Manual Organization

The manual is organized into four chapters and an appendix.

- The remainder of this chapter describes the QNIVERTER II.
- The second chapter contains a step-by-step installation procedure.
- The third chapter describes QNIVERTER II applications.
- The fourth chapter describes care and service; it gives detailed troubleshooting information and tells how to call for support.
- Appendix A tells how to order DEC handbooks.
- Appendix B provides Q-bus connector assignments.
- Appendix C provides UNIBUS connector assignments.

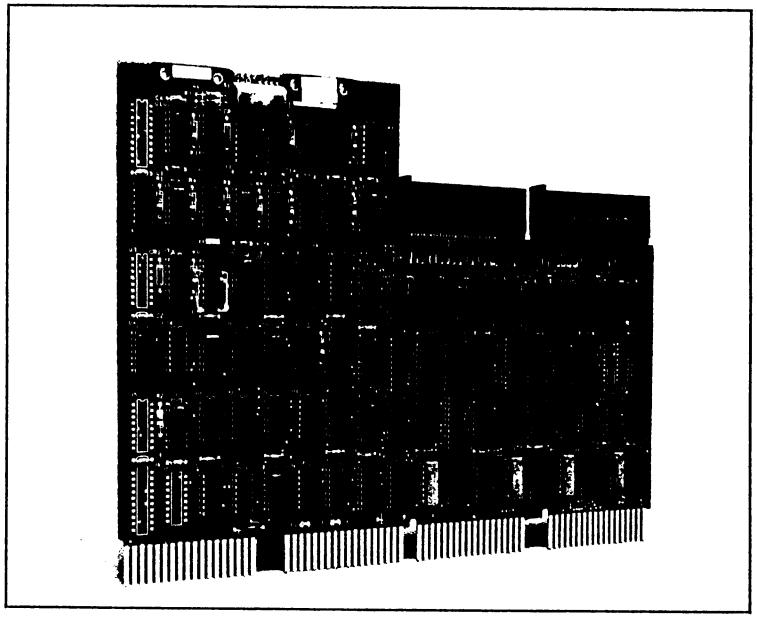


Figure 1-1: QNIVERTER II

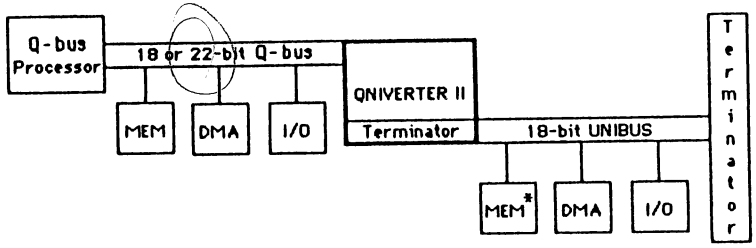
Product Description

The QNIVERTER II is a quad-width Q-bus board that performs one of two functions:

In a Q-Bus System:

Used in an LSI-11/2, LSI-11/23, LSI-11/73, MicroVAX I, MicroVAX II, or PDP-11/03 computer system, QNVERTER II allows access to UNIBUS compatible controllers and memories. The Q-bus CPU remains as bus arbitrator. The QNIVERTER II provides the ability for 18-bit UNIBUS DMA devices to access one of multiple 256K byte pages within the 22-bit Q-bus address range. The DMA page address is user switch selectable. Figure

1-2 is a simplified block diagram of this application.

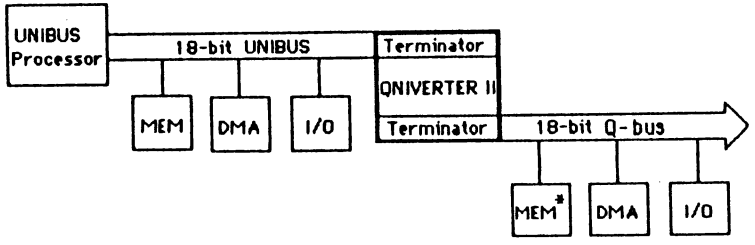


* UNIBUS memory is not allowed on 22-bit systems with more than 256K byte or cache memory.

Figure 1-2: Simplified Block Diagram of a Q-bus CPU System

In a UNIBUS System:

QNIVERTER II allows a PDP-11 UNIBUS system such as the PDP-11/34 and PDP-11/70 to access Q-bus compatible controllers and memories. The bus arbitration is performed by the UNIBUS CPU. Figure 1-3 shows a simplified block diagram.



