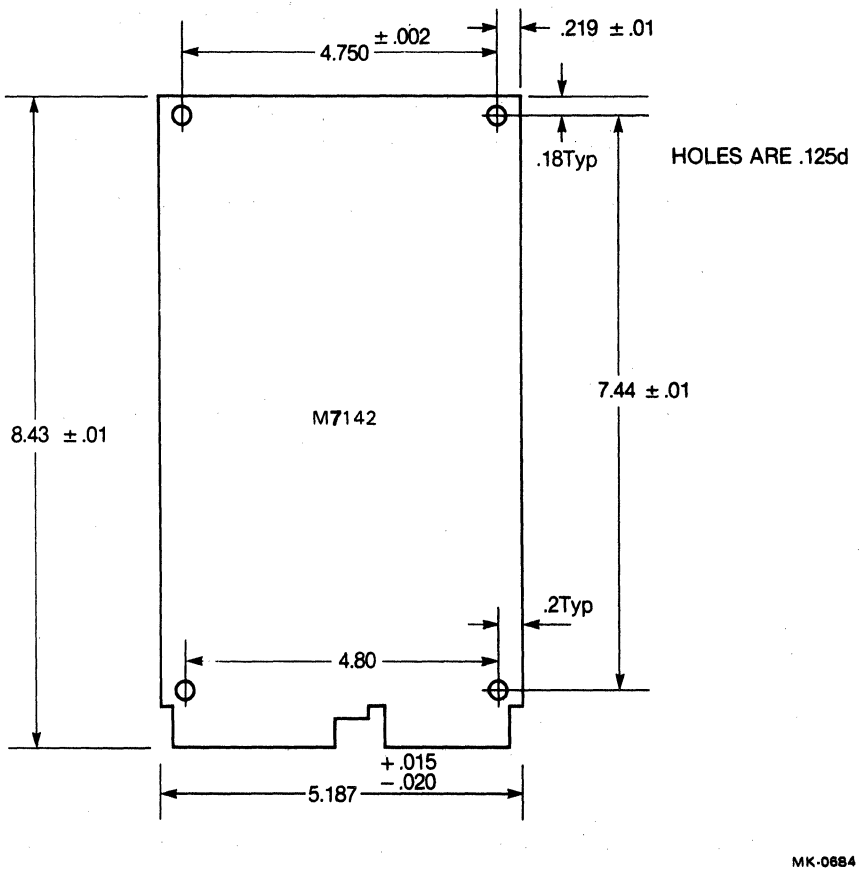


Figure 1-2 Mechanical Packaging

1.4 OPTIONS

The options designated below may be either customer selected or DIGITAL selected.

- Communication Port:

  Electrical interface operates in either Electronic Industries Association (EIA) RS423 or conventional DEC 20 milliamp passive current loop.

- Power Input:

  Power input is regulated +5 Vdc at 1.2 amps typical. If the RS423 communications interface is selected, a source of +12 volts or -15 Vdc is required at 150 milliamps typical.

- Character Sets:

  Space for two character set ROMs is available. One of two optional character sets may be selected by the attribute.

  At power up, the standard graphics are enabled. The standard character set ROM is soldered in place. A 24-pin socket is provided for installing an optional graphics ROM. A 2716/2316 or equivalent may be used to hold two optional character sets.

- Keyboard Power:

  Keyboard power is available at the keyboard data connector (J2) to allow operation with a keyboard such as the DEC LK02. Current should not exceed 100 milliamps of +5 volts and/or 10 milliamps of -12 volts.

1.5 VIDEO CHARACTERISTICS

- The video image consists of 25 lines of 80 characters each presented in adjacent 8 × 8 dot cells (see Figure 1-3).

  Horizontal Frequency = 15.36 kHz
  Vertical Frequency = 60 Hz
  Horizontal scan lines per frame = 256 lines

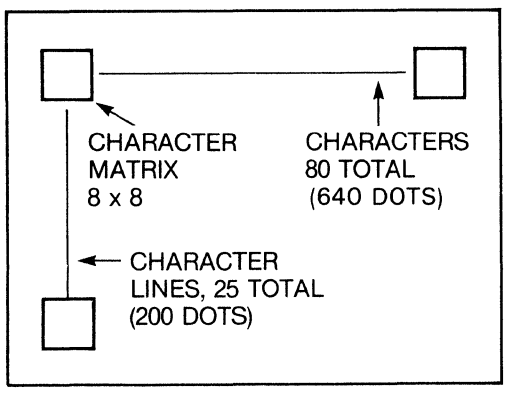


Figure 1-3 Video Image

- The standard character font is presented in a 7×7 dot portion of the 8×8 dot cells.
- Smooth scrolling rolls a clear line into the bottom of the image display. It is used whenever an attempt is made to move the cursor down with a line feed (LF) or a vertical tab (VT) after the cursor has reached the bottom line.
- Direct cursor addressing is available (VT52 compatible). See Section 3.3, CURSOR ADDRESSING.
- Character attributes are available allowing selection of blink, forward and reverse video, alternate character set, or half intensity. The selected attribute may be set/cleared with bit 8 of the received data or with ASCII characters SO/SI (Shift Out/Shift In).
- The cursor is a flashing reversed video cell with a 500 millisecond nominal period and a reversed duty of 60% to 80%.

CHAPTER 2
INSTALLATION

2.1 SCOPE
This chapter contains the procedures for unpacking, installing, and the initial checkout of the M7142. More detailed checkout procedures are outlined in Chapter 5 of this manual.

2.2 UNPACKING AND INSPECTION
The M7142 is packaged in accordance with commercial packaging practices. First, remove all packing material and check the equipment against the shipping list. Report damage or shortages to the shipper immediately and notify the DIGITAL representative. Inspect all parts of the module for cracks, loose components, and separations in the etched paths.

2.3 INTERFACE
This section describes the sequences of signal exchanges that occur among the M7142 and other external devices. Refer to Figure 2-1 for the pin number locations of the interfacing connectors.

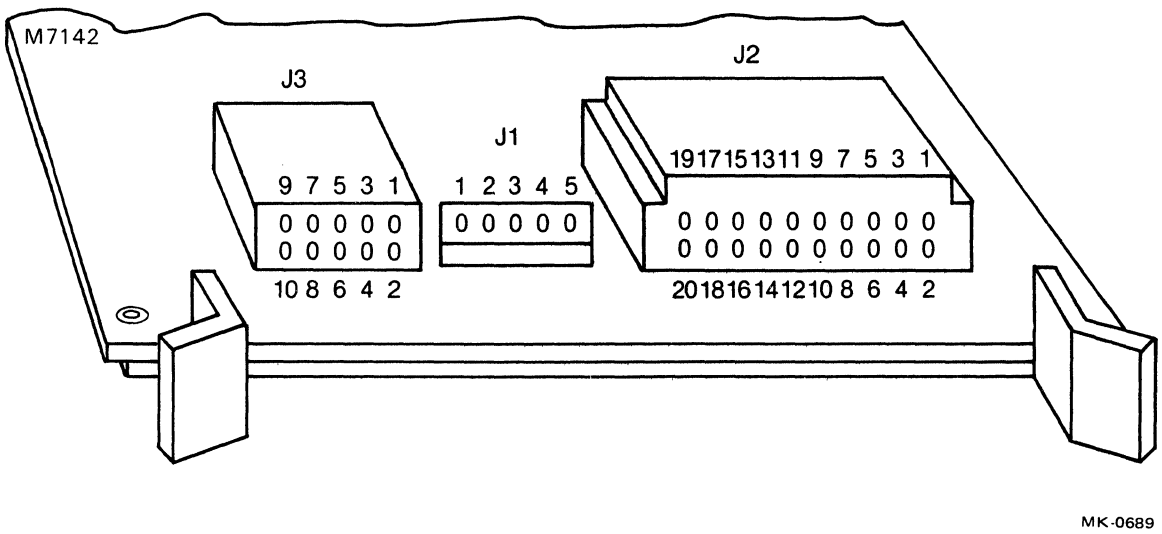


Figure 2-1 Connector Pin Number Location Diagram

2.3.1 Keyboard/M7142 Interface
The keyboard interfaces to the M7142 via a 20-pin connector (J2). Table 2-1 presents the connector pin numbers and associated signal names.

