DECchip 21140 PCI Fast Ethernet Evaluation Board

User Guide

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Preface

This document describes the DECchip 21140 PCI Fast Ethernet Evaluation Board, which is a sample design and development board for systems based on the DECchip 21140 PCI Fast Ethernet LAN Controller. The DECchip 21140 PCI Fast Ethernet Evaluation Board (also referred to as the EB140) complies with the electrical and protocol requirements of the *PCI Local Bus Specification, Revision 2.0*.

Audience

This document is intended for developers who are evaluating the functionality of the DECchip 21140 PCI Fast Ethernet LAN Controller, and who use the EB140 to design systems based on the DECchip 21140 PCI Fast Ethernet LAN Controller.

Content Overview

This manual contains the following chapters and an appendix:

- **Chapter 1, Introduction** — Describes the DECchip 21140 PCI Fast Ethernet LAN Controller and the EB140.
- **Chapter 2, System Requirements, Kit Contents, and Installation** — Lists the requirements for installing the EB140 and loading its drivers. It also provides the contents of the DECchip 21140 PCI Fast Ethernet Evaluation Board Kit and the procedure for installing the EB140.
- **Appendix A, Technical Support, Ordering, and Associated Literature** — Contains information about how to obtain technical support and order Digital Semiconductor products.

1
Introduction

This chapter describes the DECchip 21140 PCI Fast Ethernet LAN Controller and the EB140. It describes the LEDs and connectors on the EB140, the network low-power protection mechanism, general-purpose port bit mapping, and the main blocks of the EB140.

1.1 DECchip 21140 PCI Fast Ethernet LAN Controller

The DECchip 21140 PCI Fast Ethernet LAN Controller (21140) is a single-chip master, direct memory access (DMA) Fast Ethernet LAN controller with a direct interface to the peripheral component interconnect (PCI) local bus. The 21140 is compliant with the PCI revision 2.0 specification.

The 21140 provides two ports: a serial (SRL) 10-Mb/s port and a media independent interface (MII/SYM) 100-Mb/s port. using onchip control and status registers (CSRs), and a shared PCI memory area that is set up mainly during initialization to minimize processor involvement in the 21140 operation during normal reception and transmission. To minimize host CPU utilization and bus traffic, received runt frames are filtered out and collided frames are automatically retransmitted without a repeated fetch from PCI memory.

For more information about the 21140, refer to the *DECchip 21140 PCI Fast Ethernet LAN Controller Data Sheet*.

1.2 DECchip 21140 PCI Fast Ethernet Evaluation Board

The DECchip 21140 PCI Fast Ethernet Evaluation Board (EB140) is a +5-volt PCI form-factor option card that has the following features:

- Direct PCI interface
- 100BASE-TX (100-Mb/s UTP category 5) network interface
- 10BASE-T (10-Mb/s UTP) network interface
- Transmit (TX), receive (RX), link pass/fail, and port selection LEDs
- PCI revision 2.0 compliance
- Network low-power protection
- IEEE address ROM
- Onboard voltage regulator to convert from +5 volts to +3.3 volts
- Four onboard software-programmable loopback levels

Note

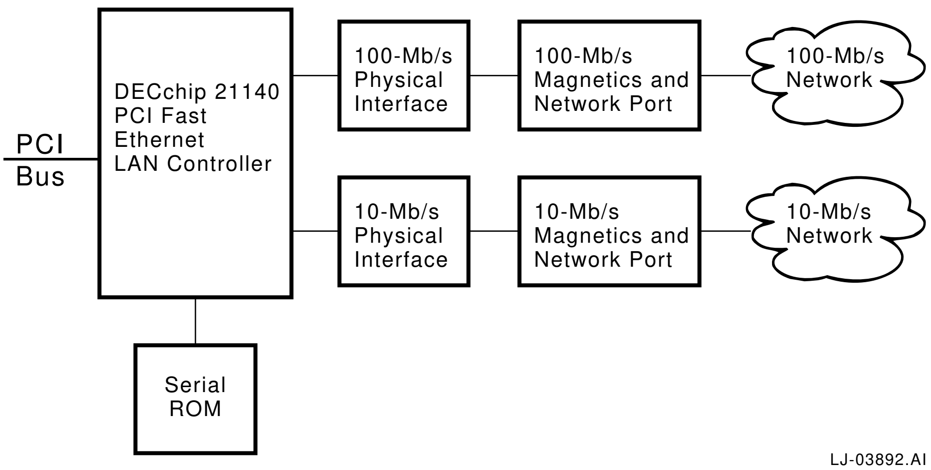
The EB140 has not been FCC tested.