* On systems with cache memory, Q-bus memory can be used only if excluded from cache operation.

Figure 1-3: Simplified Block Diagram of a UNIBUS System

With QNIVERTER II, memories and controllers may reside on

both the UNIBUS and Q-bus. NPR data transfers are supported across the QNIVERTER II in either direction.

The QNIVERTER II installs into a quad slot of a Q-bus backplane. A pair of UNIBUS connectors on the board provides connection to the UNIBUS via a UNIBUS cable (not supplied). The QNIVERTER II arbitration and system functions are user switch selectable.

Features

- Provides switch selection for UNIBUS DMA from/to 22-bit Q-bus memory on 256K byte page boundaries
- Readily available UNIBUS devices can be used on a Q-bus computer system.
- Less expensive and more compact Q-bus devices can be used on a UNIBUS computer system.
- Requires only one quad slot in a Q-bus backplane.
- Supports four-level interrupt structure on the Q-bus.
- Parity memory supported.
- Supports full 256K byte DMA addressing (248K byte memory plus 8K byte I/O).
- Software transparent to 18-bit address operating systems.
- Q-bus drive capability equivalent to a Q-bus computer system can be added to a UNIBUS computer system.
- 19 UNIBUS loads can be added to an LSI-11 computer system.
- Switch selectable configuration.
- Excellent performance history.
- Transparent to all devices on both buses.
- Supports a CPU on either bus.

Specifications

Physical

Dimensions:	10.5 in. (26.7 cm) by 8.4 in. (21.3 cm) excluding handles.

Electrical

Power Required:	3.2 amps @ 5 volts in a UNIBUS computer system. 2.5 amps @ 5 volts in a Q-bus computer system.

Environmental

Operating Temperature:	32° to 122°F (0° to 50°C)
Humidity:	85% noncondensing

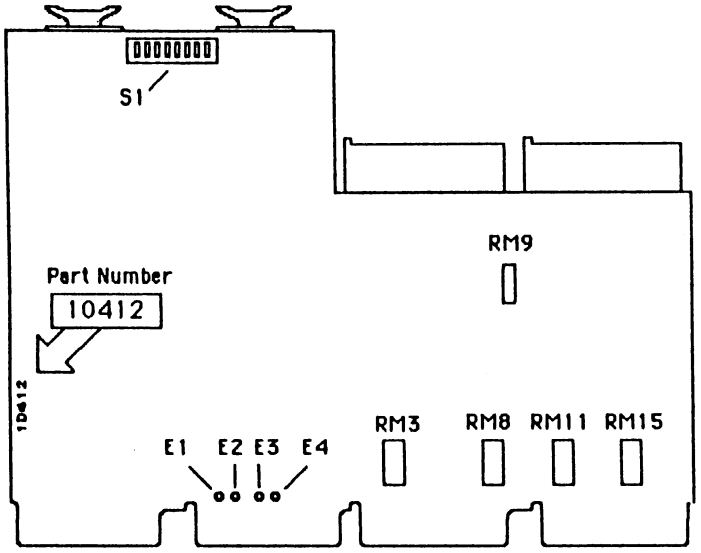


Figure 2-1: QNIVERTER II Board Layout

Switch Settings

An eight position switch on the board (S1) allows selection of DMA address page, UNIBUS or Q-bus arbitration, and 18 or 22-bit address support. Figure 2-1 shows the location of the switch, Figure 2-2 shows the function of each switch position. The following sections describe switch settings.

Note

For switches labelled ON:
On = Closed; Off = Open

SWITCHPACK 1 POSITION

8	7	6	5	4	3	2	1	ARBITRATOR
OPEN	OPEN	CLOSED	OPEN	CLOSED				UNIBUS CPU
OPEN	CLOSED	OPEN	OPEN*	CLOSED				18-BIT Q-BUS CPU
CLOSED	CLOSED	OPEN	OPEN*	CLOSED**				22-BIT Q-BUS CPU (such as the MicroVAX)
22B	UAR	QAR	IXD	A21	A20	A19	A18	

* Closed only for Q-Obus systems using the KDJ11-A series 11/73 dual-width processor board with a DH11 emulation device on the UNIBUS.