Table 2-1 Keyboard/M7142 Connector (J2)

Pin No.	Signal Name	Pin No.	Signal Name
1	+5 Volts	11	KB4
2	-12 Volts	12	Not used
3	GND	13	KB3
4	KB8	14	BREAK (GND)
5	KB7	15	KB2
6	GND	16	GND
7	KB6	17	KB1 (LSB)
8	KB STRB H	18	GND
9	KB5	19	Not Used
10	BREAK	20	Not Used

2.3.2 Edge Connector

M7142 edge connector pins and associated signals are presented in Table 2-2.

Table 2-2 M7142 Edge Connector

Pin No.	Signal Name
AA2,BA2	+5 Vdc
AC2,AT1,BC2,BT1	GND
AB2	-15 Volts
AD2	+12 Volts
OTHERS	Not Connected

2.3.3 Video Output Connector

Video output is provided as RS170 compatible and as separate TTL output lines. A 5-pin MOLEX* connector (J1) is used with pin assignments as shown in Table 2-3. (Mating connector = DIGITAL Part No. 12-10547; Pins = DIGITAL Part No. 12-14979.)

Composite video output provides RS170 output generated by combining the video signal with a composite sync signal. The picture signal from the balancing level to reference white across 75 ohms is 1 volt. The synchronizing levels are imposed at 40% of the signal.

*Vendor Trademark

Table 2-3 Video Output Connector (J1)

Pin No.	Signal Name	Timing/Freq
5	HORIZONTAL DRIVE H	15.36 kHz/27 μs.
4	VERTICAL DRIVE L	60 Hz/520 μs.
3	VIDEO HI Z	
2	GND	
1	RS 170 VIDEO	

0 volts = SYNC
0.4 volts = BLACK
1.4 volts = WHITE

For direct drive output, jumper W4 must be cut providing a high impedance source at the MOLEX* connector, pin 3. The M7142 has been tested with the following direct drive monitors:

ITOH,
Ball Brothers,
Elston.

2.3.4 Communications Port Connector

The communciations port is a 10-pin connector (J3), pinned for direct DLV11-J connection. The electrical interface may be wired for RS423 or 20 mA communication (see Figure 2-2). Table 2-4 presents the pin assignments and associated signal names.

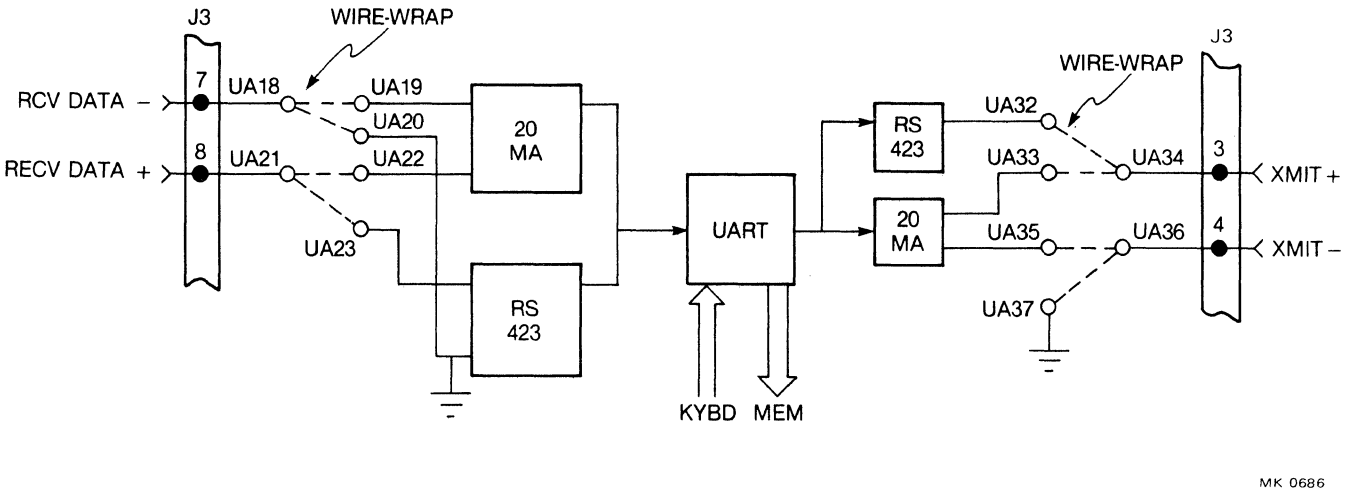


Figure 2-2 Select RS423/20 mA Loop

*Vendor Trademark

Table 2-4 Communications Port Connector (J3)

Pin No.	Signal Name
1	CLOCK I/O
2	GND
3	XMIT DATA +
4	XMIT DATA -
5	GND
6	NOT USED/POLARIZING POINT
7	RCV DATA -
8	RCV DATA +
9	GND
10	20 mA SOURCE

2.4 INSTALLATION PROCEDURES

The following sections describe the installation of the M7142 module.

2.4.1 Jumper Configurations

Figure 2-3 illustrates the locations of the various jumpers and wire wrap posts of the M7142. Verify that the factory installed jumpers are configured per Table 2-5. Any jumper configuration changes required for user application should be made at this time.

2.4.2 Data Rates Selection

The data rates are generated via a 13.5168 MHz crystal and selected through a dual 4-bit decade and binary counter. The following data rates are selectable: 150, 300, 600, 1200, 2400, 4800, 9600, 19200, and 38400.

The UART may be configured to transmit and receive at either the same data rate or at split data rates. Data rates are configured by connecting a jumper from the selected data rate wire-wrap pin to the clock input pin(s) of the UART. When configuring at the same data rate, the wire-wrap pins may be daisy-chained. Table 2-6 lists the data rates and their respective pin numbers.

The UART can be configured to operate from an external clock source via pin 1 of J3. Both UA26 and UA27 must be jumpered to the external clock. Do not select a data rate pin when using an external clock.

