VSV21 Version 2.0
Installation Manual

AZ-FV71B-TC

March 1986

This manual describes the hardware installation procedure, diagnostic system and checkout for the VSV21 graphics peripheral.

This manual is part of the VSV21 Version 2.0 document set that supersedes the VSV21 Version 1.0 document set.

Operating Systems: RSX-11M-PLUS Version 3.0
Micro/RSX Version 3.0
MicroVMS Version 4.2

Software: RSX-11M-PLUS VSV21 Version 2.0
Micro/RSX VSV21 Version 2.0
MicroVMS VSV21 Version 2.0

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PREFACE

MANUAL OBJECTIVES

The VSV21 Installation Manual describes the method of installation and the diagnostic procedures for the VSV21. The manual lists the actions which the engineer must perform when the equipment has been delivered, for final acceptance by the customer.

The installation and checkout procedure for peripheral devices (color monitor and pointing devices) is mentioned only in connection with the VSV21. Refer to the supplier's documentation for complete details of these devices.

INTENDED AUDIENCE

The audience is intended primarily to be DIGITAL field service engineers and OEM engineers.

ASSOCIATED DOCUMENTS

Title	Document Number
PDP-11/23B Mounting Box Technical Manual or *BA23 Mounting Box and PS Technical Description* or *BA123 World Box and PS Technical Description*	*EK-23BMB-TM*
LK-201-A-1 Keyboard	*MP-01395-00*
VSV21 User Guide	*AZ-FV70B-TC*
VSV21 Software Installation Guide	*AA-FV66B-TC*
VSV21 Pocket Service Guide	*EK-VSV21-PS-002*
VSV21 Programmer's Guide	*AA-FV67B-TC*
VSV21 Programmer's Reference Card	*AV-FV68B-TC*
VR241-A Video Monitor Installation Manual	*EK-VR241-IN*
**Joystick Model 869-G1358*	
**Trackball (2-inch) Model 622-G1356*	
**Trackball (3-inch) Model 626-G1357*	
**Mouse Model 122-G1355*	

* Available from Digital Equipment. For further details refer to:
Ordering Information Document, YK-AF01A-55
Brochure, YK-AF01A-53
Technical Datasheet, AK-AF01A-54

CHAPTER 1
GENERAL DESCRIPTION

1.1 INTRODUCTION

The VSV21 is a color graphics module contained on a single quad board which is mounted on a Q-bus backplane. The module is connected to a bulkhead panel which houses serial port connectors and color video output connectors.

NOTE: Before beginning the installation, you must make sure that the equipment, documentation, and software are complete. See Chapter 2 for the procedure you should follow.

WARNING: Procedures which call for the removal of system covers should be performed only by trained personnel. Information on such procedures is included for user information only.

The VSV21 option does not include a color monitor, or any pointing device such as a joystick or trackball. The customer must obtain these peripherals separately, either from DIGITAL or from sources recommended by DIGITAL. The customer must also obtain the cables connecting the peripherals to the VSV21.

The installation consists of the following steps:

- Check that the components are present
- Configure the module
- Connect the module to the system box backplane
- Connect the module to the host and peripheral ports
- Run the on-board and host-based diagnostic programs

These are described in Chapters 2 to 4 of this manual.

CHAPTER 2
INSTALLATION PROCEDURE

2.1 GENERAL

The VSV21 option is made up of the basic VSV21-AA module, and one of several kits, depending on the system box used to house the option. Each kit is a unique combination of bulkhead panels, and of sets of cables.

The VSV21 power and loading requirements are:

- 5.5 A (typical), 7.6 A (maximum) at +5 V dc
- 0.15 A (typical), 0.2 A (maximum) at +12 V dc
- 1.9 Q-bus ac bus loads
- 0.5 Q-bus dc bus loads

Peripheral power requirements are additional to the option requirements.

To install the option, you must perform the following tasks, as detailed in the remaining sections of this chapter.

- Check that all the option items are available.
- Configure the M7656 module for correct addresses and graphics resolution.
- Plug the module into the backplane of the host box.
- Attach the I/O bulkhead panel to the enclosure of the host system.
- Install and connect the cables between the module and the I/O panel.
- Connect a host serial port to the VSV21 serial port, if necessary.

- Connect such peripherals as the keyboard, color monitor, and pointing device (joystick).

- Run appropriate diagnostic programs to verify that all installed items are operating correctly.

2.2 HOST-DEPENDENT INSTALLATION

For a typical installation you will need the basic VSV21-AA module (M7656), and one of three mounting options shown in Table 2-1. The correct option will depend on the available system cabinet.

Table 2-1 Mounting Options

Option Number and Item	VSV21-AD kit (BA11-S)	VSV21-AB kit (BA23 Box)	VSV21-AC kit (BA123 Box)
70-20093-02 Data cable	1	–	1
70-20093-01 Data cable	–	1	–
70-20094-02 Color cable	1	–	1
70-20094-01 Color cable	–	1	–
74-28684-00 Panel adapter	1	–	–
70-20091-01 Panel assembly	1	1	1

NOTE: The VSV21-AD kit is designed to comply with FCC-specified limits of RFI/EMI emission when installed in a BA11-S box, which is mounted, together with a H349 distribution panel, in a H9642-FB cabinet. In any other configuration, the RFI/EMI emission may not be within FCC-specified limits.

The complete VSV21 kit may comprise some of the following options shown in Table 2-2, which are ordered separately:

Table 2-2 Additional Options for the VSV21

Option	Description	Part No.
VSV21-AA	Basic module M7656	
VSV21-AE	25-foot video cable	17-00223-02
VSV21-AF	14-foot keyboard cable	17-00397-01
VSV21-AG	1-foot host cable (PDP)	17-00301-04
VSV21-AH	25-foot transparent port cable	17-00300-01
VSV21-AJ	Loopback test connector kit containing:	
	1 × keyboard jack plug	70-20131-01
	2 × 9-way connectors	70-20130-01
	1 × 25-way connector	12-15336-01
VSV21-AK	1-foot host cable (MicroVAX)	70-21425-01
VSV21-AL	Data-tablet adapter cable	70-23421-01
VSV21-BB	VSV21-AA module + VSV21-AB mounting option	
VSV21-BC	VSV21-AA module + VSV21-AC mounting option	
VSV21-BD	VSV21-AA module + VSV21-AD mounting option	

Before proceeding with the installation perform the following steps:

1. Check that every item listed in Table 2-1 is present for the appropriate kit. Check that additional items match the shipping list provided. Inform the unit manager of any missing or incorrect items.

2. Ask the customer to contact the carrier to find any missing items. If the carrier does not have the missing items, ask the unit manager to check with the DIGITAL traffic and shipping department.

3. Examine all hardware items and make sure that none are damaged. Notify the customer of any damage and list it on the LARS report. If damage is serious, call the unit manager for instructions on how to proceed.

When you are ready to proceed with the installation, perform the following steps:

1. Find the bulkhead panel 70-20091-01, for installation into a BA23 or BA123 box. For installation into a H9642 cabinet with a BA11-S box, you must also have a 74-28684-00 adapter plate. Figure 2-1 shows these items.

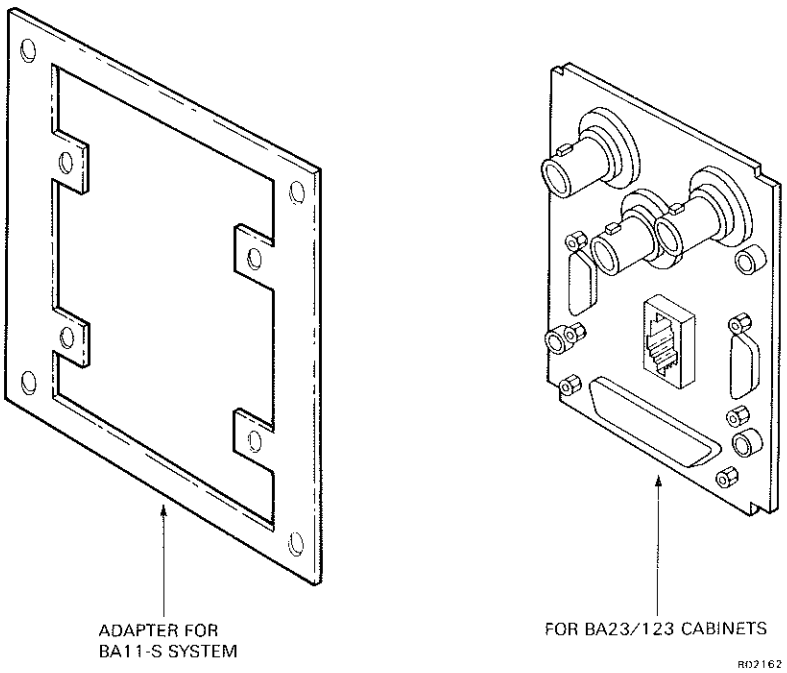

Figure 2-1 Bulkhead Panel for the VSV21 Graphics Option

2. Find a suitable blank rear I/O panel on the BA23/BA123 system box, and remove it, taking care to save the screws. On the H9642 cabinet (with a BA11-S box), find and remove a blank I/O sub-panel on the H349 connector panel.

3. Mount the new bulkhead panel using the screws saved in step 2. On the H9642 cabinet, you first mount the panel on the 74-28684-00 adapter plate, which is then installed on the H349. Figure 2-2 shows the various possible combinations of panel and system box.