** Open only for special applications as described below.

Figure 2-2: Switch Settings

Address Offset Switches

Position	Option	Enabled (True)	Disabled (False)
1	A18	Open	Closed
2	A19	Open	Closed
3	A20	Open	Closed
4	A21	Open	Closed

These four switches are typically disabled (closed). They can be used in special applications to control the state of Q-bus address bits 18 through 21 during a UNIBUS DMA cycle. They provide an address offset of the 18-bit UNIBUS address to a particular 248K byte address range on the 22-bit Q-bus. The user selects which 248K byte range is chosen by enabling and/or disabling these four switches. Table 2-1 shows the switch settings for each address range.

Switch Position 1	2	3	4	DMA Address Range (248K bytes per range) 22-Bit Q-bus		
C	C	C	C	00000000	-	00757777
-	C	C	C	01000000	-	01757777
C	-	C	C	02000000	-	02757777
-	-	C	C	03000000	-	03757777
C	C	-	C	04000000	-	04757777
-	C	-	C	05000000	-	05757777
C	-	-	C	06000000	-	06757777
-	-	-	C	07000000	-	07757777
C	C	C	-	10000000	-	10757777
-	C	C	-	11000000	-	11757777
C	-	C	-	12000000	-	12757777
-	-	C	-	13000000	-	13757777
C	C	-	-	14000000	-	14757777
-	C	-	-	15000000	-	15757777
C	-	-	-	16000000	-	16757777
-	-	-	-	17000000	-	17757777

Note

The upper 8K bytes of the selected 256K byte bank of memory is mapped as the I/O page, leaving the standard 248K bytes of usable memory for UNIBUS DMA's.

Table 2-1: DMA Address Switch Settings

The QNIVERTER II also maintains the UNIBUS DMA to I/O space capability by asserting the Q-bus signal BBS7 when the UNIBUS DMA address is in the I/O address range as shown in Figure 2-3.

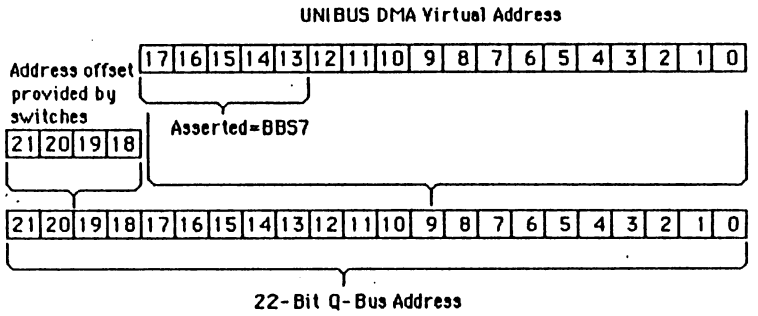


Figure 2-3: Address Offset

Mode Switches

Position	Option	Enabled (True)	Disabled (False)
5	IXD	Closed	Open

This switch is used only for a special application. It is enabled in applications where a UNIBUS DH11 emulation is being interfaced to a KDJ11-A series 11/73 processor through the QNIVERTER II. In all other applications, this switch should be disabled (Open).

Position	Option	Enabled (True)	Disabled (False)
6	QAR	Open	Closed

This switch is enabled in applications where the arbitrator is a Q-bus CPU. If QAR is enabled (Open) then UAR, switch position 7, must be Closed.

Position	Option	Enabled (True)	Disabled (False)
7	UAR	Open	Closed

This switch is enabled in applications where the arbitrator is a UNIBUS CPU. If UAR is enabled (Open), then QAR, switch position 6, must be Closed.

Position	Option	Enabled (True)	Disabled (False)
8	22B	Closed	Open

This switch is enabled in applications where the arbitrator is a 22-bit Q-bus processor. No memory can reside on the UNIBUS in this application since UNIBUS control signal

MSYN is only asserted by the QNIVERTER II during UNIBUS I/O transfers.

This switch is disabled for 18-bit Q-bus CPU applications, where memory can reside on the UNIBUS. It is also disabled in UNIBUS CPU applications where memory and I/O are permitted on both buses.

Installing QNIVERTER II into a UNIBUS System

The QNIVERTER II is shipped ready for installation in conjunction with a PDP-11 UNIBUS computer system such as the PDP-11/34. (For use with a Q-bus system, see below.) To verify that QNIVERTER II is ready to use for attaching Q-bus compatible devices to a PDP-11 UNIBUS, verify that resistor termination modules are installed in the following locations on the printed circuit board (see Figure 2-1):

- RM3, RM8, RM11, RM15 - Q-bus Termination - 330 ohm pull-up, 680 ohm pull-down
- RM9 - UNIBUS Termination - 390 ohm pull-down

Set the switches on switchpack 1 as described earlier in the chapter.