1.2.1 Block Diagram

The EB140 has the following main parts (Figure 1–1):

- DECchip 21140 PCI Fast Ethernet LAN Controller (21140) for 100-Mb/s and 10-Mb/s medium access control (MAC) with a serial ROM connected to the 21140.
- 100-Mb/s physical interface consisting of Motorola MC68836 and MLT3 Micro Linear ML6671 transceivers.
- 100-Mb/s magnetics using the Pulse Engineering PE68503 or PE68509 part to implement integrated filters, transformers, and chokes.
- 10-Mb/s physical interface using Level One LXT901, 10-Mb/s twisted-pair SIA and transceivers.
- 10-Mb/s magnetics using the Valor ST7010 or FilMag Z3Z356SM part to implement transformers and chokes.

Figure 1–1 EB140 Block Diagram



1.2.2 LEDs and Connectors

Figure 1–2 shows the LEDs and connectors on the EB140, and Table 1–1 describes these components.

Figure 1–2 EB140 Connectors and LEDs

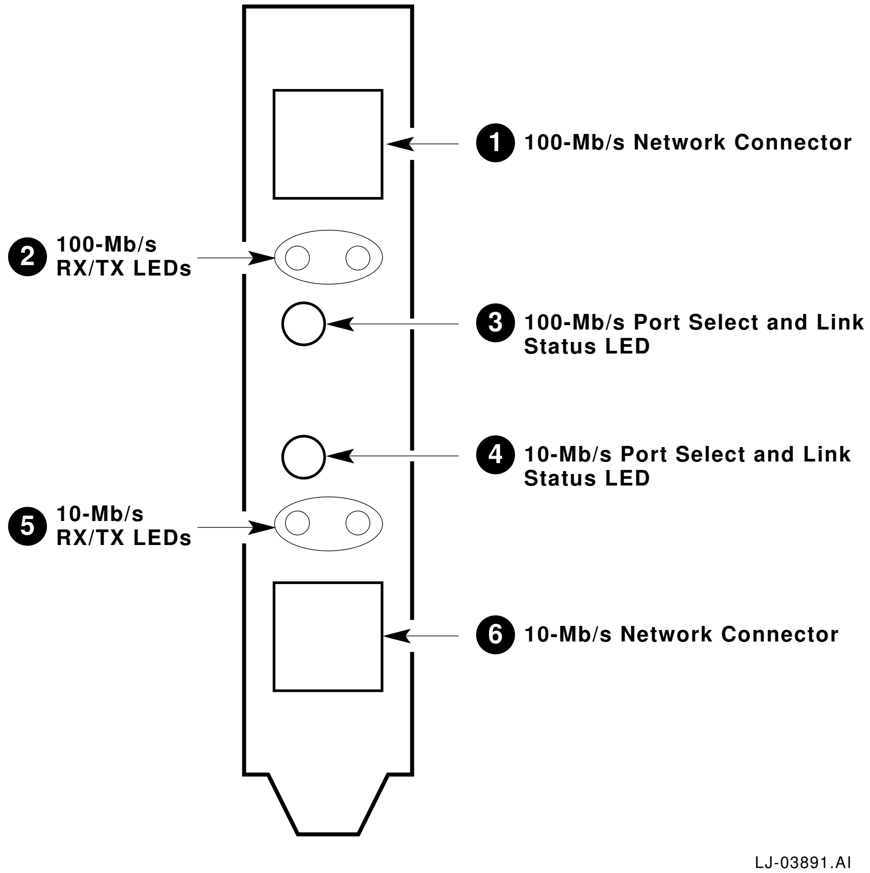


Table 1–1 LED and Connector Descriptions

<table>
<tr><th>Reference</th><th>Component</th><th>Description</th></tr>
<tr><td>❶</td><td>100-Mb/s Network Connector</td><td>The connector for the 100-Mb/s port is an RJ-45 that requires UTP category 5 (CAT5) cable. The pinout is the same as 10BASE-T.</td></tr>
<tr><td>❷</td><td>100-Mb/s RX/TX LEDs</td><td>The Receive (RX) and Transmit (TX) LEDs for the 100-Mb/s port are controlled by the 21140. The RX and TX LEDs are on for a minimum of 20 milliseconds for each packet. The RX and TX LEDs function as follows:
<table>
<tr><th>LEDs</th><th>LED Status</th><th>Meaning</th></tr>
<tr><td>RX</td><td>Green on</td><td>A receive packet that passed the address filtering of the 21140 is being received.</td></tr>
<tr><td>TX</td><td>Yellow on</td><td>A transmission is in process.</td></tr>
<tr><td>RX and TX</td><td>Green and yellow on</td><td>An external loopback, full-duplex, or collision is occurring.</td></tr>
</table></td></tr>
<tr><td>❸</td><td>100-Mb/s Port Select and Link Status LED</td><td>Indicates whether the 100-Mb/s port is selected and indicates the link status. This LED displays the following patterns:
<table>
<tr><th>LED Status</th><th>Meaning</th></tr>
<tr><td>Green on</td><td>Indicates the following:
The port is selected.
An active network cable, that may not be carrying valid data or IDLE signals, has been identified.
The synchronization of the 21140 to incoming data.</td></tr>
<tr><td>Red on</td><td>The port is selected and the link is in the fail state.</td></tr>
<tr><td>Off</td><td>The port is not selected.</td></tr>
</table></td></tr>
</table>