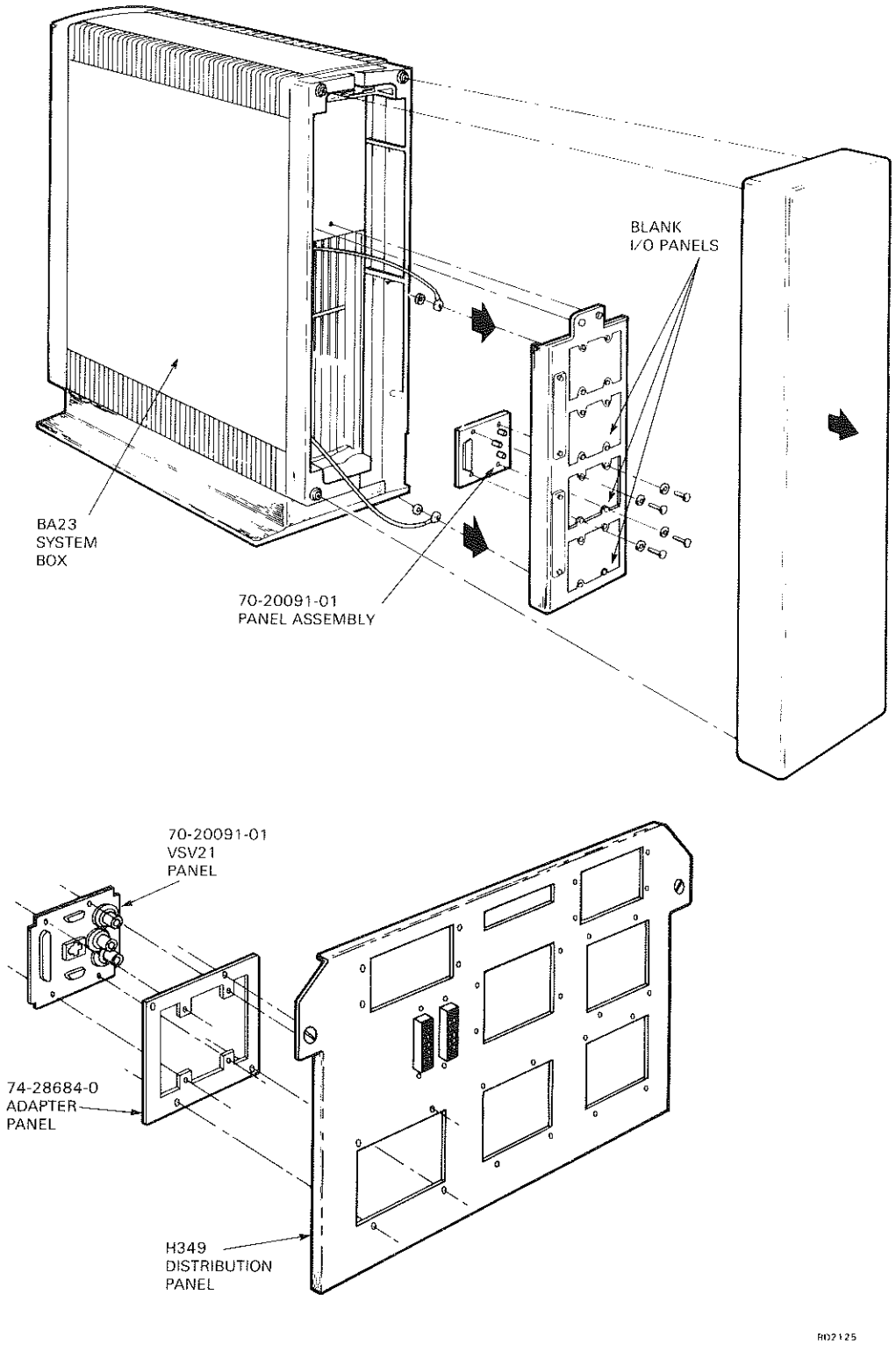

Figure 2-2 Bulkhead Panel Installed on System Boxes

2.3 CONFIGURATION AND INTERCONNECTION

The following steps describe how you must prepare the module before installing it into the system box backplane.

CAUTION: Protect the M7656 module against static when you are handling it.

1. Find the two switchpacks E48 and E61 on the M7656 module, as shown in Figure 2-3. Figure 2-4 shows how to perform the device address setting. Figure 2-5 shows how to perform the vector setting.

   The VSV21-AA module is set in the factory to a device address of 17772010_8. This is a fixed device address. You should not change it unless more than one VSV21-AA device is installed on the same host system. See Appendix A for full information on selecting addresses. The device modulus is 10_8, so that the next device address up should be not less than 17772020_8. Decide on the address needed and make sure that the switch settings on E61 are correct. Use the blank row in Figure 2-4 to help you, if necessary.

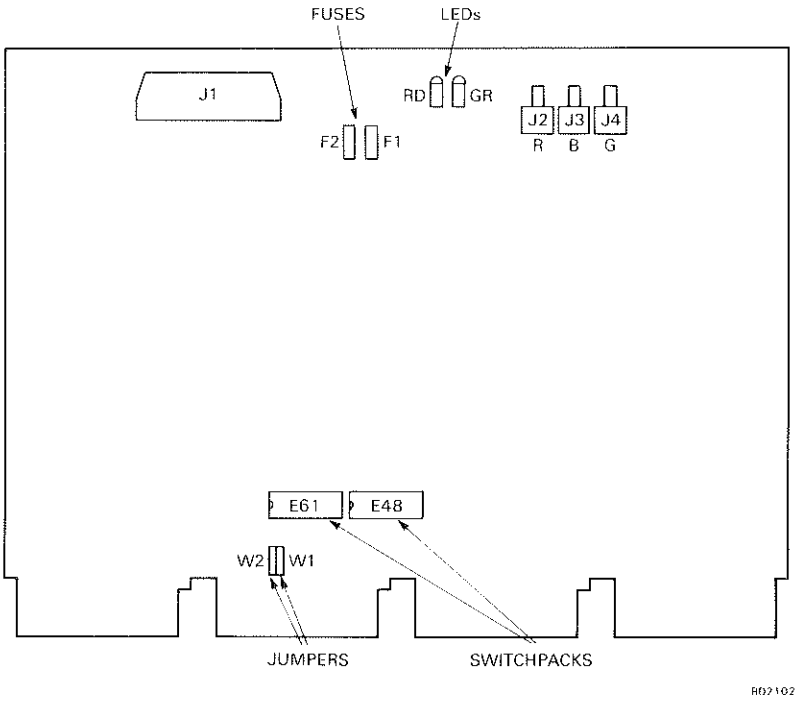

Figure 2-3 Switchpack and Jumper Locations on the M7656 Module

2. The vector address of the VSV21-AA is set in the factory to 320_8, which is in the floating vector address space. If other devices use the same floating vector address, you must change the address of the device with the lower device ranking to the next suitable address. See Appendix A for full information on selecting addresses. The VSV21 ranking is 17. The device vector modulus is 4, so that the next device vector should be not less than 324_8. Decide on the vector address needed, and make sure that the switch settings on E48 are correct. Use the blank row in Figure 2-5 to help you, if necessary.