Equipment Needed with a UNIBUS System

The following additional equipment is needed to install the QNIVERTER II in a UNIBUS computer system:

- Q-bus expansion box(es) with adequate backplane space and power for installation of the QNIVERTER II and other desired Q-bus peripherals. If multiple Q-bus expansion boxes are used, additional bus cables and a terminator for the Q-bus are needed.

- One BC11-A UNIBUS cable of sufficient length to reach the Q-bus expansion box. (Total system UNIBUS should not exceed 50 feet or 19 UNIBUS loads.)

Board Installation into a UNIBUS System

The QNIVERTER II is installed in the first quad-width Q-bus backplane slot. Guide the board carefully into the card guides of the selected slot, orienting it in the same way as other boards. When the board begins to make contact with the backplane connectors, apply a little more force to seat it securely in the backplane.

Note

If you install the QNIVERTER II into a DEC BA11-N expansion chassis, remove the jumpers between E1 and E2 and between E3 and E4.

Cabling in a UNIBUS System

Connect the board to the UNIBUS by inserting one end of a UNIBUS cable into the connectors provided on the QNIVERTER II. Remove the UNIBUS terminator from the last slot in the UNIBUS backplane, and insert the other end of the UNIBUS cable into positions A and B of the UNIBUS-OUT slot. (The UNIBUS-OUT slot is slot 9 of a 9-slot backplane, slot 4 of a 4-slot backplane.) See Figure 2-4. This makes the QNIVERTER II the last device on the UNIBUS, and the UNIBUS termination is now supplied by the QNIVERTER.

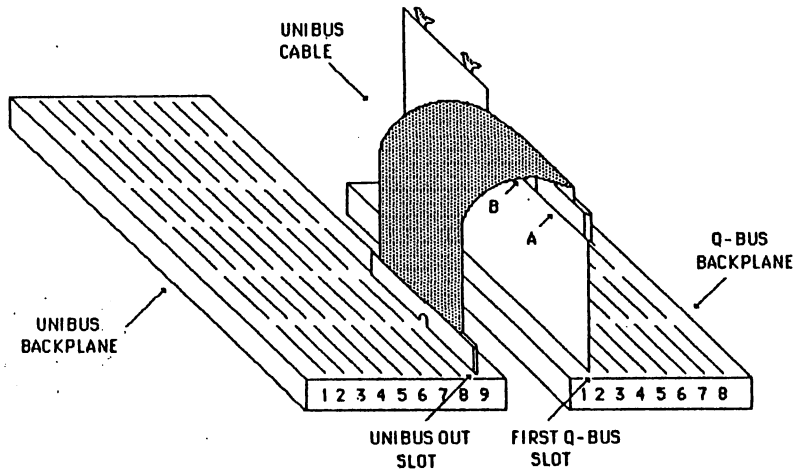


Figure 2-4: Installing the UNIBUS Cable in a UNIBUS System

Installing QNIVERTER II into a Q-Bus System

This section describes how to install the QNIVERTER II into a Q-bus system such as the MicroVAX or LSI-11.

The QNIVERTER II is shipped configured for use in a UNIBUS system. To configure it for the Q-bus, remove resistor termination modules RM9, RM3, RM8, RM11 and RM15 from their IC sockets. (See Figure 2-1.) Store them in a safe place for possible future use.

Set the switches on Switchpack 1 as described earlier in the chapter.

Equipment Needed with a Q-Bus System

- A UNIBUS expansion box (BA11 type) and backplane space for the installation of the required UNIBUS controllers.
- A quad-width Q-bus slot for installation of the QNIVERTER II.
- One BC11-A UNIBUS cable of sufficient length to reach the UNIBUS expansion box. (Total system UNIBUS should not exceed 50 feet or 19 UNIBUS loads.) If multiple UNIBUS expansion boxes are used, additional BC11-A bus cables are needed.
- An adapter kit for routing the UNIBUS cable out of the Q-bus system cabinet. Kits are available from ABLE, part number 10435-0.