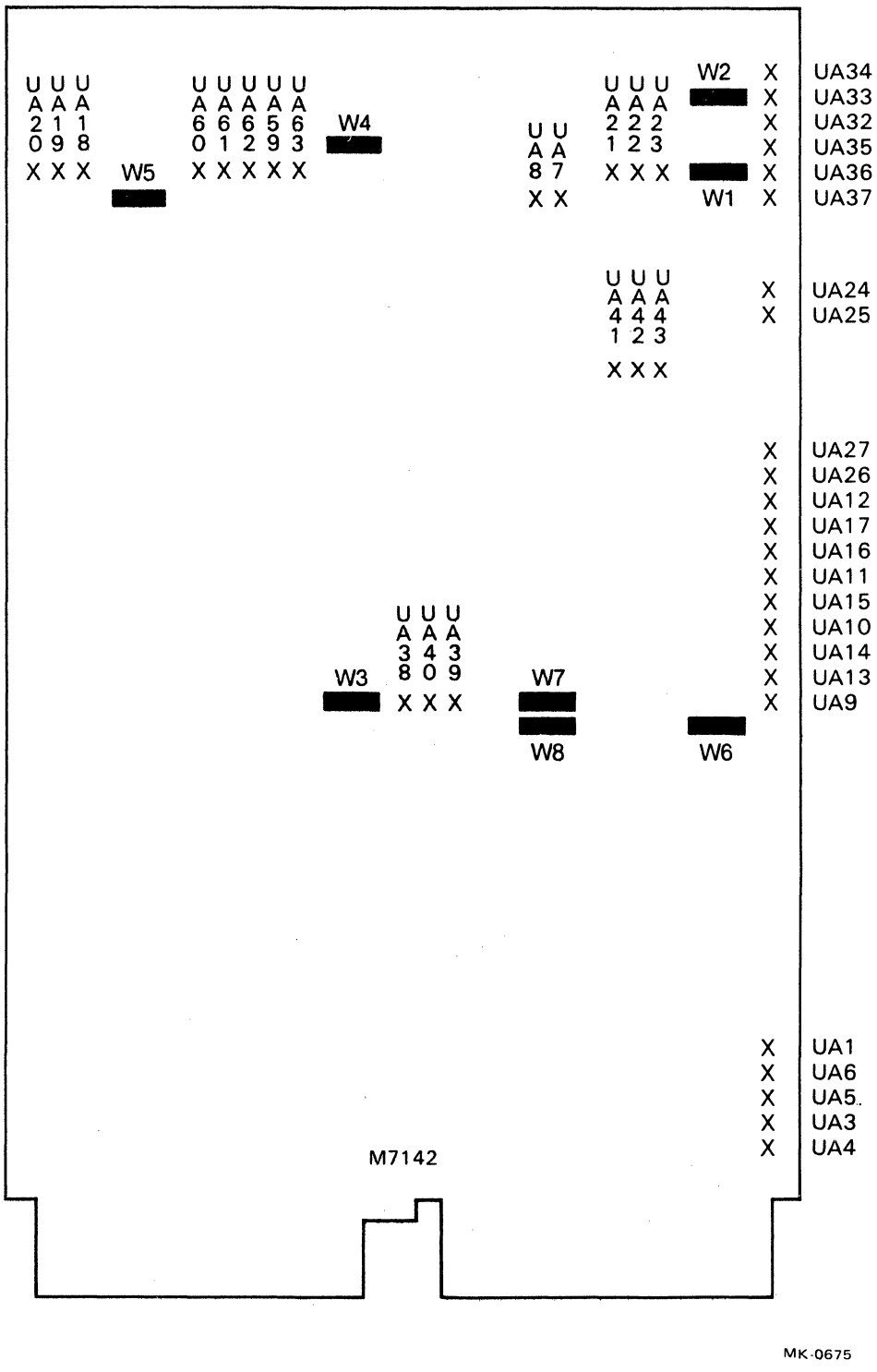


Figure 2-3 Jumper and Wire Wrap Post Locations

Table 2-5 Factory Installed Jumper Configurations

Jumper	Function Implemented
W1 (or UA1 to UA5) W2 (or UA4 to UA6)	+12 V Operation
W4	RS170 Operation
W7	Form Feed Receive enabled for Remote Initialization
UA59 to UA61 to UA62	8-bit – No Parity
UA18 to UA20 UA21 to UA23 UA34 to UA32 UA36 to UA37	EIA RS423 Operation
W3	E52 Character Set Enabled
UA39 to UA40	SI/SO (Shift In/Shift Out) Attribute Control
W5	Forward Video
UA41 to UA43	Blink attribute enabled
UA26 to UA27 to UA15	9600 Data Rate selected

Table 2-6 Data Rate Jumper Configurations

FROM \ TO	Pin	Data Rate
Transmit clock pin UA27 and/or Receiver clock pin UA26	UA9	150
	UA10	300
	UA11	600
	UA12	1200
	UA13	2400
	UA14	4800
	UA15	9600
	UA16	19200
	UA17	38400

2.4.3 Attributes and Attribute Control Selection

Several jumpers are used for attribute and attribute control selection. Table 2-7 lists the various attribute and attribute control configurations.

2.4.4 Communications Selection

Four jumpers are used for communications selection. Table 2-8 lists the jumper configurations required for either EIA RS423 or 20 mA current loop communications.

Table 2-7 Attribute Jumper Configurations

Jumper	Characteristic
W3	Install to enable character set E52 Remove to enable character set XE53
W5	Install for forward video Remove for reverse video
UA7 to UA8	Install to disable half intensity
UA41 to UA42	Install to select reverse attribute
UA41 to UA43	Install to select blink attribute
UA40* to UA38	Install to select character bit 8 for attribute control
UA40* to UA39	Install to select SI/SO for attribute control

*UA40 can either be jumpered to UA38 or UA39, but not both at the same time.

Table 2-8 Communications Jumper Configurations

FROM \ TO	RS423	20 mA
UA18	UA20	UA19
UA21	UA23	UA22
UA34	UA32	UA33
UA36	UA37	UA35

2.4.5 Parity Selection

As many as three jumpers can be used to select ASCII serial data format. Table 2-9 lists the jumper configurations required to select either odd, even, or no parity.

2.4.6 Voltage Selection

As many as six jumpers (two are optional) can be used for voltage selection. Table 2-10 lists the jumper configurations required for either +12 volt or -15 volt operation.

Table 2-9 Parity Jumper Configurations

Characteristic	Jumper
No Parity	UA59 to UA61 to UA62
Odd Parity	UA60 to UA61 to UA62 to UA63
Even Parity	UA60 to UA61 to UA62 and UA59 to UA60

Table 2-10 Voltage Jumper Configurations

Jumper	+12 V	-15 V
W1 (or UA1 to UA5)	In	Out
W2 (or UA4 to UA6)	In	Out
UA3 to UA5	Out	In
UA1 to UA6	Out	In

2.4.7 Remote Initialize Selection

As many as three jumpers are used for remote initialize selection. Table 2-11 lists the jumper configuration required for remote initialization.

Table 2-11 Remote Initialize Jumper Configurations

Characteristic	W6	W7	W8
Form Feed Receive	Out	In	Out
Break	In	Out	In
None	Out	Out	In
Form Feed or Break	In	In	Out

2.4.8 Module Mounting

The M7142 module is mounted by one of two methods.

1. The module can be mounted in a Digital Equipment Corporation computer backplane, taking care that all signals (e.g., grant lines) are jumpered on the backplane as required.

2. The module can be mounted on a panel or chassis using nylon hardware (i.e., spacers and #2-56 screws and nuts as required), utilizing the mounting holes in the module.

   Digital Equipment Corporation has available the H807 edge connector for providing power connection to the M7142 when used in this mounting configuration.

2.5 CHECKOUT PROCEDURES

Two checkout methods are available to the user:

1. When the M7142 is used on a PDP-11 system, run the diagnostic CZVTO in accordance with the instructions distributed with the diagnostic.

2. To check out the M7142 without a processor, local testing can be done over the RS423 or 20 mA communication lines.

   If the M7142 is configured for RS423 operation, jumper J3-3 (XMIT DATA +) to J3-8 (RCV DATA +) to provide local testing with a user-supplied display monitor and keyboard.

   If the M7142 is configured for 20 mA current loop (passive), local testing is provided by the following three jumpers:

   J3-10 (+ Voltage) to J3-3 (XMIT DATA +)
   J3-4 (XMIT DATA -) to J3-7 (RCV DATA +)
   J3-8 (RCV DATA -) to J3-9 (GND)

   Once these three jumpers are installed, a user-supplied keyboard and display monitor can be used to check the operation of the module.

CHAPTER 3
PROGRAMMING

3.1 SCOPE

This chapter contains a description of the control/function characters, direct cursor addressing, and data formats.

3.2 CONTROL/FUNCTION CHARACTERS

The control/function characters are interpreted as non-graphic data. The following actions occur at the terminal upon receipt of these characters from the communication port:

- BS (backspace) – The cursor moves one position to the left, if it is not currently in its leftmost position (left margin).
- HT (horizontal tab) – The cursor moves one position to the right, if it is not currently in its rightmost position (right margin).
- FF (form feed) – The module is reinitialized, if remote initialize Form-Feed jumper is installed (34 ms of fill required).
- CR (carriage return) – The cursor moves to the left margin.
- LF (line feed) – The cursor moves down one line. If required, a smooth scroll occurs and a clear line is provided. If a scroll operation occurs at data rates above 19200, 512 microseconds are required before another scroll can be requested.
- VT (vertical tab) – The cursor moves down one line as in a line feed, except the next line is not cleared. If a scroll operation occurs at data rates above 19200, 512 microseconds are required before another scroll can be requested.
- BREAK (spacing condition) – An initialize sequence similar to power up initialization is generated if remote initialize BREAK jumpers are installed.