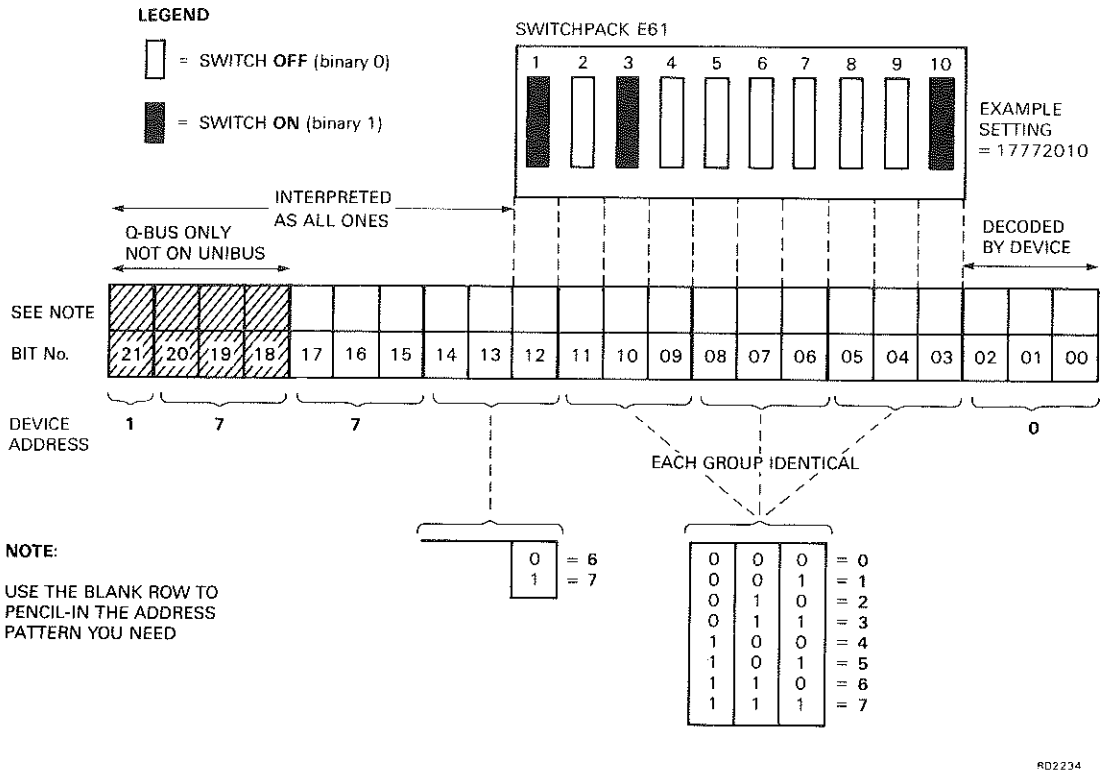

Figure 2-4 Device Address Setting Guide

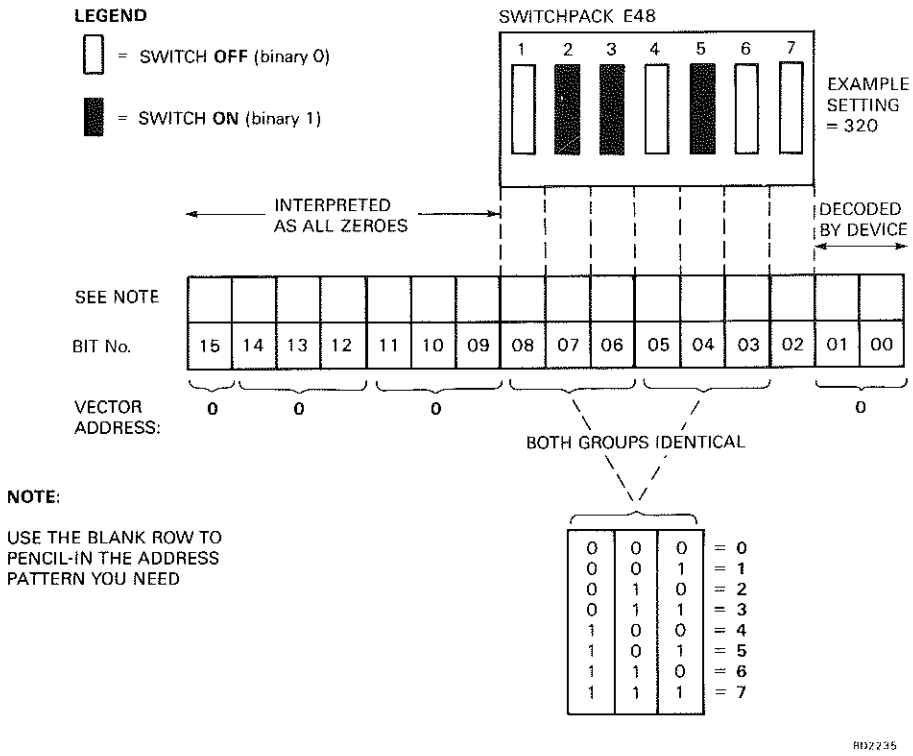

Figure 2-5 Vector Address Setting Guide

3. Refer to Table 2-3 which shows the E48 switch settings for selecting the VSV21 graphics resolution. Ask the customer what resolution setting is wanted, and adjust the switches accordingly. For HIGH resolution, when switch 10 is ON, you must have a suitable high-definition monitor, such as one of the recommended BARCO units. For LOW resolution, with switch 10 OFF, you can use the DIGITAL VR241 monitor. The two are NOT compatible.

Table 2-3 Graphics Resolution Selection Guide

E48 Switch 9	E48 Switch 10	Resolution
ON	ON	512 × 512
ON	OFF	512 × 256
OFF	ON	640 × 480
OFF	OFF	640 × 240

4. Set switch 8 of switchpack E48 to ON. This is the normal condition. Switch 8, when turned OFF, disables the M7656 response to BUSINIT signals on the Q-bus. If the VSV21 is used as a system console, turn this switch OFF when running diagnostics on any other modules so that the console VSV21 does not respond to the BUSINIT signals and enter the self-test mode. Remember to return the switch to ON after completion of diagnostic tests.

5. Open the system box to gain access to the module cage. See the appropriate system box documentation for details of the system box. Find an empty quad slot. This can be either a Q/Q slot (A-B/A-B) or a Q/C-D slot (A-B/C-D). You should choose a slot as near to the CPU as possible.

6. If a Q/C-D slot is to be used, remove jumpers W1 and W2 on the M7656 module. Refer to Figure 2-3 for the location of these jumpers. If a Q/Q slot is to be used for the M7656 module, make sure the jumpers are installed.

7. Do not insert the module yet. Switch the system power ON and measure the power supply rails in the selected slot position. Check the +5 V supply between AA2 and ground, and the +12 V supply between BD2 and ground. Correct any power supply problems before installing the M7656 module. If you find these pins difficult to reach, then test at the power-supply terminals.

CAUTION: Always switch the power OFF before inserting or removing modules. Be careful not to snag module components on the card guides or on adjacent modules.

8. Now turn the power OFF and install the M7656 module in the slot previously selected.

9. Turn the power ON and check the supply voltages again. Correct any problems before proceeding with the installation.

10. Turn the power OFF again. Connect the ribbon cable between J1 on the M7656 module and J1 on the I/O panel, making sure that the connectors match pin 1 with pin 1. Connect the three coaxial cables between J2, J3, and J4 on the M7656 module and the I/O panel, making sure that the red cable connects to the red connector on the module (J2). The blue cable connects to the blue connector (J3), and the green cable connects to the green connector (J4) in the same way.

11. Turn the power ON again and, using a voltmeter, check that +5 volts is present on pin 11 and +12 volts on pin 18 of the 25-way D-type connector on the I/O bulkhead panel. Use pin 1 or pin 7 as common ground. The 5-volt supply is fed through fuse F2, and the 12-volt supply through fuse F1. If any fuse is blown, the supply will not appear on the connector. Replace any damaged fuse. The rating should be 3.0 amperes. Remember that F1 also supplies the keyboard through the keyboard-jack.

12. Fold any excess cable as shown in Figure 2-6, 2-7 or 2-8.

13. If the VSV21 is also to be used as the console terminal find the correct cable (VSV21-AG for a PDP host, or VSV21-AK for a MicroVAX host) and connect it as shown in Figure 2-9 or Figure 2-10.

14. If the VSV21 is to be used as a terminal (not console) on the host system, find the correct cable (VSV21-AG) and connect it as shown in Figure 2-11 or 2-12.

CAUTION: You must not plug in either the keyboard or the pointing device while the power is ON. The current surge will blow the module fuses. Always switch power OFF before plugging in these devices.

15. When the VSV21 is being used as a terminal (whether as a console or not) it will need the addition of a keyboard. An LK-201 keyboard must be available. Connect the keyboard cable jack-plug to the jack-socket on the system I/O panel. If the keyboard is needed at a distance greater than 1 meter (3 feet 3 inches) from the system, then an extension cable (VSV21-AF) must be provided. Connect this cable between the I/O panel and the LK-201. If the keyboard is other than a USA version LK-201-AA, then the system software must know this. Further details on how to do this are found in Section 4.2.