Board Installation into a Q-Bus System

This section describes in general terms how to install the QNIVERTER II board into a Q-bus system. If you are not familiar with these procedures, consult your DEC field service

representative for assistance. Figures 2-5 and 2-6 give examples of installing the board into DEC BA 23 pedestal enclosures, BA123 office enclosures, and H9642 cabinets.

1. Bring your system down and remove AC power to the expansion cabinet that will contain the board.
2. Open the system cabinet and find a vacant quad Q-bus slot for the board. Keep in mind that priority level 4 devices should be located behind the QNIVERTER II, priority level 5, 6, and 7 devices should be placed ahead of the QNIVERTER II. Remove any bus grant continuity card from the slot. See Figure 2-5.
3. Insert the board into its slot orienting it in the direction of the existing modules. Lock it into place. See Figure 2-6.

Note

If you are expanding your system to install the QNIVERTER II into a DEC BA11-N expansion chassis, remove the jumpers between E1 and E2 and between E3 and E4 on the QNIVERTER II board.

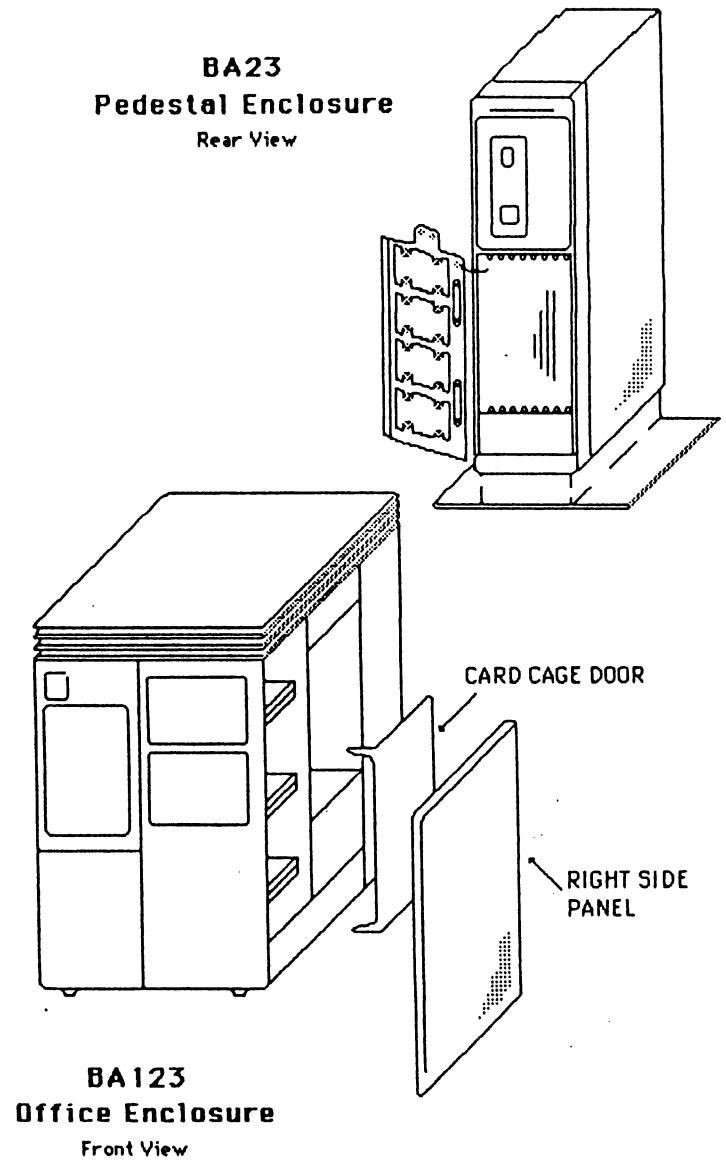


Figure 2-5: Accessing the Card Cage

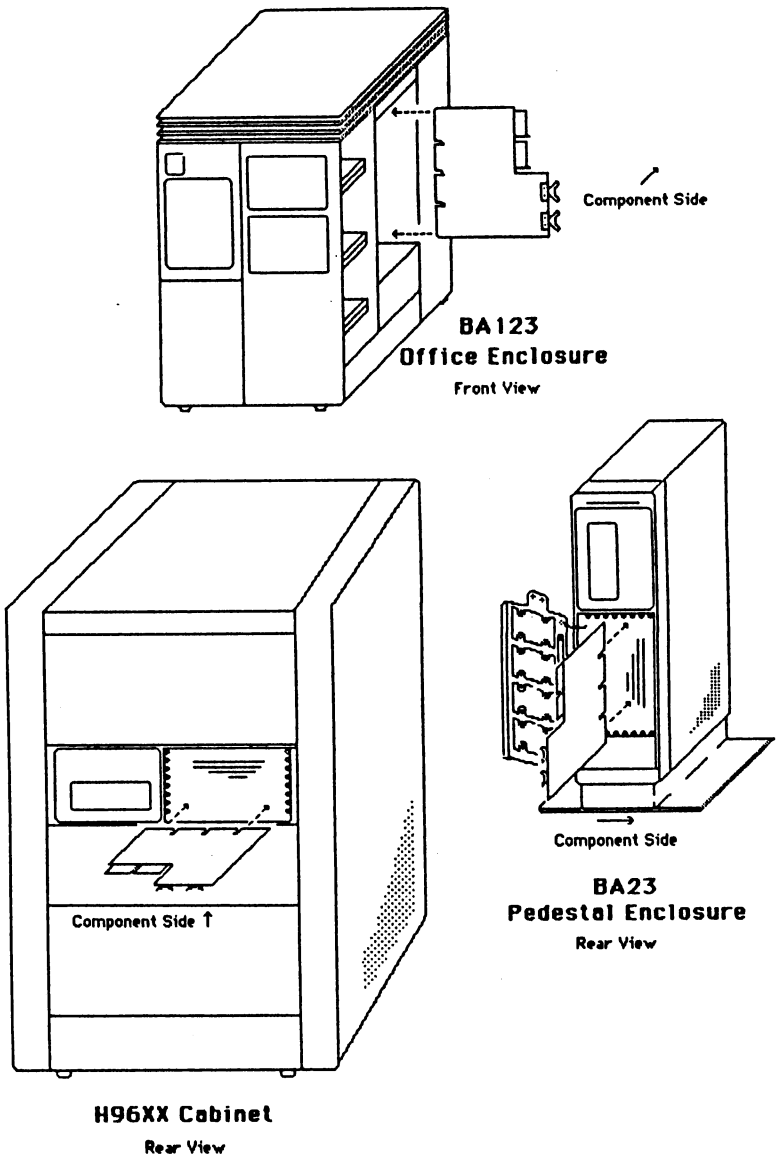


Figure 2-6: Installing the QNIVERTER II Board into Q-Bus Systems

Cabling QNIVERTER II in a Q-bus System

1. Install a UNIBUS cable into the top connectors on the QNIVERTER II board as shown in Figure 2-7.

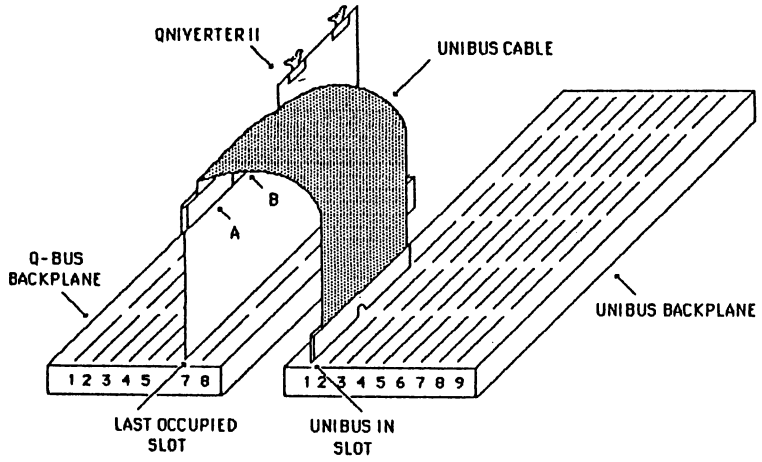


Figure 2-7: Installing the UNIBUS Cable in a Q-Bus System

2. Use the optional UNIBUS cable adapter panels to route the UNIBUS cable out of the Q-bus cabinet. To install the panel first remove the bracket post between two cutouts in the I/O connection panel, then install one adapter panel into the double-size cutout as shown in Figure 2-8. Route the UNIBUS cable through the cutout and then install the second adapter panel. (Note: two "A" size cutouts are provided for other I/O devices.)