3.3 CURSOR ADDRESSING

Direct cursor addressing allows cursor movement to any position on the screen by transmitting an escape sequence to the module.

The ESC character followed by the Y character sets up the logic for a new cursor location; e.g.,

<ESC> <Y> <Line number> <Column number>

- <ESC> <Y> = Defines cursor addressing function

- <Line number> = one character

  040 = top line (ASCII space)

  041 = second line (ASCII !)

  .
  .
  .

  070 = bottom line (ASCII 8)

- <Column number> = one character

  040 = leftmost column (ASCII space)

  .
  .
  .

  157 = rightmost column (ASCII o)

The cursor is moved to the specified column of the specified line. For example, the sequence <ESC> <Y> <)> <A> places the cursor on the tenth line (because ASCII<)> is 51_8) and in the thirty-fourth column (because ASCII<A> is 101_8; and -40_8 for the offset results in octal column 41). The initial sequence should be preceded by a form feed (FF) to initialize the screen registers, if a scroll has been performed.

3.4 OPTIONAL CHARACTER SET SELECTION

Selection of the optional character set is accomplished via the attribute select bit and the removal of jumper W3. An optional character-generator socket is provided on the M7142. For information on creating customer character sets, refer to Appendix A.

3.5 DATA FORMATS

The data mode for ASCII serial input is eight-level without parity. In this case, the lower order bits represent the appropriate character with bit 8 as the attribute select bit. If bit 8 is set, the selected attribute is enabled for the character received.

For the 7 bits with odd or even parity mode, SI/SO can be used to select the attribute bits. When enabled, all characters received after SO have the attribute selected. All characters received after SI have the attribute deselected. The implemented ASCII 7-bit character set is shown in Figure 3-1.

3.6 ATTRIBUTES

Selection of the various attributes is controlled by setting ASCII bit 8 to a logical one (1) or manipulation of SI/SO and adding/deleting wire-wrap jumpers on the M7142 module (see Figure 3-2).

This section contains a description of each attribute, instructions for implementation, and illustrations of each attribute as it appears on the screen.

3.6.1 Reverse Video Versus Forward Video

The forward video display on the CRT consists of white characters on a black background. To change the entire display to reverse video, (black characters on a white background), jumper W5 must be removed as shown in Figure 3-3. Figure 3-4 shows sample displays of forward and reverse video output.

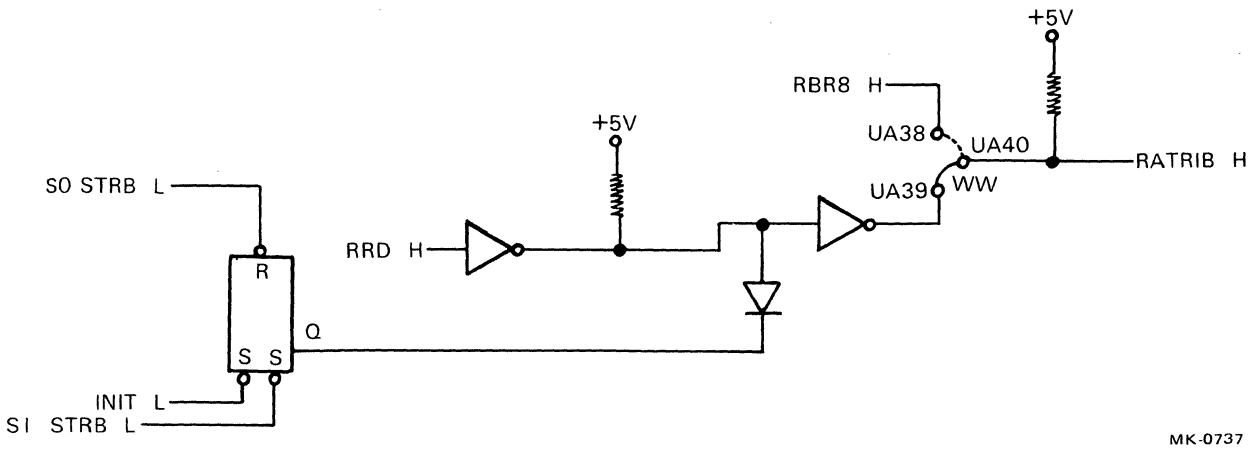
3.6.2 Reverse Video Attribute

The reverse video attribute reverses the video on a character-by-character basis. Wire-wrap UA41 to UA42 must be installed for the reverse video function. (Refer to Figure 3-3.)

b_7 / b_6 / b_5					0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
BITS b_4	b_3	b_2	b_1	ROW ↓ COLUMN →	0	1	2	3	4	5	6	7
0	0	0	0	0			SP	0	@	P	‘	p
0	0	0	1	1			!	1	A	Q	a	q
0	0	1	0	2			*	2	B	R	b	r
0	0	1	1	3			#	3	C	S	c	s
0	1	0	0	4			$	4	D	T	d	t
0	1	0	1	5			%	5	E	U	e	u
0	1	1	0	6			&	6	F	V	f	v
0	1	1	1	7			’	7	G	W	g	w
1	0	0	0	10	BS		(	8	H	X	h	x
1	0	0	1	11	HT		)	9	I	Y	i	y
1	0	1	0	12	LF		*	:	J	Z	j	z
1	0	1	1	13	VT	ESC	+	;	K	[	k	{
1	1	0	0	14	FF		,	<	L	\	l	:
1	1	0	1	15	CR		-	=	M	]	m	}
1	1	1	0	16	SO		.	>	N	^	n	~
1	1	1	1	17	SI		/	?	O	–	o	

MK-0688

Figure 3-1 ASCII Character Set



MK-0737

Figure 3-2 Attribute Selection Flow

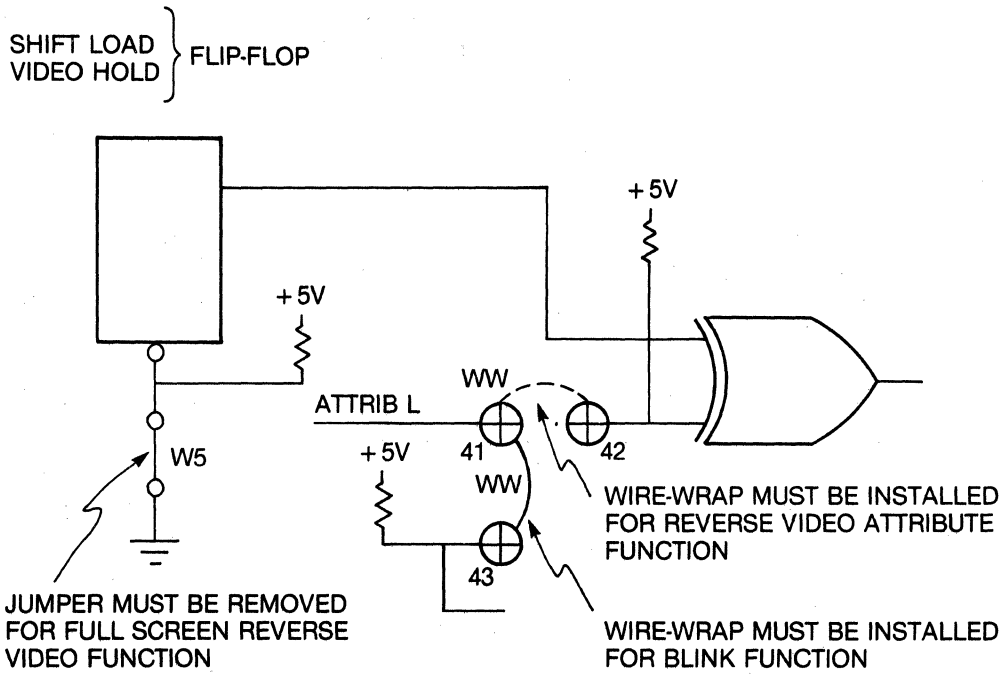


Figure 3-3 Reverse Video and Blink Attributes

3.6.3 Blink Attribute

A wire-wrap must be installed as shown in Figure 3-3 to implement the blink attribute. A series of terminal displays is provided in Figure 3-5 to illustrate the effects of the blink attribute on the screen. Samples are shown for both forward and reverse video. Blink duty is approximately 60 to 80% with a 2 Hz cycle rate.