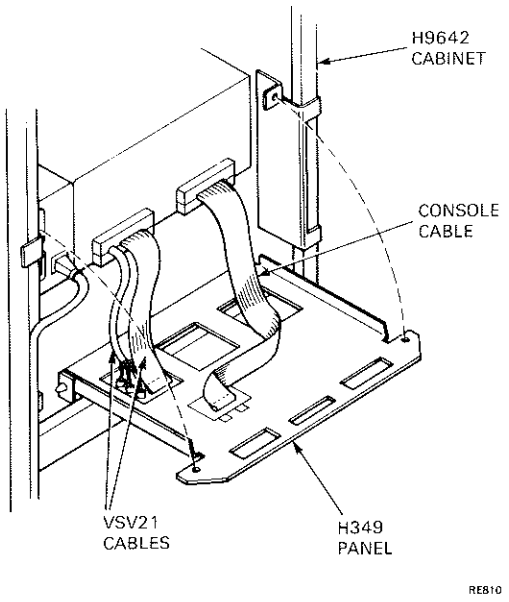

Figure 2-6 Cable Layout for the H9642 Cabinet

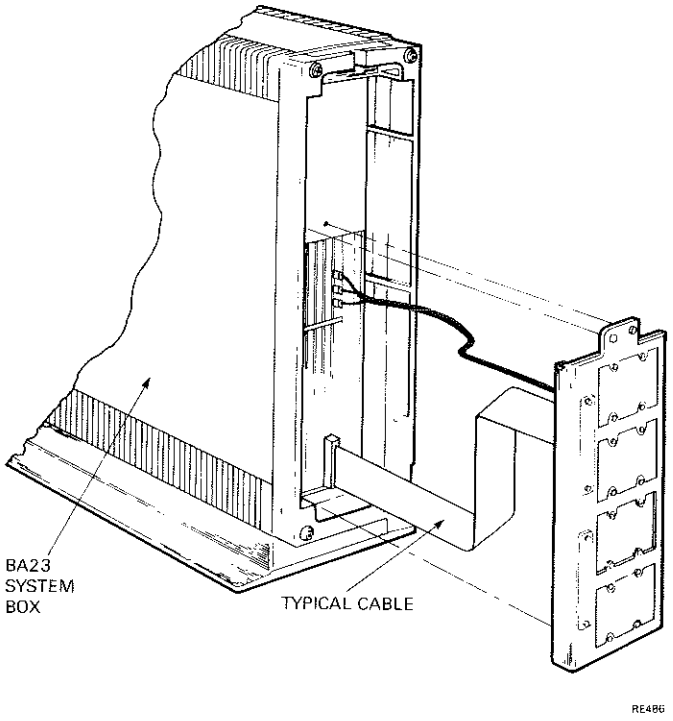

Figure 2-7 Cable Layout for the BA23 Cabinet

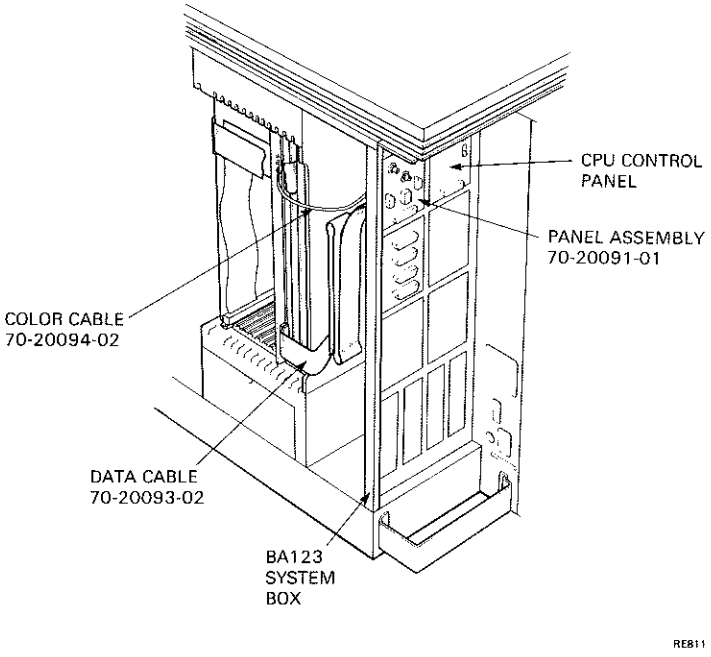

Figure 2-8 Cable Layout for the BA123 Cabinet

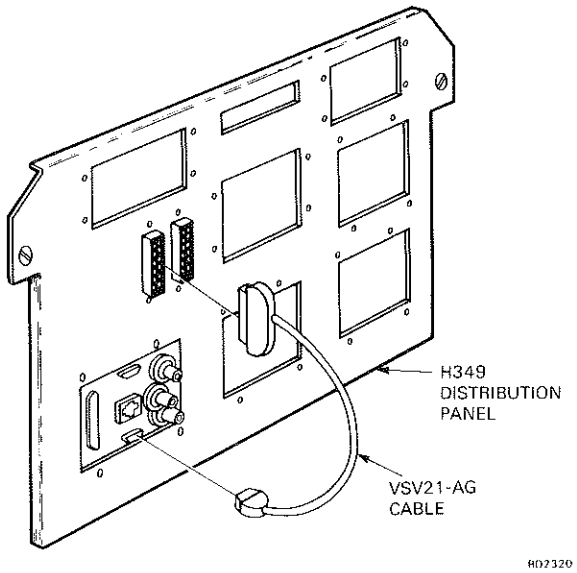

Figure 2-9 Console Connection on BA11-S Systems

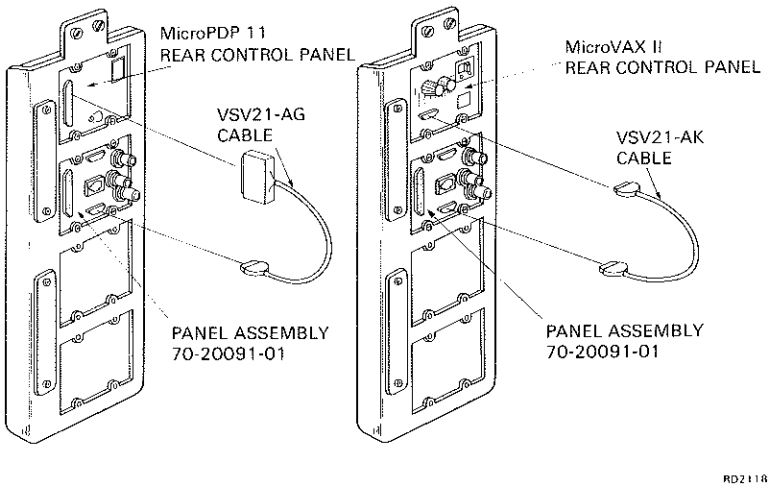

Figure 2-10 Console Connection on BA23 Systems

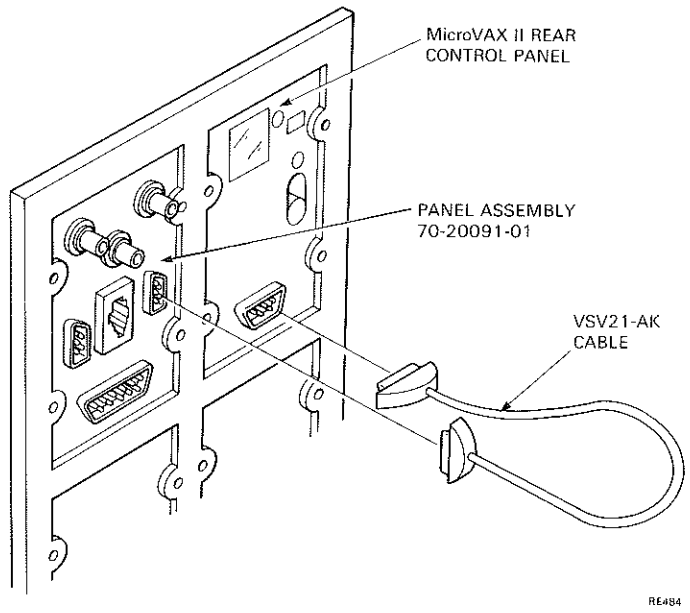

Figure 2-11 Console Connection on BA123 Systems

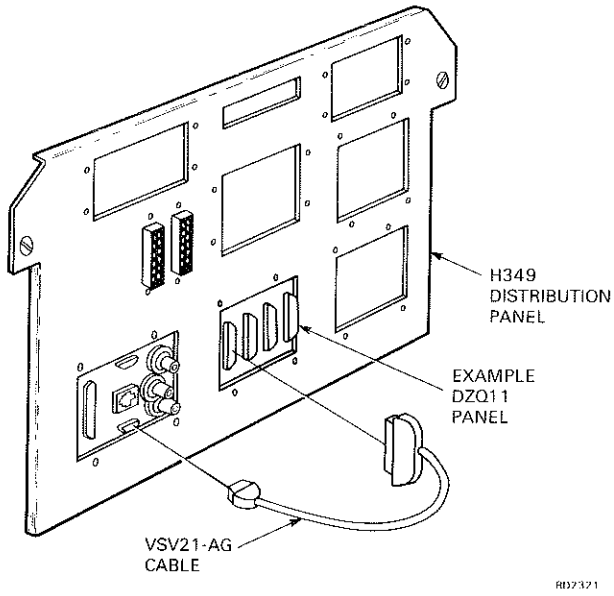

Figure 2-12 Terminal Connection on BA11-S Systems

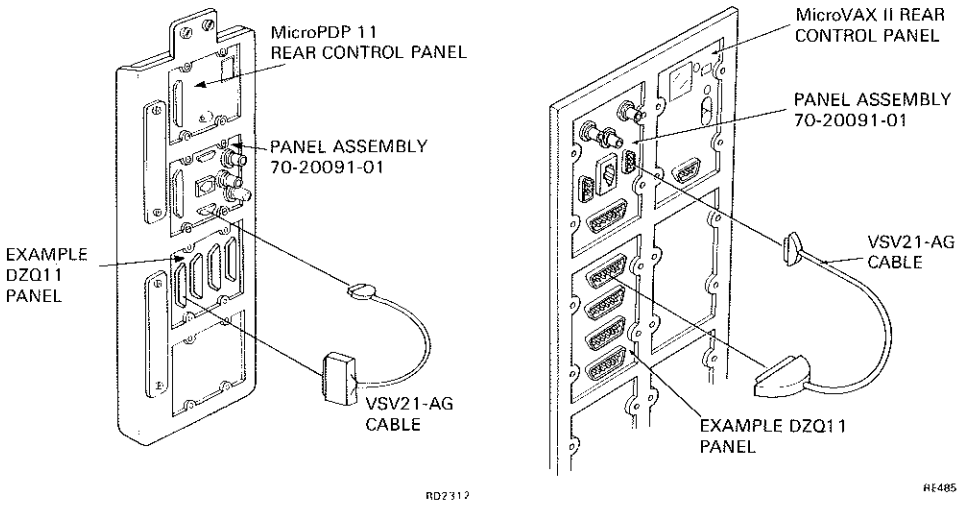

Figure 2-13 Terminal Connection on BA23/BA123 Systems

16. Connect the VSV21 to the color monitor by plugging the three BNC connectors of the video cable (VSV21-AE) to the monitor. Make sure that the correct color connector is used for each color. The cable is color-coded red, green, and blue. Connect the other end of the cable to the VSV21 I/O panel, again matching the three colors.

CAUTION: You must not plug in either the keyboard or the pointing device while the power is ON. The current surge will blow the module fuses. Always switch power OFF before plugging in these devices.