(continued on next page)

Table 1–1 (Cont.) LED and Connector Descriptions

Reference	Component	Description
❹	10-Mb/s Port Select and Link Status LED	Indicates whether the 10-Mb/s port is selected and indicates the link status. This LED displays the patterns described in ❸.
❺	10-Mb/s RX/TX LEDs	The Receive (RX) and Transmit (TX) LEDs for the 10-Mb/s port are controlled by the Level One SIA. The RX and TX LEDs are on for a minimum of 20 milliseconds for each packet. The LEDs function as follows:

LEDs	LED Status	Meaning
RX	Green on	A receive packet that passed the address filtering of the 21140 is being received.
TX	Yellow on	A transmission is in process.
RX and TX	Green and yellow on	An external loopback, full-duplex, or collision is occurring.

Reference	Component	Description
❻	10-Mb/s Network Connector	The connector for the 10-Mb/s port is an RJ-45 that requires UTP category 3 (CAT3) cable.

1.2.3 Network Low-Power Protection Mechanism

The network low-power protection mechanism protects the network by blocking invalid data that is produced when there is a low-power environment on the EB140. When the Maxim MAX700 chip on the EB140 detects a voltage below 4.5 volts, it blocks all transmissions from the EB140 to the network by disabling the ML6671 and FCG transceivers.

Another mechanism to protect the network is the default loopback operating mode of the ML6671. This mode disables all network transmissions of unwanted data.

1.2.4 General-Purpose Port

The 21140 has an 8-bit, general-purpose port for setting the various operating modes of the EB140. CSR12 in the 21140 controls the general-purpose port.

Figure 1–3 shows the bit mapping of the general-purpose port, and Table 1–2 describes the bit operations.

For detailed information about the general-purpose port, refer to the *DECchip 21140 PCI Fast Ethernet LAN Controller Hardware Reference Manual*.

Figure 1–3 General-Purpose Port Bit Mapping

Bit Number	7	6	5	4	3	2	1	0
	10-Mb/s Link Pass	100-Mb/s Signal Detect	100-Mb/s Symbol Link	Reserved	10-Mb/s Loopback Level 2	10-Mb/s Loopback Level 1	100-Mb/s Loopback Level 2	100-Mb/s Loopback Level 1
	Input	Input	Input	Output	Output	Output	Output	Output

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Table 1–2 Description of the General-Purpose Port Bits

Bit	Description	21140 Operating Mode	Active Level *
0	100-Mb/s loopback control on the first level outside the 21140 using the MC68836 chip internal loopback mode.	Output	Low (0)
1	100-Mb/s loopback control on the second level ML6671 internal loopback mode. Includes the 21140, the MC68836 chip, and ML6671.	Output	Low (0)
2	10-Mb/s SIA and transceivers (Level One LXT901 transceiver) internal loopback mode.	Output	High (1)
3	10-Mb/s SIA and transceivers (Level One LXT901 transceiver) external loopback mode. **Note:** This mode requires a loopback connector.	Output	Low (0)
4	Reserved.	Output	–
5	100-Mb/s symbol link input indicates that the 21140 active port is the MII/SYM and that the 21140 is fully synchronized to the incoming data from the MC68836.	Input	High (1)
6	100-Mb/s signal detect input from the FCG chip indicates that the port is connected, and the receiver identifies the right voltage level for normal operation in the network inputs. This bit can be used as a hook for software port auto-detection procedures.	Input	High (1)
7	10-Mb/s link pass input indication from the 10-Mb/s SIA (LXT901). This bit can be used as a hook for software port auto-detection procedures.	Input	High (1)

* Active level represents inputs to the physical chips.