3.6.4 Half Intensity

The wire-wrap shown in Figure 3-6 must be removed to enable the half intensity attribute.

Figure 3-4 Forward and Reverse Video Displays

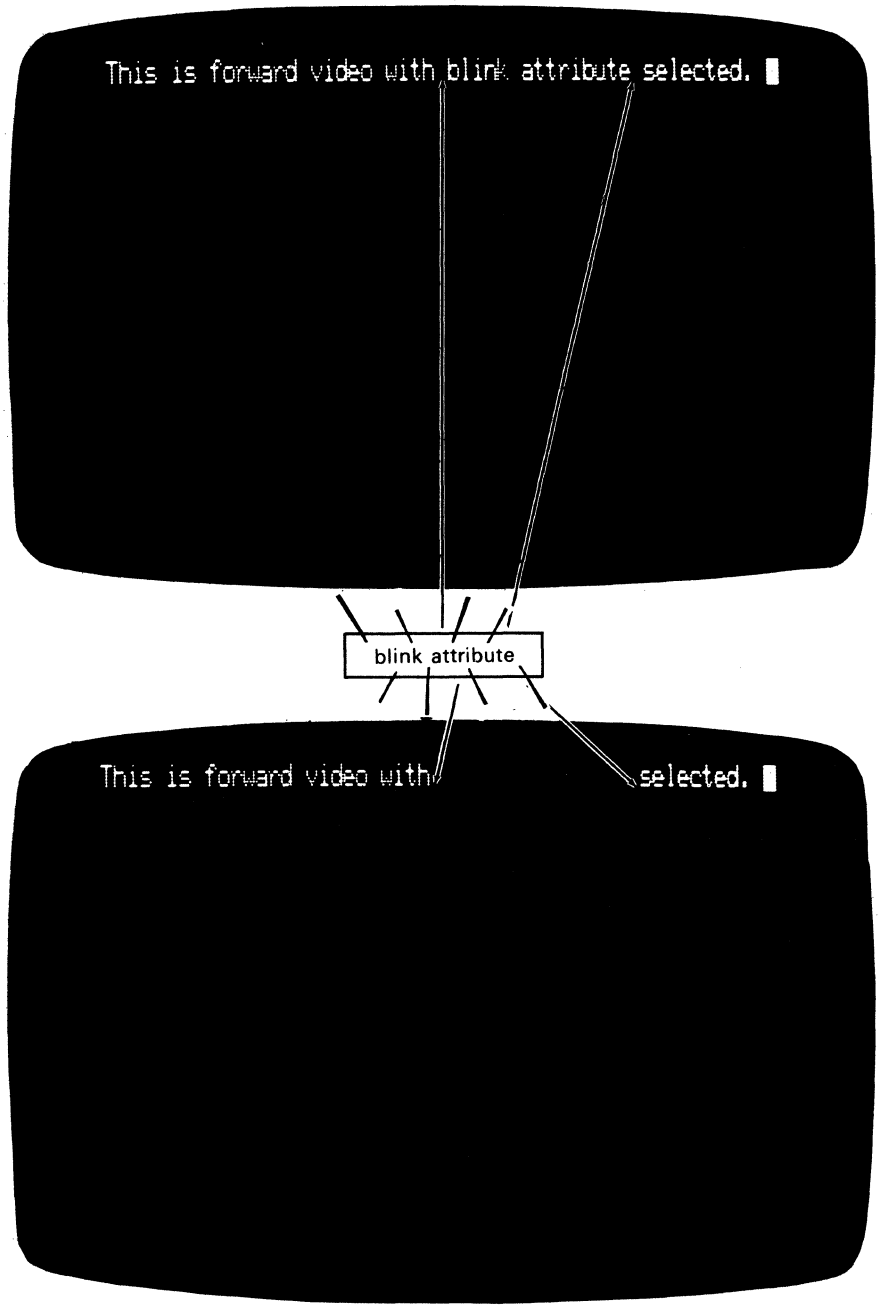


Figure 3-5 Forward Video with Blink Attribute

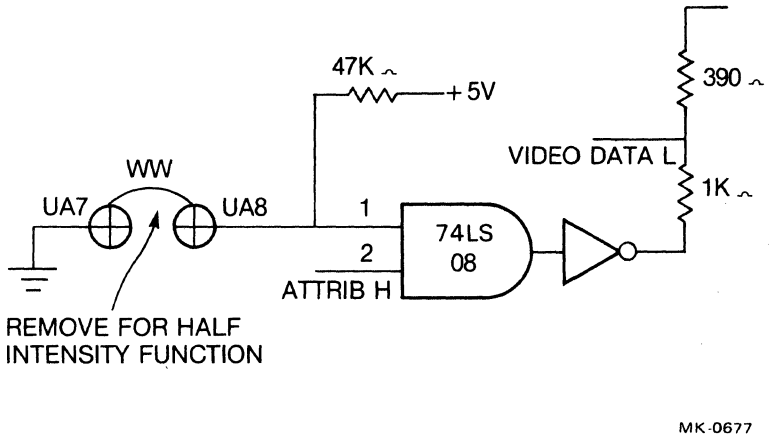


Figure 3-6 Half Intensity Wire-Wrap Removal

CHAPTER 4
APPLICATIONS

4.1 SCOPE
This chapter contains four user applications, each intended to satisfy specific user needs.

4.2 FULL FEATURE TERMINAL WITH BUILT-IN MONITOR
Blink, half-intensity, reverse video, and alternate character set attributes are selectable by interconnecting wire-wrap posts (see Chapter 3). Figure 4-1 illustrates one of the possible applications for the M7142. This configuration provides all the normal terminal features from a user-provided keyboard on a user-provided monitor.

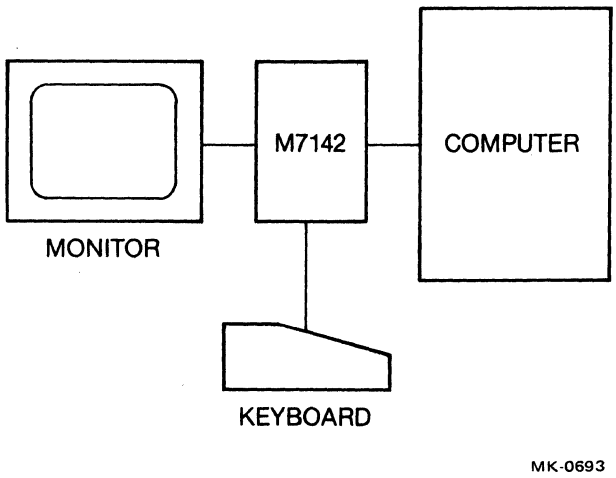


Figure 4-1 Full Feature Terminal

4.3 PROCESS CONTROL MONITOR
Figure 4-2 illustrates an applicable configuration, utilizing a custom character set of industry symbols installed in the alternate character set socket on the M7142. The attribute selected is that required to display the desired information for the process being monitored.

4.4 SECURITY APPLICATION
This application is ideal for implementation of the blink attribute. Alarm status may be represented via the blinking characteristic with the entire or partial screen displayed in reverse video (see Chapter 3 and Figure 4-3). The optional keyboard may be used for operator inputs.