17. Connect the pointing device (if available) to the serial 25-way D-type connector (according to the panel labels).

18. Connect the printer (if available) to the serial 9-way D-type connector (according to the panel labels).

You are now ready to start the checkout procedure by running diagnostic programs. The next chapter describes the diagnostics philosophy and explains the preparations needed for running these tests.

CHAPTER 3
DIAGNOSTICS

3.1 GENERAL

This chapter contains a description of the diagnostic philosophy as used in the VSV21 product. Detailed instructions for running these diagnostics, and the error messages generated, are contained in Chapter 4.

3.2 MAINTENANCE STRATEGY

3.2.1 Preventive Maintenance

No preventive maintenance is planned for this option. However, if you are servicing the host system, examine the option for loose connectors and damaged cables.

3.2.2 Corrective Maintenance

Corrective maintenance is based on finding and replacing the defective FRU. You should not spend a long time on troubleshooting and repairs in the field.

3.3 DIAGNOSTICS OVERVIEW

The diagnostic programs provided are intended to find faulty field-replaceable units (FRUs). They are not intended to find faulty parts smaller than FRU. Except for fuses, spare parts for module repair are not available in the field. Some of the diagnostics need loopback test connectors. You must either make sure that these connectors are available on-site, or get them from Logistics before going on-site.

The FRUs identified by the diagnostics are:

- The M7656 VSV21-AA module
- The 70-20091-01 bulkhead-mounting panel assembly
- The 70-20093-xx data cable assembly
- The 70-20094-xx video cable assembly

- The 12-10929-07 +12-volt peripheral device fuse F1
- The 12-10929-07 +5-volt peripheral device fuse F2.

3.3.1 The Power-Up Self-Test

This test runs without intervention from the operator. When successfully completed, it provides a high level of confidence that the VSV21 can operate as a limited function VT220, and can sufficiently control and respond to the Q-bus interface, so that it can understand and begin to run additional host-based diagnostic software. Until the Q-bus/host interface is proved, test results are indicated by on-board LED lights.

The VSV21-AA (M7656) module has a green LED and a red LED to indicate the results of self-test. When the module is powered up, both LEDs are ON. The self-test program first checks:

- The basic operation of the 68000 microprocessor
- The interfacing to the device status register.

If either of these tests fail, both LEDs stay ON. If the tests are successful, the green LED goes OFF and the following checks are made:

- PROM checksum test
- NVRAM (non-volatile RAM) test
- RAM read and write test (by memory bank)
- 68000 microprocessor instruction set
- Serial-line communications (UARTs) with internal loopback
- Interface to the graphics processor
- Setting up the graphics processor from configuration switches
- Pixel memory read and write (by memory bank)
- Screen self-test

The last test (screen self-test) is intended for initial adjustment of the color monitor, and also as a test pass indicator.

If all these tests are successful, the green LED comes ON and the red LED goes OFF. Otherwise the previous condition stays. LED timings and the displayed picture are described in more detail in Section 4.2.

You can now select the type of LK201 used on the VSV21, by entering a specific code via the keyboard. Refer to Section 4.2 for detailed procedure.

You can run each of these tests separately by using the host-based diagnostics. When this is done, the LEDs do not reflect the result of the tests.

3.3.2 Host-Based Diagnostics

These host-based routines perform more intensive tests of individual hardware and on-board software areas, and interfaces of the VSV21. All results are indicated via the VSV21/host interface.

In order to run the host-based diagnostics successfully, you must configure the VSV21 as a non-console device, and have a separate console terminal on the system. You cannot test the VSV21 and, at the same time, use it as a console terminal for providing error messages and other diagnostic information.

The host-based diagnostics are designed to run under the XXDP+ monitor for PDP-11 systems (ZVSWB?), or under the VAX-MDM for MicroVAX systems. The diagnostics are distributed in a package which is available on various media. The medium must be compatible with the system. In addition, an exerciser module (CXVSVA) is available to run under DECX/11.

3.4 BUILDING THE DIAGNOSTIC SYSTEM

Before you can run the diagnostics on PDP-11 systems, you must transfer them to the medium used by XXDP+ Version 2. You must do this by using the UPDAT utility.

You must then reconfigure the diagnostic modules and link them to the DECX/11 run-time exerciser. If you need help to do this, refer to the *XXDP+ System User Manual (AC-F348F-MC),* the *DECX/11 User Manual (AC-F053C-MC),* and the *DECX/11 Cross-Reference Manual (AC-F055D-MC).*

You are now ready to start running the diagnostic programs.

CHAPTER 4
CHECKOUT AND ACCEPTANCE

4.1 CONTROL AND STATUS REGISTERS

The VSV21 module interfaces to the host processor using four addressable word locations on the host bus. This block of locations is assigned an address beginning on a modulo-4 word boundary by means of address select switches as described in Section 2.3. Table 4-1 below shows this block of locations which are referred to as the Status and Control Registers (CSR).

Table 4-1 Status and Control Registers

Address	Read Function	Write Function
177XXXX0	DMA Address Register	Hardware Initialize
177XXXX2	Status Register	Command Register
177XXXX4	Parameter Register	Parameter Register
177XXXX6	(Undefined)	(Undefined)

4.1.1 The DMA Address Register

The location contains the least significant 16 bits of the physical address of the last DMA operation performed by the controller when DMA has been enabled.

4.1.2 The Hardware Initialize Register

This is not a real register because no bits are defined and none have any function. The action of writing to this location causes the VSV21 module to be reset.

4.1.3 The Status Register

This register shows the operational status of the controller and information about the progress of operations by it. The following status bits are defined:

Bit Definition

12 Controller Ready Bit
This bit is set to 1 when the controller is ready to accept a new command from the host. When 0, it indicates the controller is busy.

Bit Definition

13 Parameter Ready Bit
This bit is set to 1 when the controller has information for the host. It is cleared when the parameter register is read. Otherwise it is 0.

14 Controller Error Bit
This bit is set to 1 when the VSV21 module has been reset; and will be cleared when a command is written to the command register, or when the parameter register is read after the parameter bit was set. Otherwise this bit is 0.

15 Status Valid Bit
This bit is set to 1 when the status of the above bits is valid. When 0 it indicates that the status is not valid and the bits may be updated. For valid information, the host must wait until this bit is set before taking action in response to this register.

4.1.4 The Command Register

This register is used for passing commands from the host to the VSV21 module.

4.1.5 The Parameter Register

This is a read/write register. The host writes into this register when it needs to send parameters prior to writing to the command register. The host reads this register in response to a valid set Parameter Ready Bit, and keeps reading this register for more data until the Parameter Ready Bit is clear.

4.2 ON-BOARD DIAGNOSTIC

4.2.1 Test Indications

Make sure that a color monitor is connected to the VSV21 module, as described in Section 2.3, step 3. Make sure also that the system power is switched OFF. Observe the M7656 LEDs and switch the system power ON. Both green and red LEDs should come on. After about one second the green LED will go OFF and the red LED will stay ON. This indicates that the M7656 module has passed the first stage of testing.

After another four seconds, the green LED will come ON again, and the red LED will go OFF. This indicates that the module has passed the second stage of testing (see Figure 4-1). Examine the monitor display. It must show a picture like that in Figure 4-2. If the picture is unstable, if the circle is distorted, or if the white border is not centered, then you need to adjust the monitor controls as described in the manufacturer's documentation.

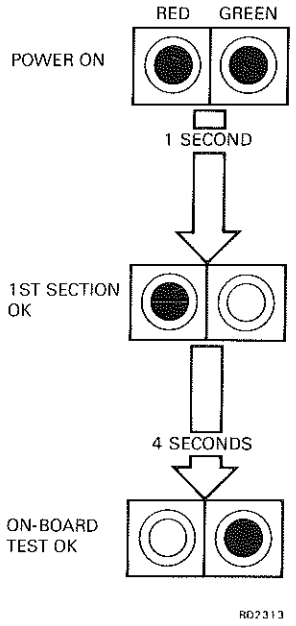

Figure 4-1 On-Board Diagnostic LED Indication

If the displayed picture is incorrect, check the video 3-color cable and all the associated connections, and check the monitor as described in Section 4.2.3. If the picture is still incorrect, or if the LEDs indicate that a failure has occurred during this stage, you must replace the M7656 module.

When tests are completed without failure, you can define the version of LK201 keyboard attached to the VSV21, so that it will be correctly interpreted. The VSV21 is normally supplied to accept the USA version LK-201-AA.

4.2.2 Keyboard Version Selection

If the keyboard version has not been permanently saved in NVRAM, then it can be selected after the completion of every power-up self-test. If it has been saved, then it can only be changed either by software control or by running the Parameters Reset test of the diagnostic suite.

The picture referred to in Section 4.2.1 shows whether the keyboard version has been saved or not. If not, it displays the message NVRAM X on a red rectangular background. You can now enter the number associated with the keyboard version, then press RETURN and the VSV21 will clear the display and enter VT220 emulation mode.

Refer to Table 4-2 for the correct number associated with the different supported keyboard versions.

If the keyboard version has been previously saved, then the picture will display the message NVRAM v on a green rectangular background. The keyboard version can only be changed either by program control or by resetting the NVRAM using the diagnostic programs. Press RETURN and the VSV21 clears the screen and enters the VT220 emulation mode.

You can now run the host-based diagnostics.