1.2.5 Specifications

The physical dimensions and power requirements for the EB140 are as follows:

Dimensions

Height: 13.2 cm (5.19 in)

Width: 10.5 cm (4.13 in)

Power Requirements

Power dissipation: 3.8 W maximum with both ports fully operational at the same time.

2

System Requirements, Kit Contents, and Installation

This chapter provides the system requirements for using the EB140, lists the contents of the DECchip 21140 PCI Fast Ethernet Evaluation Board Kit, and describes how to install the EB140. It also provides information about how to obtain additional drivers and updates.

2.1 System Requirements

To use the EB140, you need the following:

- A +5-volt PCI master mode expansion slot
- A system that is compliant with the PCI revision 2.0 specification
- A 3½-inch diskette drive
- The following cables:
  - To operate at 100-Mb/s, an unshielded twisted-pair (UTP) category 5 (CAT5) cable with an RJ-45 connector
  - To operate at 10-Mb/s, a UTP category 3 (CAT3) or CAT5 cable with an RJ-45 connector
  - A crossed cable (CAT3 or CAT5) when two stations do not have a repeater or switch between them

2.2 Kit Contents

The DECchip 21140 PCI Fast Ethernet Evaluation Board Kit contains the following materials. For additional drivers or software updates, contact your Digital sales representative or your local distributor.

- DECchip 21140 PCI Fast Ethernet Evaluation Board (EB140)
- A hardware design package (on a 3½-inch diskette) that contains the following information. Section 2.2.2 describes how to unpack the files.
  - Board schematics (MD and UA)
  - Gerber files
  - Vendor parts list
- Driver executables including:
  - Novell NetWare (client/server)
  - NDIS2 (DOS, OS/2)
- TP loopback connector
- The following documents:
  - *DECchip 21140 PCI Fast Ethernet LAN Controller Product Brief*
  - *DECchip 21140 PCI Fast Ethernet LAN Controller Data Sheet*
  - *DECchip 21140 PCI Fast Ethernet LAN Controller Hardware Reference Manual*
  - *Connecting the DECchip 21140 PCI Fast Ethernet LAN Controller to the Network: An Application Note*
  - *Digital Semiconductor PCI Ethernet Driver Information Sheet*
  - *EB140 Evaluation Board Schematics (MD and UA)*
  - *EB140 Vendor Parts List*
  - Warranty agreement

2.2.1 Using the Documentation

Table 2–1 provides guidelines for using the documentation and software to accomplish specific tasks.

Table 2–1 Guidelines for Using Documentation

If you want to ...	Start with the ...
Install the DECchip 21140 PCI Fast Ethernet Evaluation Board	DECchip 21140 PCI Fast Ethernet Evaluation Board User Guide
Install a driver	README.TXT file on the diskette with the driver
Design new hardware	DECchip 21140 PCI Fast Ethernet LAN Controller Data Sheet
	DECchip 21140 PCI Fast Ethernet LAN Controller Hardware Reference Manual
	Connecting the DECchip 21140 PCI Fast Ethernet LAN Controller to the Network: An Application Note
Obtain driver sources	Digital Semiconductor PCI Ethernet Driver Information Sheet

2.2.2 Unpacking the Hardware Design Package

Table 2–2 lists the files that are on the hardware design package diskette. The files with an .EXE extension have been compressed using PKZIP, Version 2.04g and converted to self-extracting archives using ZIP2EXE.

Table 2–2 Hardware Design Package Files

File Name	Contents	Comments
README.TXT	Provides a general description of the diskette contents.	You do not have to extract this file.
GERBER.EXE	Contains the gerber files.	To extract this file, enter **GERBER** at the system prompt.
PCIDIAG.EXE	Contains the diagnostic program PCITEST.EXE which is used to verify compliance with the *PCI Local Bus Specification, Revision 2.0* and the *PCI BIOS Specification, Revision 2.0*.	To extract this file, enter **PCIDIAG** at the system prompt.
EB140VPL.TXT	Contains a vendor parts list.	You do not have to extract this file.
SCHEM.EXE	Contains the schematics, mechanical drawings, and unit assembly drawings.	This file is scaled to print on 8½ x 11 paper. To extract this file, enter **SCHEM** at the system prompt.
EBDEBUG.EXE	Contains the EVBDEBUG program which is used to access the EB140 at the register level.	To extract this file, enter **EBDEBUG** at the system prompt.