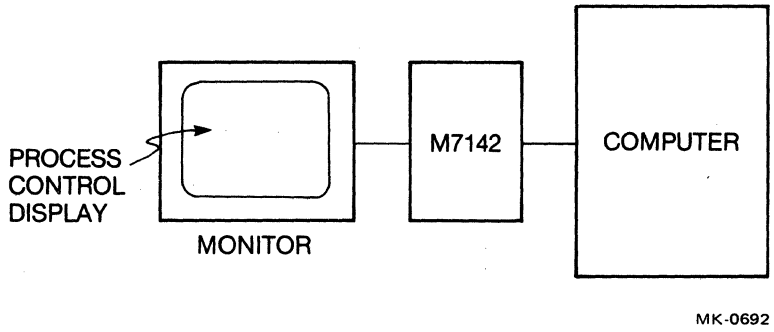


Figure 4-2 Process Control Monitor

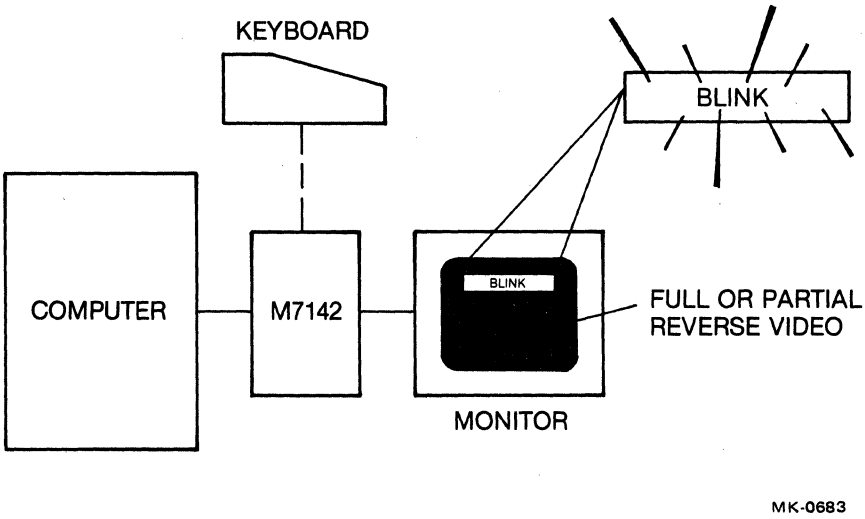


Figure 4-3 Blink Attribute/Alarm Status

4.5 MULTIMONITOR APPLICATION

This application features the use of several sequential monitors (see Figure 4-4) daisy-chained to provide simultaneous display of the same data.

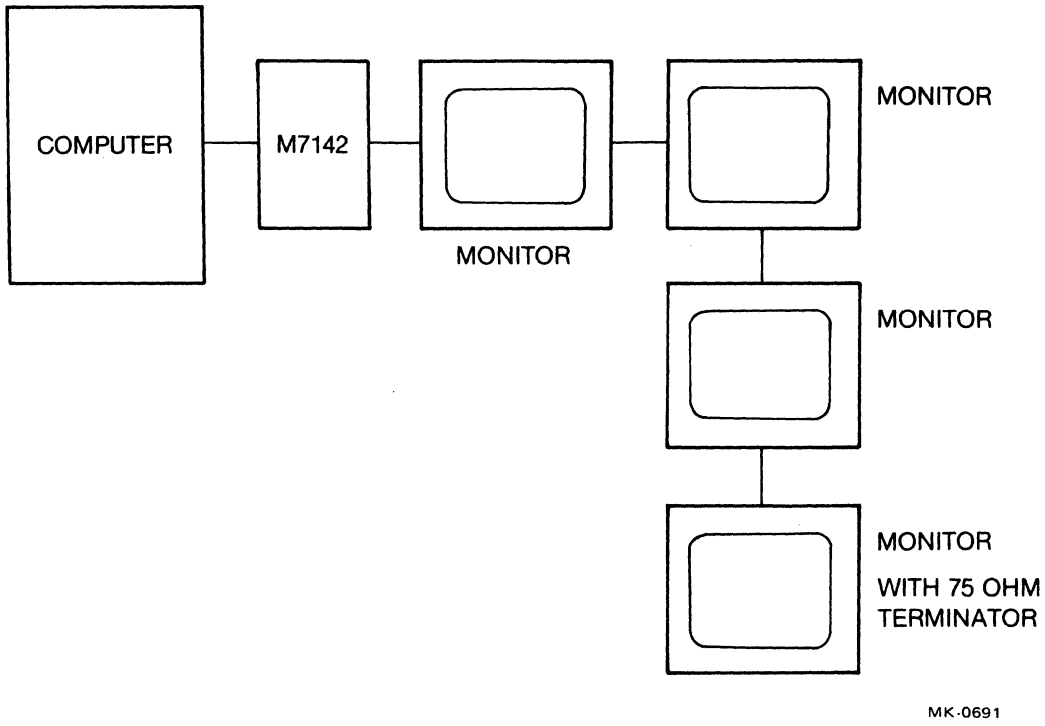


Figure 4-4 Multilocation Tabular Data Display

CHAPTER 5
DIAGNOSTICS

5.1 SCOPE

The program described in this chapter is an acceptance test of the M7142 Serial Video Board. The program consists of five parts, all of which require operator inspection or interaction. The program is capable of handling multiple units in a sequential DLV11 (Serial Line Unit) fashion (see Section 5.8).

NOTE
Only one M7142 is tested at any one time.

The program defaults to the console device (see Sections 5.5 and 5.8). All characters and commands are tested. In the keyboard character test, the BREAK and REPEAT function keys are not tested.

Part 1 consists of a series of test patterns displayed on the screen (see Section 5.9). The operator must visually inspect each test pattern for error detection.

Part 2 is a keyboard character test. This test verifies that the terminal configuration is generating the expected ASCII codes. An operator is required to follow the instructions displayed on the screen and execute them. Because of the flexibility of different processors or options, parity bit testing must be selected by the operator via switch 00–01.

Part 3 is a keyboard octal value loop. When a key is pressed, the octal value is displayed on the screen. If the key pressed is printable, it is displayed on the screen. Some non-printable characters (such as CTRL-C, CTRL-D.... or CR, LF....) have been defined in the program such that, if any of these keys are pressed, their two-letter equivalents are displayed.

Part 4 is a keyboard echo loop. When a key is pressed, the character is echoed to the screen. No testing of the character is performed. This characteristic provides the operator with a local mode of operation between the M7142 and the host computer.

Part 5 is a character attribute test (most significant bit [MSB] selected). A full screen of five blocks (five lines each) is printed. Alternate blocks have any enabled character attribute selected by setting the MSB in each of the character codes as they are printed.

5.2 REQUIREMENTS

Equipment:

1. A PDP-11 family computer with at least 8K words of read/write memory.

2. An M7142 serial video board with screen and keyboard connected via a DLV11 type interface.

   - FORM-FEED INIT must be jumper enabled.
   - SI/SO CHARACTER ATTRIBUTE SELECTION must be enabled for the default attribute test to run correctly (Test F).
   - MSB SET IN CHARACTER CODE TO SELECT CHARACTER ATTRIBUTE must be enabled for test M to run correctly.
   - At least one character attribute must be selected for tests F and M to run correctly.

5.3 LOADING PROCEDURE

The normal procedure for loading binary tapes should be followed.

5.4 STARTING PROCEDURE

Control Switch Settings:

Standard PDP-11 Format

SW 15 = 1	(100000)	Halt on error
SW 14 = 1	(040000)	Loop on present test
SW 13 = 1	(020000)	Inhibit error typeouts
SW 12 = 1	(010000)	Inhibit program sub-test delay
SW 10 = 1	(002000)	Skip keyboard character test (I)
SW 09 = 1	(001000)	Select non-default (non-console) addresses for M7142s being tested
SW 08 = 1	(000400)	Loop on test in SWR <7:0>

Keyboard Character Test Only

SW02 = 1	Enable parity bit test
SW00-01 = 00	Even parity check
SW00-01 = 01	Odd parity check
SW00-01 = 10	Always 0
SW00-01 = 11	Always 1

NOTE

If the computer used is an LSI-11 or one without a switch register, the program uses locations 174 and 176 as a display register and a switch register respectively. The operator is responsible for loading the switch register location prior to starting or restarting the program.