4.2.3 Monitor Adjustment

When the on-board diagnostics have completed without an indication of failure, the test display picture should appear on the monitor screen. This picture provides a white border all round the screen, with a yellow circle in the middle, as shown in Figure 4-2.

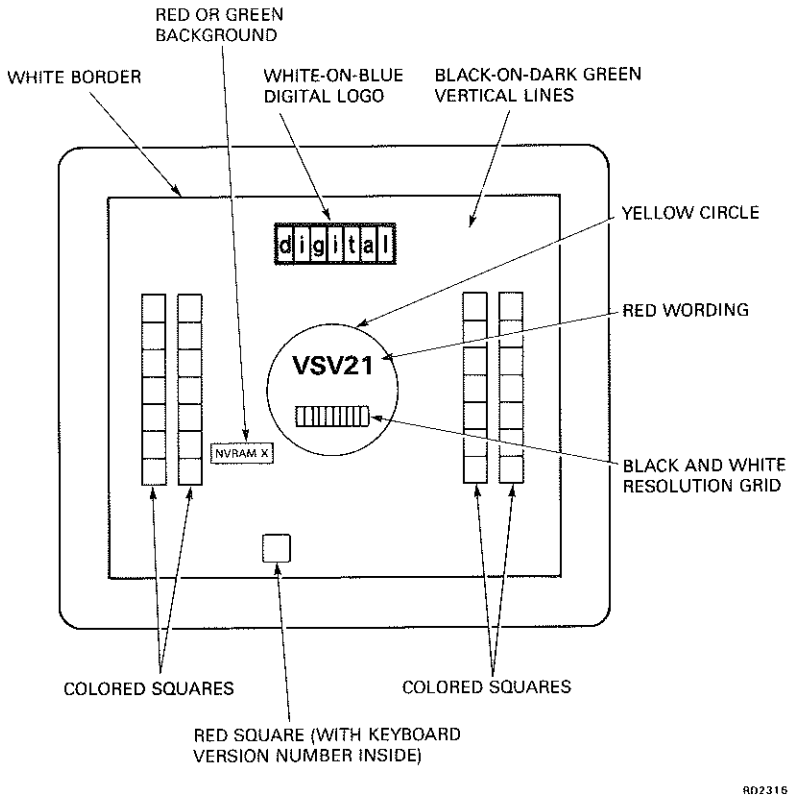

Figure 4-2 Self-Test Test Picture

If you are using a high-resolution BARCO monitor, as recommended, refer to the manufacturer's documentation if any adjustment is needed.

If the monitor is a DIGITAL VR241-A and any adjustment is needed, remove the outer cover by releasing the four screws. Find the Vertical Gain adjustment, and adjust it until the displayed circle is undistorted. Replace the cover.

4.3 HOST-BASED DIAGNOSTICS

4.3.1 XXPD+ Diagnostic Programs

The following tests are performed under the XXDP+ Version 2 Supervisor by the VSV21 diagnostic CZVSWB0:

1. VERIFY

   This test verifies the presence of the VSV21.

2. IN-DEPTH-Q22

   This is an extensive test of DMA.

3. FORCED-ERROR

   Error bit test.

4. ROM-CHECKSUM-TEST

   Tests the integrity of the ROM.

5. NVRAM-CHECKSUM-TEST

   Tests the integrity of the non-volatile RAM.

6. RAM-TEST

7. RAM-ADDRESSING-TEST

8. 68000-PROCESSOR-TEST

9. INTERNAL-EXCEPTIONS-TEST

10. ACRTC-INTERNAL-TEST

    (ACRTC = Advanced CRT Controller)

11. ACRTC-EXTERNAL-TEST

12. DUART-BASIC-TEST

    (DUART = Dual Universal Asynchronous Receiver Transmitter)

13. DUART-FULL-TEST

14. FULL-ON-BOARD-TEST

    This test runs the on-board diagnostics.

15. INTERNAL-LOOPBACK-TEST

16. EXTERNAL-I/O-LOOPBACK-TEST

17. NVRAM-READ/WRITE-TEST

18. DISPLAY-PICTURES-TEST

    This test outputs a selected screen color or pattern to the monitor.

19. KEYBOARD CONFIDENCE TEST

20. POINTING DEVICE CONFIDENCE TEST

21. PERIPHERAL-CONFIDENCE

    This test inputs or outputs data to selected peripherals.

22. CONTROL-PARAMETERS-RESET

    This is not really a test but a function used mainly at the factory and for resetting the NVRAM in the field.

4.4 RUNNING PDP-11 DIAGNOSTICS

NOTE: You cannot run host-based diagnostics on the VSV21 when it is configured as the system console. You should connect another terminal to the host system to act as system console instead.

To run the diagnostic package:

1. Fit the loopback test connectors

2. Boot XXDP+ Version 2

3. The system responds with the display:

   ```
   XXDP-SM SMALL MONITOR VER.2
   ....
   ....
   THIS IS XXDP-SM  TYPE 'H' OR 'H/L' FOR HELP
   ```

   Type:

   ```
   R  ZVSWB?
   ```

   to load and run the VSV21 diagnostic.

The Diagnostic Runtime Service is loaded, and the program started. The following message is output:

```
DRSSM-F0
CZVSWB?-A-0
VSV21 DIAGNOSTIC
UNIT IS VSV21
RSTRT ADR ???????

DR>
```

5. At the DR> prompt type:

   STA/FLA:UAM

6. Answer Y to the 'CHANGE H/W (L) ?' query

7. In answer to the ' # UNITS (D) ?' prompt, type the number of units under test.

8. Type the address and the vector for each unit under test (see Figures 2-4 and 2-5).

The program asks if you want to change the software. This allows you to run the tests without interrupts enabled. If you want this option, answer YES to the query.

The diagnostic tests now start to test the VSV21 module(s) and execute the non-intervention tests 1 to 16. At the end of each pass, the pass error-count is printed. Allow at least three error-free passes to complete before you continue the test.

9. Press CTRL/C to return the diagnostic to command mode.

You can now request the manual-intervention tests. They are:

- Test 17 NVRAM Read/Write Test
- Test 18 Screen Test
- Test 19 Keyboard Confidence Test
- Test 20 Pointing Device Confidence Test
- Test 21 Peripheral Confidence Test
- Test 22 Control Parameter reset

Test 17 NVRAM Read/Write Test

This test checks the non-volatile RAM on the VSV21 module.

At the DR> prompt type:

```
STA/PASS:1-2:17
```

The diagnostic starts the execution of the test and asks the following question:

```
**WARNING** WRITING TO NVRAM REDUCES ITS LIFE
DO YOU STILL WANT TO DO THIS TEST. (L) ?
```

Type Y. The diagnostic will now test the NVRAM.

Test 18 Display Test Pictures

This test generates and displays selected pictures on the monitor screen.

At the DR> prompt type:

```
STA/PASS:1/TEST:1-2:18
```

The diagnostic starts the execution of the test and asks the following question:

```
PICTURE NUMBERS ARE :
0 = FINISH THIS TEST
1 = RED SCREEN
2 = GREEN SCREEN
3 = BLUE SCREEN
4 = WHITE SCREEN
5 = CROSS HATCH AND CIRCLE (HIGH RESOLUTION SCREEN)
6 = CROSS HATCH AND CIRCLE (LOW RESOLUTION SCREEN)
7 = VERTICAL COLOR BARS
8 = VERTICAL GREY SCALE BARS
PLEASE INPUT PICTURE NUMBER
```

Type the number you want and press the RETURN key.

Examine the picture displayed on the monitor screen. If necessary, use this to make any adjustments to the monitor. You can repeat the test to select any other test picture you need.

Pictures numbers 5 and 6 display a cross-hatched screen with a circle in the center. Picture number 5 is for high-resolution monitors and picture number 6 is for low-resolution monitors.

Test 19 Keyboard Confidence Test

This test displays the ASCII code (in octal) of the first six keys pressed after the test is started. You can verify the codes by comparing them with the information in the ZVSWB0 list file or the table in Appendix B.

At the DR> prompt type:

STA/PASS:1/TEST:1-2:19

Then press the six keys.

Test 20 Pointing Device Confidence Test

This test allows you to choose the correct test for the pointing device attached to the system being tested.

At the DR> prompt type:

STA/PASS:1/TEST:1-2:20

Test 1 is for the Measurement Instruments joystick

Test 2 is for the Penny & Giles joystick

Test 3 is for the USXXX-AB Digitizing tablet

This test expects you to activate the pointing device. It displays six consecutive values of X and Y from the device. You must not interpret these values numerically. You should only examine the signs of X and Y in order to determine if the correct quadrant is indicated.

Test 21 Peripheral Device Confidence Test

This test is a general-purpose peripheral confidence test, which allows you to select a port as follows:

Port 0 = Keyboard port, 4-way jack (J2)

Port 1 = Host port, 9-pin D-type (J3)

Port 2 = Pointing device port, 25-pin D-type (J4)

Port 3 = Transparent serial port, 9-pin D-type (J5)

If output is selected, then the test will output a fixed ASCII string as follows:

/!@#$%^&*()_+1234567890QWERTYUIOP{}asdfghjkl;'/

If input is selected, the first 16 characters input to the port are displayed on the console running the test.

This test should only be run when there is no specific test for the peripheral device.

Test 22 Control Parameter Reset

This routine allows you to reset the on-board NVRAM to its default setting.