3. Place the opposite end of the UNIBUS coble into the UNIBUS-IN slot of a DD11 type backplane 9connectors A and B) or into a UNIBUS-IN slot of an externally mounted controller. See Figure 2-7.

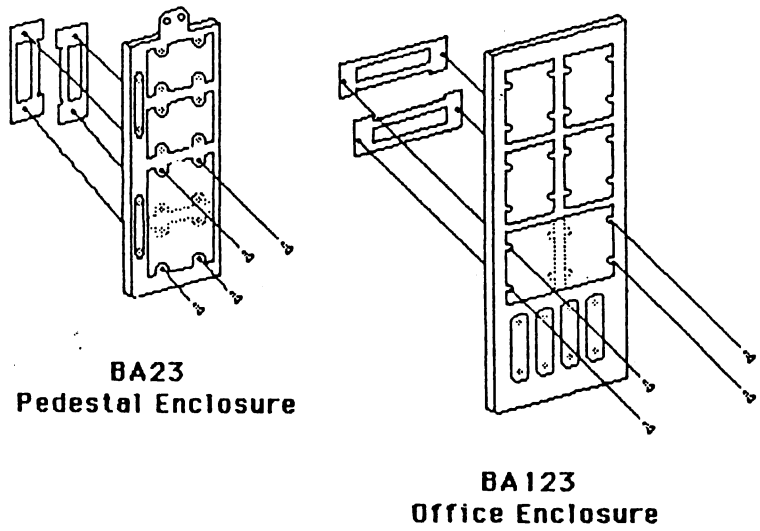


Figure 2-8: Installing the UNIBUS Cable Adapter Panel into a Q-Bus System

The QNIVERTER II provides UNIBUS termination for the beginning of the UNIBUS. The far end of the UNIBUS requires a separate M930 terminator, check that one is installed. Be sure that the UNIBUS controller and teminator are provided adequate power to allow proper system operation.

Installation Verification

The QNIVERTER II is totally software transparent to the arbitrating CPU system. Therefore, any diagnostic appropriate for the device attached through QNIVERTER to the arbitrating system bus may be used to verify proper installation. (Note that certain device/memory diagnostics may not be completely computer independent. Consult the diagnostic listing for applicable devices and computers.)

With the QNIVERTER II installed, the computer system is provided with a second bus structure: UNIBUS or Q-bus. The arbitration of the two buses is performed by the processor in the system. The QNIVERTER II is software transparent. It is important to insure that address assignments of devices on the UNIBUS and Q-bus do not conflict. This can be accomplished by verifying that there are no duplicate address assignments.

3
Application

The QNIVERTER II can be configured to operate in one of three basic modes:

- UNIBUS arbitration - The QNIVERTER II is installed on a UNIBUS system to allow access to Q-bus peripherals.
- Q-bus arbitration - The QNIVERTER II is installed on an 18-bit Q-bus system to allow access to UNIBUS peripherals.
- Q-bus arbitration with 22-bit addressing - The QNIVERTER II is installed on a 22-bit Q-bus system to allow access to UNIBUS peripherals.

Chapter 2 explains how to set switches for the desired mode. The following sections discuss applications for each mode.

Typical UNIBUS Application

This application allows the user of PDP-11 UNIBUS systems to take advantage of the often lower-cost peripherals and memories available for the Q-bus. The QNIVERTER II and Q-bus peripheral devices or memories are installed in the Q-bus backplane and supplied with +5 volt power. The QNIVERTER II is installed in the Q-bus backplane slot normally occupied by the processor. The QNIVERTER II and other devices and memories in the Q-bus backplane are connected to a PDP-11 UNIBUS computer system by a standard UNIBUS extender cable connected between the top side of the QNIVERTER II and the last UNIBUS slot (A & B) in the PDP-11 backplane. Appendix C contains a UNIBUS connector list. The QNIVERTER II is electrically the last device on the UNIBUS and provides the far-end UNIBUS termination.

QNIVERTER II provides the system with a second bus structure, the Q -BUS. The arbitration of the two buses is performed by the PDP-11 processor located on the UNIBUS.

Typical Q-Bus Application

This application allows the wider range of PDP-11 UNIBUS peripherals and memories to be used with the LSI-11 and MicroVAX computers. The QNIVERTER II can be installed in any quad slot of the LSI-11, LSI-11/2, LSI-11/23, or PDP-11/03 systems. It can be installed in any Q22 slot of the MicroVAX I or MicroVAX II. Other LSI-11 interfaces and memories can be located either ahead or behind the QNIVERTER II. Devices located behind the QNIVERTER II have a lower priority (both interrupt and NPR/DMA) than the UNIBUS devices attached to the QNIVERTER II.