Starting Address or Addresses

200	Starting address of the acceptance test
204	Restart address of the acceptance test
210	Starting address of the full keyboard character test
214	Starting address of the keyboard octal value loop
220	Starting address of the keyboard echo loop
224	Starting address of the character attribute test (MSB selected)

5.5 OPERATING PROCEDURE

The operator must insert the correct information in the switch register when requested by the program, or an error occurs. Once started, the test runs in its normal manner, including the execution of a "Quick" keyboard test that requires operator intervention, unless SW 10 is set in the switch register. If SW 10 is not set, the program does "TIMEOUT" and continues if a key is not pressed in a reasonable period of time.

If the M7142 is not the console terminal with its first device address at 177560, then SW 07 must be set to tell the program where it is. SW 07 must also be set if more than one M7142 is to be tested.

5.6 ERRORS

Most errors must be detected by visual inspection of patterns printed on the screen. Only the keyboard tests result in any error reporting and typeout. Refer to the "Error Pointer Table" contained in the diagnostic listing for type and description of errors.

The error information consists of the following:

ERRPC	-	Location where the error was detected
VTNOW	-	Current DLV11 bus address of M7142 under test
TSTNUM	-	Test number of failing test
EXPT	-	Expected input character
RCVD	-	Received input character

5.7 RESTRICTIONS

The operator should set SW 07 if the M7142 under test is not the console terminal, or not at address 177560 (see Section 5.5).

5.8 MISCELLANEOUS

Execution Time:

Execution time varies with the data rate. The program types 'END PASS' on the console when a pass has been completed. The keyboard loop and character test does not exit until the program is restarted.

Device Address Program Locations (at approximately 1222):

Location "FIRST" contains the first DLV11 address if several M7142s are being tested. The default is console address 177560. Location "LAST" contains the last DLV11 address if several M7142s are being tested. Location "VTNOW" contains the current DLV11 base address. If several M7142s are being tested, their addresses are assumed to be 10 octal bytes apart.

NOTE

If locations "FIRST" or "LAST" are changed, the operator must start the test again at location 200. The program uses the base address to update the actual program values.

5.9 PROGRAM DESCRIPTION (SCREEN)

A - Full Screen of the Letter E

This test fills the screen with the letter E and loads the screen RAM with a single character in all locations. This test is used to visually check the linearity and centering of the M7142/CRT system.

B – Simple Character Set
This test prints one full line of each character (codes 40 through 176) of the character set. It also verifies that all words in the screen RAM can be loaded and the scrolling function is operational.

```
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
BBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB
CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC
DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD
```

C – Incrementing and Sliding Character Set

This test prints one full line of an incrementing character set across the full screen, starting with the code 40 (space). The next line begins with the "!" character (code 41), etc. The pattern continues by incrementing the first column character until the full character set has been exhausted.

This pattern verifies that the full character set can be displayed in each screen word.

D – Cursor Motion Test (CR, TAB, LF, BKSP, VT used) – Form-Feed initialized

This test is the basic cursor motion test using the carriage return, tab, line-feed, backspace, and vertical tab characters.

The first part of the test prints a line of text, "carriage returns" to the left margin and then "tabs" over the text to be sure a "tab" doesn't erase characters.

The second part of the test moves the cursor down by printing some line-feeds, prints a message, and then backspaces over that message to be sure a backspace does not erase characters.

The third part of the test executes a series of vertical tabs to be sure a vertical tab advances the cursor down the screen one line.

Figure 5-1 shows how the screen should look when the test is complete:

NOTE
The Form-Feed initialized function must be enabled.

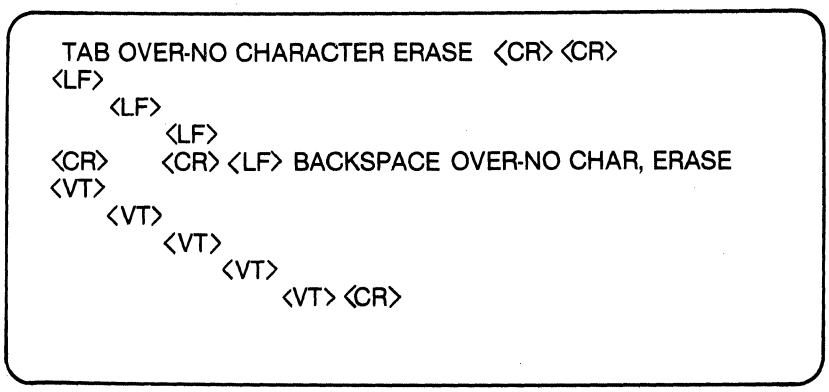


Figure 5-1 Cursor Motion Test Display

E - Direct Cursor Addressing (D.C.A.) - Form-Feed initialized

This test is run using the "ESC-Y" sequence and randomly fills the screen. The end result is a full screen of 25 statements. Each statement is rotated right one character with respect to the line above it.

NOTE
The Form-Feed initialized function must be enabled.

F - Character Attribute Test (SO/SI Selected)

This test prints a full screen of five blocks (five lines each). Alternate character blocks have any enabled character attributes selected by CNTRL-N (SO). A CNTRL-0 (SI) deselects character attributes.

NOTE
The ability to select character attributes using SO/SI and at least one character attribute must be enabled.

G - Scroll Speed Jump Test

This test uses sets of vertical tabs to test the scrolling abilities of the M7142. The screen is first filled with 25 lines of single characters across all columns. The top line contains all A characters and the bottom line contains all Y characters. Then 3 sets of 25 vertical tabs are sent (with a delay between sets) to see if the screen scrolls correctly. After each set of vertical tabs, the top line should still be all As and the bottom line should still be all Ys. This test ensures that smooth scroll and high speed jump scroll interact properly.

H - Column Address Test

This test prints 25 lines of a full line of an incrementing character set. Each line starts with 0, followed by 123456789:;<, and so on. Each column on the screen is filled with a single character.

This pattern verifies that each column is uniquely addressable.

I - "QUICK" Keyboard Character Test

If SW 10 is set (= 1), this test is not executed. If the keyboard is included in every pass of this acceptance procedure, this partial test provides a quick check of the keyboard interface (switch 10 not set). SW 0 and SW 1 have the same use as in the full-blown keyboard character test. The full-blown test should be run to adequately check the keyboard (see J - Full Keyboard Character Test).

Only printing characters are echoed as the keys are pressed.

J - Full Keyboard Character Test

This test is designed to verify that correct character codes and parity bit are generated when a key is pressed. This test requires the operator to execute the instructions displayed on the screen. The operator should only press one key at a time, with some exceptions. The program informs the operator which row to test. Only printing characters are echoed as the keys are pressed.

In testing the parity bit, SW 0 and SW 1 are used to inform the program of the expected parity. An incorrect switch setting results in an error.

K - Keyboard Octal Value Loop

This loop is provided to enable the operator to examine the octal value of a character. When a key is pressed, the octal value is displayed. If the character is a printable character, it is displayed. Codes defined as CONTROL are displayed as two-letter mnemonics (i.e., DE = delete, BL = bell, CL = cursor left, etc.).

L - Keyboard Echo Loop

When a key is pressed, the character is displayed. No modification or data test is performed. This test can be used to determine if there is a UART or serial line problem.

M - Character Attribute Test (MSB of Character Code Selected)

This test is started by using a separate starting address. It is designed to ensure that setting the MSB of the character codes sent to the M7142 causes enabled character attributes to be displayed.

A full screen of five blocks (five lines each) is printed. Alternate blocks have any enabled character attributes selected, using the MSB on each of the characters as they are printed.

NOTE

The ability to select character attributes using the MSB and at least one character attribute must be enabled.