The following list shows the supported LK-201 keyboard versions and the associated code number to select that version:

Table 4-2 Code Numbers of Supported Keyboards

USA	LK-201-AA	Code 00
UK	LK-201-AE	Code 01
Swedish	LK-201-AM	Code 02
Dutch	LK-201-AH	Code 03
Flemish	LK-201-AB	Code 04
Canadian/French	LK-201-AC	Code 05
Danish	LK-201-AD	Code 06
Finnish	LK-201-AF	Code 07
German	LK-201-AG	Code 08
Italian	LK-201-AI	Code 09
Swiss/French	LK-201-AK	Code 10
Swiss/German	LK-201-AL	Code 11
Norwegian	LK-201-AN	Code 12
French	LK-201-AP	Code 13
Spanish	LK-201-AS	Code 14

A warning is issued when this test starts, that permanent control parameters will be reset. If these parameters are reset without subsequent change, then the VSV21 will display an 'NVRAM FAIL' message every time it goes through its self-test.

When all these tests have been run successfully, the installation checkout of the VSV21 is complete.

Press CTRL/C to return the diagnostic to the DR> prompt.

4.5 RUNNING MicroVAX MDM DIAGNOSTICS

NOTE: You cannot run host-based diagnostics on the VSV21 when it is configured as the system console. You should connect another terminal to the host system to act as system console instead.

The following tests are available for the MicroVAX installation:

v=Verify Mode
s=Service Mode

FUNCTIONAL RESTS

1v – In-Depth Q-22 Bus Test
2v – ROM Checksum Test
3v – NVRAM Checksum Test
4v – RAM Test
5v – RAM Addressing Test
6v – 68000 Processor Test
7v – Internal Exceptions Test
8v – ACRTC Internal Test
9v – ACRTC External Test
10v – Illegal Command Test
11s – Basic DUART Test (Loopback connectors needed)
12s – Full DUART Test (Loopback connectors needed)
13s – Full On-board Test (Loopback connectors needed)
14s – External Loopback Test (Loopback connectors needed)
15s – External Loopback Test (Loopback connectors needed)

EXERCISER TEST

1v – Verify DMA Test
2v – Verify Screen Exerciser
3s – Service Exerciser

UTILITIES

1 – Monitor Test Picture Utility
2 – NVRAM Reset Utility
3 – On-board Error Control Set-up Utility
4 – Peripheral Confidence Test Utility
5 – Keyboard Confidence Test Utility
6 – MSI Pointing Device Test Utility
7 – NVRAM Read/Write Test Utility

Table 4-3 shows which tests are performed under the different MDM modes.

The recommended tests to check out the VSV21 are:

- Functional Tests 1 to 15 (Service Mode), 4 Passes
- Exerciser Test 1 to 3 as part of the overall MDM system exerciser
- Utilities 1 and 4 to 7 (depending on connected peripherals), 1 Pass

Table 4-3 Diagnostic Tests Under MDM

	Verify Mode	Service Mode
Functional Tests	Tests 1 to 10	Tests 1 to 15
Exerciser Tests	Tests 1 and 2,	Tests 1 to 3
Utility Tests	Tests 1 to 7	

APPENDIX A
MULTIPLE OPTIONS

A.1 FLOATING DEVICE ADDRESSES

On Q-bus systems, a block of addresses in the top 4K words of address space is reserved for options with floating device-addresses. This range is from 17760010 to 17763776_8.

Options which can be assigned floating device addresses are listed in Table A-1. This table gives the sequence of addresses for both UNIBUS and Q-bus options. For example, the address sequences could be:

UNIBUS	Q-Bus
DJ11	DJ11
DH11	DH11
DQ11	DQ11
DU11	DUV11
DUP11	DUP11 and so on.

Having one list allows us to use one set of configuration rules and one configuration program.

Table A-1 Floating Device Address Assignments

Rank	Device	Size (Decimal)	Modulus (Octal)
1	DJ11	4	10
2	DH11	8	20
3	DQ11	4	10
4	DU11, DUV11	4	10
5	DUP11	4	10
6	LK11A	4	10
7	DMC11/DMR11	4	10 (DMC before DMR)
8	DZ11/DZV11, DZS11, DZ32	4	10 (DZ11 before DZ32)
9	KMC11	4	10
10	LPP11	4	10
11	VMV21	4	10

Table A-1 Floating Device Address Assignments (Cont)

Rank	Device	Size (Decimal)	Modulus (Octal)
12	VMV31	8	20
13	DWR70	4	10
14	RL11, RLV11	4	10 *
15	LPA11-K	8	20 *
16	KW11-C	4	10
17	VSV21	4	10
18	RX11/RX211, RXV11/RXV21	4	10 * (RX11 before RX211)
19	DR11-W	4	10
20	DR11-B	4	10 **
21	DMP11	4	10
22	DPV11	4	10
23	ISB11	4	10
24	DMV11	8	20
25	DEUNA	4	10 *
26	UDA50/RQDX1	2	4 *
27	DMF32	16	40
28	KMS11	6	20
29	VS100	8	20

* The first device of this type has a fixed address. Any extra devices have a floating address.

** The first two devices of this type have a fixed address. Any extra devices have a floating address.

NOTE: DZ11-E and DZ11-F are treated as two DZ11s.

The address assignment rules are as follows.

1. Addresses, starting at 760010_8 for UNIBUS systems, are assigned according to the sequence of Table A-1.

2. Option and gap addresses are assigned according to the octal modulus as follows.

   a. Devices with an octal modulus of 4 are assigned an address on a 4_8 boundary (the two lowest-order address bits = 0).

   b. Devices with an octal modulus of 10 are assigned an address on a 10_8 boundary (the three lowest-order address bits = 0).

   c. Devices with an octal modulus of 20 are assigned an address on a 20_8 boundary (the four lowest-order address bits = 0).

   d. Devices with an octal modulus of 40 are assigned an address on a 40_8 boundary (the five lowest-order address bits = 0).

3. Address space equal to the device's modulus must be allowed for each device which is connected to the bus.

4. A 1-word gap, assigned according to rule 2, must be allowed after the last device of each type. This gap could be bigger when rule 2 is applied to the following rank.

5. A 1-word gap, assigned according to rule 2, must be allowed for each unused rank on the list if a device with a higher address is used. This gap could be bigger when rule 2 is applied to the following rank.

If extra devices are added to a system, the floating addresses may have to be reassigned in agreement with these rules.

In the following example, a brief description of Q-bus address assignment is given. Note that the list includes floating vector addresses. These are explained in Section A.2.

Example: One DU11, one RL11, and two DHU11s

Address (Octal)		Vector
17760010	DJ11 gap	
17760020	DH11 gap	
17760030	DQ11 gap	
17760040	DU11	300
17760050	DU11 gap	
17760060	DUP11 gap	
17760070	LK11A gap	
17760100	DMC11 gap	
17760110	DZ11 gap	
17760120	KMC11 gap	
17760130	LPP11 gap	
17760140	VMV21 gap	
17760160	VMV31 gap	
17760170	DWR70 gap	
17760200	RL11	310
17760210	RL11 gap	
17760220	LPA11-K gap	
17760230	KW11-C gap	
17760240	reserved gap	
17760250	RX11 gap	
17760260	DR11-W gap	
17760270	DR11-B gap	
17760300	DMP11 gap	
17760310	DPV11 gap	
17760320	ISB11 gap	

Address (Octal)		Vector
17760340	DMV11 gap	
17760350	DUENA gap	
17760354	UDA50 gap	
17760400	DMF32 gap	
17760420	KMS11 gap	
17760440	VS100 gap	

The first floating address is 760010. As the DJ11 has a modulus of 10_8, its gap can be assigned to 760010. The next available location becomes 760012.

As the DH11 has a modulus of 20_8, it cannot be assigned to 760012. The next modulo 20 boundary is 760020, so the DH11 gap is assigned to this address. The next available location is therefore 760022.

A DQ11 has a modulus of 10_8. It cannot be assigned to 760022. Its gap is therefore assigned to 760030. The next available location is 760032

A DU11 has a modulus of 10_8. It cannot be assigned to 760032. It is therefore assigned to 760040. As the 'size' of DU11 is four words, the next available address is 760050.

There is no second DU11, so a gap must be left to indicate that there are no more DU11s. As 760050 is on a 10_8 boundary, the DU11 gap can be assigned to this address. The next available address is 760052.

And so on.

A.2 FLOATING VECTORS

Each device needs two 16-bit locations for each vector. For example, a device with one receive and one transmit vector needs four words of vector space.

The vector assignment rules are as follows.

1. Each device occupies vector address space equal to 'Size' words. For example, the DLV11-J occupies 16 words of vector space. If its vector was 300_8, the next available vector would be at 340_8.

2. There are no gaps, except those needed to align an octal modulus.

An example of floating vector address assignment is given in Section A.1.