2.3 Installation Procedure

To install the EB140 and load the drivers, do the following:

1. From the diskette that contains the driver you are loading, read the README.TXT file. It provides information about how to configure the EB140.
2. Power down the PC and remove its cover.
3. Insert the card edge of the EB140 into an available master PCI option slot in the PC.
4. Connect the EB140 to a 10-Mb/s or 100-Mb/s network using one of the RJ-45 connectors on the board. Figure 1–2 shows the connectors for 10-Mb/s or 100-Mb/s operation.
5. Remove any diskettes from the PC disk drive.
6. Replace the PC box cover and power up the PC. The Port Select and Link Status LED, associated with the RJ-45 connector you are using, is green if the port is selected and the link is in the pass state.

   If the Port Select and Link Status LED is red, the port is selected but the link is in the fail state. If the LED is off, the port is not selected. In these cases, check that the connections to the RJ-45 connector and network are secure. If the LED remains red or off, contact the Digital Semiconductor Information Line (Appendix A).
7. Load the driver for your operating system. Each driver is stored in its own subdirectory on the shipped diskettes. For installation and release information, refer to the README.TXT and RELEASE.TXT files.

2.4 Drivers and Updates

Additional drivers and updates are available on a regular basis. To register your evaluation board and be notified of these updates, complete the customer reply card included in the kit, or send the following information to the address listed below:

Name
Address
Telephone number
FAX number
Product purchased
Serial no.
Date purchased

Mail the information to:

Digital Equipment Corporation
Attn: Marketing/Product Updates
77 Reed Road, HLO2-2/M9
Hudson, MA 01749
USA

A

Technical Support, Ordering, and Associated Literature

This appendix provides information about ordering Digital's microprocessor and peripheral chips, and associated literature. It also explains how to obtain technical support and information.

A.1 Digital Semiconductor Information Line

If you need technical support or help deciding which literature best meets your needs, call the Digital Semiconductor Information Line:

United States and Canada	**1–800–332–2717**
TTY (United States only)	**1–800–332–2515**
Outside North America	**+1–508–568–6868**

A.2 Ordering Digital Semiconductor Products

To order the following Digital Semiconductor products, contact your local distributor.

To order DECchip samples or Sample Kits, call **1–800–DIGITAL**.

Alpha Microprocessors and Peripheral Chips	
Product	**Order Number**
DECchip 21040 Ethernet LAN Controller for PCI	21040–AA
DECchip 21140 PCI Fast Ethernet LAN Controller	21140–AA
DECchip 21050 PCI-to-PCI Bridge	21050–AA
Evaluation Board Kits	
DECchip 21040 PCI Evaluation Board Kit	21A40–01
Quad DECchip 21040 PCI Evaluation Board Kit	21A40–02
DECchip 21140 PCI Fast Ethernet Evaluation Board Kit	21A40–03
DECchip 21050 Evaluation Board Kit	21A50–01

A.3 Ordering Associated Literature

The following table lists some of the available Digital Semiconductor literature. For a complete list, contact the Digital Semiconductor Information Line. For ordering information, see Sections A.4 and A.5.

Title	Order Number
Connecting the DECchip 21140 PCI Fast Ethernet LAN Controller to the Network: An Application Note	EC–QAR2A-TE
DECchip 21140 PCI Fast Ethernet LAN Controller Product Brief	EC–QC0AA–TE
DECchip 21140 PCI Fast Ethernet LAN Controller Data Sheet	EC–QC0BA–TE
DECchip 21140 PCI Fast Ethernet LAN Controller Hardware Reference Manual	EC–QC0CA–TE

A.4 Ordering Electronically

To place an order through your account at the Electronic Store, dial 1–800–234–1998, using a modem set to 2400- or 9600-baud. You must use a VT terminal or terminal emulator set at 8 bits, no parity. If you need assistance using the Electronic Store, call 1–800–DIGITAL (1–800–344–4825) and ask for an Electronic Store specialist.

A.5 Ordering by Telephone and Through Direct Mail

From	Call	Write
U.S.A.	DECdirect Phone: 1–800–DIGITAL (1–800–344–4825) FAX: 603–884–5597	Digital Equipment Corporation P.O. Box CS2008 Nashua, NH 03061
Puerto Rico	Phone: 809–781–0505 FAX: 809–749–8377	Digital Equipment Corporation 3 Digital Plaza, 1st Street Suite 200 Metro Office Park San Juan, Puerto Rico 00920
Canada	Phone: 1–800–267–6215 FAX: 613–592–1946	Digital Equipment of Canada Ltd. 100 Herzberg Road Kanata, Ontario, Canada K2K 2A6 Attn: DECdirect Sales
International	—	Local Digital subsidiary or approved distributor
Internal orders	DTN 264–3030 603–884–3030 FAX: 603–884–9690	U.S. Software Supply Business Digital Equipment Corporation 10 Cotton Road Nashua, NH 03063–1260