APPENDIX A
CUSTOM CHARACTER SET GENERATION

The M7142s optional character generator socket provides two alternate custom character sets for use in place of the standard character set. An 8716 Erasable PROM or its masked equivalent (2316) can be used for the alternate character generator ROM.

The user defines the alternate character set and then programs it into a suitable PROM or ROM. Once the programmed device is installed in the optional character generator socket and jumper W3 is removed, the user has access to the custom character set either by MSB selection or sending SI/SO. (See Section 3.6 for more information.)

Figure A-1 shows the relationship between the ROM addresses and the character presented on the video display. Note, the following features:

- In the standard character font, the left column and the bottom row are set to zero to provide a space between characters.
- The right octal digit of the ROM address identifies the display scan line (row 1-8, address 0-7).
- The three remaining octal digits of the ROM address identify the character to be displayed.

		ROM CONTENT	
ROM ADDRESS (OCTAL)	DISPLAY POSITION (ROW)	VIDEO DOT MATRIX	OCTAL
0440	1 (TOP)	00000000	010
0441	2	00●●●●●0	076
0442	3	0●000●00	110
0443	4	00●●●●●0	076
0444	5	0000●00●	011
0445	6	00●●●●●0	076
0446	7	00000●00	010
0447	8 (BOT)	00000000	000
		MSB LSB	
		← LEFT	← RIGHT

MK-0680

Figure A-1 ROM Address/ROM Content Relationship

The information below is useful in planning the characters to be presented.

- By defining adjacent video dots to be on, abutting 8×8 character matrices can form continuous lines.
- The first 40_8 character locations (400_8 ROM addresses) are not used for displayable characters. These locations are addressed by codes reserved for control characters.

The following example illustrates the steps required to generate a custom character. Assume the standard character # (ASCII 043_8) is to be replaced with a £. The £ is then displayed whenever the M7142 receives the code 043_8.

- First, identify the video dot matrix for the desired character (see Figure A-2).
- Next, program the ROM. Blast location 0430_8 with 034_8, 0431_8 with 042_8, 0432_8 with 040_8 $0433_8$with 040 $_8$, $0434_8$with 170_8, $0435_8$with 041_8, 0436 $_8$with 176 $_8$and $0437_8$with 000_8.
- Finally, install the newly programmed ROM. Now, whenever a # is received by the M7142, a £ is displayed at that location of the screen (see Figure A-3).

For a completely customized character set, the procedure outlined in the example must be repeated for each character in the set.

ROM ADDRESS (OCTAL)	DISPLAY POSITION (ROW)	ROM CONTENT: VIDEO DOT MATRIX	ROM CONTENT: OCTAL
0430	1 (TOP)	000●0●00	024
0431	2	000●0●00	024
0432	3	0●●●●●●●	177
0433	4	000●0●00	024
0434	5	0●●●●●●●	177
0435	6	000●0●00	024
0436	7	000●0●00	024
0437	8 (BOT)	00000000	000
		MSB LSB	
		← LEFT	← RIGHT

MK-0678

Figure A-2 Standard Character (ASCII 043_8)

ROM ADDRESS (OCTAL)	DISPLAY POSITION (ROW)	ROM CONTENT: VIDEO DOT MATRIX	ROM CONTENT: OCTAL
0430	1 (TOP)	000●●●00	034
0431	2	00●000●0	042
0432	3	00●00000	040
0433	4	00●00000	040
0434	5	0●●●●000	170
0435	6	00●0000●	041
0436	7	0●●●●●●0	176
0437	8 (BOT)	00000000	000
		MSB LSB	
		← LEFT	← RIGHT

MK-0679

Figure A-3 New Character (ASCII 043_8)

INDEX

A

Applications
- Full feature, 4-1
- Process control, 4-1
- Security, 4-1
- Multimonitor, 4-2

Attribute
- Selection, 3-2
- Reverse/forward video, 3-2
- Blink, 3-4
- Half intensity, 3-4
- Jumper, 2-4
- Reverse, 3-2

Attribute Control
- Character bit 8, 1-4, 2-6
- Shift out/shift in, 1-4, 2-6

B

Backspace, 3-1
Break, 3-1

C

Carriage Return, 3-1
Character font, 1-4
Character sets
- Space for, 1-3
- Selection, 3-2
- Customization, A-1

Checkout procedures, 2-9
Communications
- RS423, 2-6
- 20 mA, 2-6
- Connectors, 2-3

Cursor addressing, 3-1

D

Data formats, 3-2
Data rates, 2-4
Diagnostics
- Keyboard character test, 5-1, 5-5
- Keyboard octal value, 5-1, 5-6
- Keyboard echo loop, 5-1, 5-6
- Character attribute, 5-1, 5-6
- Test patterns, 5-1
- Hardware requirements, 5-1
- Startup, 5-2
- Operation, 5-3
- Errors, 5-3
- Restrictions, 5-3

F

Form feed, 3-1

H

Horizontal tab, 3-1

I

Installation
- Module mounting, 2-8
- Unpacking, 2-1
- Inspection, 2-1

Interfacing ports
- Communication, 1-1, 1-3, 2-3
- Keyboard, 1-1, 2-1, 1-3
- Power, 1-1, 1-3, 2-2
- Video, 1-1, 2-2

J

Jumpers
- Factory installed, 2-4
- Data rate, 2-4
- Attribute, 2-6
- RS423/20 mA, 2-6
- Parity, 2-7
- Voltage, 2-7
- Remote initialize, 2-8

L

Line feed, 3-1

O

Operating Environment
- Temperature, 1-1
- Humidity, 1-1
- Power dissipation, 1-1

INDEX (Cont)

Options
- Communication port, 1-3
- Power input, 1-3
- Character sets, 1-3
- Keyboard power, 1-3

P

Power, 1-3, 2-2

S

Smooth scrolling, 1-4

T

Tests
- Letter E, 5-3
- Simple character, 5-4
- Incrementing and sliding character, 5-4
- Cursor motion, 5-4
- Direct cursor addressing, 5-5
- Character attribute, 5-5
- Scroll speed jump, 5-5
- Column address, 5-5
- QUICK keyboard character, 5-5
- Full keyboard character, 5-5
- Keyboard octal value, 5-6
- Keyboard echo loop, 5-6
- Character attribute, 5-6

U

UART data rates, 2-4

V

Vertical tab, 3-1
Video
- Characteristics, 1-3
- Output connector, 2-2
- Reverse/forward, 3-2
- Image, 1-3
- Frequency, 1-3
- Scan lines, 1-3

M7142 SERIAL VIDEO
MODULE USER GUIDE
EK-M7142-UG-001

Reader's Commer

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

What is your general reaction to this manual? In your judgment is it complete, accurate, well organized, written, etc.? Is it easy to use? _____

_____

_____

_____

What features are most useful? _____

_____

_____

_____

What faults or errors have you found in the manual? _____

_____

_____

_____

Does this manual satisfy the need you think it was intended to satisfy? _____

Does it satisfy *your* needs? _____ Why? _____

_____

_____

_____

☐ Please send me the current copy of the *Technical Documentation Catalog*, which contains information the remainder of DIGITAL's technical documentation.

Name _____ Street _____
Title _____ City _____
Company _____ State/Country _____
Department _____ Zip _____

Additional copies of this document are available from:

Digital Equipment Corporation
444 Whitney Street
Northboro, Ma 01532
Attention: Communications Services (NR2/M15)
Customer Services Section

Order No. EK-M7142-UG-001

— — — — — — — — — — — — Fold Here — — — — — — — — — — —

— — — — — — — — — — Do Not Tear - Fold Here and Staple — — — — — — — —

FIRST CLASS
PERMIT NO. 33
MAYNARD, MASS.

BUSINESS REPLY MAIL
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

Postage will be paid by:

Digital Equipment Corporation
Communications Development & Publishing
Merrimack, New Hampshire 03054

ATTN: Site Manager 2M26