Table A-2 Floating Vector Address Assignments

Rank	Device	Size (Decimal)	Modulus (Octal)	
1	DC11	4	10	
1	TU58	4	10	
2	KL11	4	10	
2	DL11-A	4	10	
2	DL11-B	4	10	
2	DLV11-J	16	10	
2	DLV11, DLV11-F	4	10	
3	DP11	4	10	
4	DM11-A	4	10	
5	DN11	2	4	
6	DM11-BB/BA	2	4	
7	DH11 modem control	2	4	
8	DR11-A, DRV11-B	4	10	
9	DR11-C, DRV11	4	10	
10	PA611 (reader + punch)	8	10	
11	LPD11	4	10	
12	DT07	4	10	
13	DX11	4	10	
14	DL11-C to DLV11-E	4	10	
15	DJ11	4	10	
16	DH11	4	10	
17	VT40	8	10	
17	VSV11	8	10	
18	LPS11	12	10	
19	DQ11	4	10	
20	KW11-W, KWV11	4	10	
21	DU11, DUV11	4	10	
22	DUP11	4	10	
23	DV11 + modem control	6	10	
24	LK11-A	4	10	
25	DWUN	4	10	
26	DMC11/DMR11	4	10	(DMC before DMR)
27	DZ11/DZS11/DZV11, DZ32	4	10	(DZ11 before DZ32)
28	KMC11	4	10	
29	LPP11	4	10	
30	VMV21	4	10	
31	VMV31	4	10	
32	VTV01	4	10	
33	DWR70	4	10	
34	RL11/RLV11	2	4 *	

Table A-2 Floating Vector Address Assignments (Cont)

Rank	Device	Size (Decimal)	Modulus (Octal)
35	TS11, TU80	2	4 *
36	LPA11-K	4	10
37	IP11/IP300	2	4 *
38	KW11-C	4	10
39	RX11/RX211 RXV11/RXV21	2	4 * (RX11 before RX211)
40	DR11-W	2	4
41	DR11-B	2	4 *
42	DMP11	4	10
43	DPV11	4	10
44	ML11	2	4 (MASSBUS device)
45	ISB11	4	10
46	DMV11	4	10
47	DUENA	2	4 *
48	UDA50/RQDX1	2	4 *
49	DMF32	16	4
50	KMS11	6	10
51	PCL11-B	4	10
52	VS100	2	4

* The first device of this type has a fixed vector. Any extra devices have a floating vector.

NOTE: A KL11 or DL11 used as the console, has a fixed vector. ML11 is a MASSBUS device which can connect to UNIBUS via a bus adapter.

APPENDIX B
LK-201 KEYBOARD CODES

This appendix provides information about the LK-201 keyboard key layout, and the associated codes generated by each key when depressed.

Figure B-1 below shows the keyboard layout.

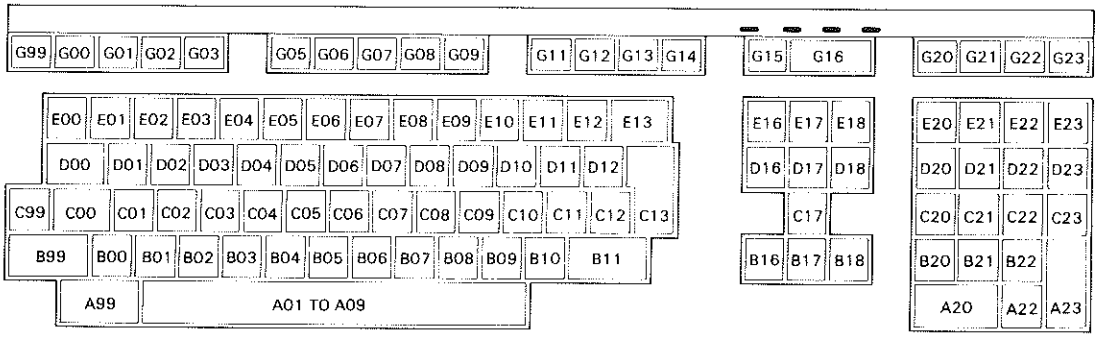

Figure B-1 LK-201 Keyboard Key Layout

The following list shows the Decimal code generated by each of the LK-201 keys:

Key position	Decimal code	Key position	Decimal code
G99	086	G11	113
G00	087	G12	114
G01	088	G13	115
G02	089	G14	116
G03	090	G15	124
G05	100	G16	125
G06	101	G20	128
G07	102	G21	129
G08	103	G22	130
G09	104	G23	131

Key position	Decimal code	Key position	Decimal code
E00	191	C04	210
E01	192	C05	216
E02	197	C06	221
E03	203	C07	226
E04	208	C08	231
E05	214	C09	236
E06	219	C10	242
E07	224	C11	251
E09	234	C12	247
E10	239	C13	189
E11	249	C17	170
E12	245	C20	153
E13	188	C21	154
E16	138	C22	155
E17	139	C23	156
E18	140	B99	174
E20	161	B00	201
E21	162	B01	195
E22	163	B02	200
E23	164	B03	206
D00	190	B04	211
D01	193	B05	217
D02	198	B06	222
D03	204	B07	227
D04	209	B08	232
D05	215	B09	237
D06	220	B10	243
D07	225	B16	167
D08	230	B17	169
D09	235	B18	168
D10	240	B20	150
D11	250	B21	151
D12	246	B22	152
D16	141	A99	177
D17	142	A01--A09	212 (SPACE BAR)
D18	143	A20	146
D20	157	A22	148
D21	158	A23	149
D22	159		
D23	160		
C99	175		
C00	176		
C01	194		
C02	199		
C03	205		

INDEX

READER'S COMMENTS

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

1. **Which of the following most closely describes your job?** 1 (a) (b) (c) (d) (e) (f) (g) (h) (i)

   (a) Administrative support (d) Scientist/Engineer (g) Educator/Trainer
   (b) Programmer/Analyst (e) Systems Manager (h) Computer Operator
   (c) Software support (f) Sales (i) Other _____

2. **How many years of experience do you have with computers?** 2 (a) (b) (c) (d) (e)

   (a) Less than 1 (b) 1 to 3 (c) 4 to 6 (d) 7 to 9 (e) 10 or more

3. **What did you like *most* about this manual?**

4. **What did you like *least* about this manual?**

5. **How do you rate this manual?**

   Indicate your opinion of the quality of the manual. For each aspect of quality, darken your response on the five-point scale, where (1) = POOR and (5) = EXCELLENT

(a)	Accuracy	(1)	(2)	(3)	(4)	(5)
(b)	Completeness	(1)	(2)	(3)	(4)	(5)
(c)	Usefulness of Examples/Figures	(1)	(2)	(3)	(4)	(5)
(d)	Clearness of Language	(1)	(2)	(3)	(4)	(5)
(e)	Helpfulness of Index/Table of Contents	(1)	(2)	(3)	(4)	(5)
(f)	Consistency in Presenting Information	(1)	(2)	(3)	(4)	(5)
(g)	Logical Organization	(1)	(2)	(3)	(4)	(5)
(h)	Visual Appeal	(1)	(2)	(3)	(4)	(5)
(i)	Relevance of Information	(1)	(2)	(3)	(4)	(5)
(j)	Ease of Learning	(1)	(2)	(3)	(4)	(5)
(k)	Ease of Use	(1)	(2)	(3)	(4)	(5)
(l)	YOUR OVERALL IMPRESSION	(1)	(2)	(3)	(4)	(5)
(m)	Quality Relative to Other Digital Manuals	(1)	(2)	(3)	(4)	(5)
(n)	Quality Relative to Other Companies' Manuals	(1)	(2)	(3)	(4)	(5)

6. **List any errors you found in the manual. (Reference page, table, or figure numbers.)**

7. **Do you have any additional comments?**

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VSV21 INSTALLATION MANUAL ADDENDUM

AD-FV71B-T1

PAGE 8 SECTION 2.3

Steps 1 and 2

Note: The required addresses and vectors for VSV21 installations in MicroVAX II systems are as follows:

Dev No.	Address	Vectors
1	7772000	300
2	7772010	320
3	7772020	340
4	7772030	360

These addresses and vectors are to enable the VSV21 to be tested successfully by the MicroVAX II diagnostic system (MDM 1.10).

PAGE 11 SECTION 2.3

Step 7

It is recommended that you do not measure the power supply voltages on the backplane but on the PSU terminals.

PAGE 11 SECTION 2.3

Step 8

Note: Interfaces in MicroVAX II systems should be installed into the backplane in a sequence derived from the following list, with the device with the lowest number being placed nearest the processor:

1) TSV05	2) DMV11	3) TK25	4) VSV21
5) DHV11	6) DEQNA	7) TK50	8) RLV12
9) RRD50	10) KDA50-Q	11) RQDX3	12) LESI-QA
13) RQDX2	14) DRV11-WA		

PAGE 24 SECTION 4.2.2

NVRAM v should read NVRAM (tick character), i.e. a "v" with the right stroke longer than the left stroke.

PAGE 28 SECTION 4.4

Test 17 NVRAM Read/Write Test

The command line should be as follows:

STA/PASS:1/TEST:1-2:17

Add the following text:

Note: If this test is run whilst the VSV21 is set to its factory default settings (indicated by an

NVRAM X message on the test picture), these defaults will be set permanently (indicated by an NVRAM "tick" message on he test picture) and the keyboard version number will be set to the default US version.

29 4.4 Test 20 Pointing Device Confidence Test

Test 3 is for the VSXXX-AB Digitizing Tablet.

32 4.5 Add the following text:

Utility Test 7 NVRAM Read/Write Test

Note: If this test is run whilst the VSV21 is set to its factory default settings (indicated by an NVRAM X message on the test picture), these defaults will be set permanently (indicated by an NVRAM "tick" message on he test picture) and the keyboard version number will be set to the default US version.

37 App A Table A-2

Add the following text:

Rank	Device	Size (Decimal)	Modulus (Octal)
17	VSV21	2	4