The UNIBUS peripherals and memories are installed in a UNIBUS backplane which must be supplied with the appropriate power. An M930 teminator (or equivalent) must be

the last device installed in the UNIBUS backplane. The UNIBUS backplane is connected to the QNIVERTER II with a standard UNIBUS extender cable connected between the first UNIBUS connectors in the UNIBUS backplane and the connectors on the top end of the QNIVERTER II. Appendix B contains a Q-bus connector list; Appendix C contains a PDP-11 UNIBUS connector list.

The QNIVERTER II provides the LSI-11 system with a second bus structure, UNIBUS. The LSI-11 processor controls the arbitration of both buses.

When the QNIVERTER II is installed into a 22-bit Q-bus, the 18-bit address supplied by UNIBUS DMA devices can address one of multiple 256K byte pages within the 22-bit address range by user selectable switch settings. This feature provides a way for 18-bit DMA devices to be used on the newer 22-Q bus systems like the MicroVAX I and MicroVAX II.

4
Care and Service

Caring for Your QNIVERTER II

ABLE products are designed to provide years of service with a minimum of care. Here are a few tips to help you avoid problems.

- If a printed circuit board is frequently inserted and removed, it tends to build up a gum-like residue on the contacts. Clean off this residue using alcohol, freon, or by gently rubbing with a pencil eraser. (Rubbing vigorously can remove some of the gold on the contacts, so go easy.)

- Every six months remove QNIVERTER II and clean off any accumulated dust. Dust can impede air flow. While the board is out, inspect it for any visual evidence of potential problems such as damaged components, loose connections, etc.

Caution

If the QNIVERTER II is inadvertently removed while power is on, the QNIVERTER II or your system can be damaged!

Troubleshooting

If QNIVERTER II does not function properly, see Chapter 2 and verify proper installation of the board as follows:

1. Verify that jumper selection, resistor module installation, and switch settings are correct.

2. Verify that QNIVERTER II is properly installed into the Q-bus backplane.

3. Verify that the UNIBUS cable is installed correctly with notches aligned and is firmly seated in the QNIVERTER II UNIBUS connectors.

4. Check the +5 volt power on the Q-bus backplane. Use a voltmeter and measure from ground to +5 volts on pin CA2, DA2, AA2, or BA2 on the backplane. Power should be +5 volts; if it is not, adjust the power supply.

5. Check that there are no vacant slots (missing bus grants) between QNIVERTER II and other modules in the backplane.

If this does not fix the problem, call for service as described below.

Customer Service

ABLE Computer's goal is to provide each customer with a product that works well in his system. We design and build our products to provide high reliability and to minimize problems. When a problem does arise, it is our intent to do everything in our power to quickly and efficiently resolve it.

For Service Within the United States

If you have followed the steps described in this chapter and your QNIVERTER II still does not function properly, contact our Customer Service Center before sending it for repair. ABLE Computer offers technical assistance over the phone and it is possible that your problem can be resolved after talking with an ABLE Support Engineer.

When calling, please have serial numbers available.

Our number in California is:

(714) 979-7030

If your product requires repair, we prefer that you return it to the factory as described below.

For Service Outside the United States

If you have followed the steps described in this chapter and your QNIVERTER II still does not function properly, contact your local distributor or telex ABLE Computer for the name and address of your local distributor:

TWX 910-595-1729

In Europe, telex our London office at:

Telex 848715 ABLE G

Returning ABLE Products to the Factory

If your QNIVERTER II must be returned to the factory, please do the following:

1. Call the ABLE Customer Service Center at one of the numbers listed above.
2. Explain that you would like to return your ABLE product, and the reason. Please have serial numbers available.
3. Obtain a Return Goods Authorization (RGA) number. Make sure that the RGA number appears on your return paperwork and on the outside shipping label.
4. Use the original container or a corrugated cardboard carton with at least one inch of cushioning material on all sides.
5. Include a description of the problem and a hard copy of the failure mode or system dump when available. Be sure to include your name, address, telephone number, and RGA number.

Ship it to the following address:

ABLE Computer
3080 Airway Avenue
Costa Mesa, California 92626