Core1553BBC DevKit

Quick Start Guide

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Core1553BBC DevKit

Quick Start Guide

Actel

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Table of Contents

Introduction

The 1553BBC DevKit is a starter kit for working with Actel Core1553BBC products and is intended to help you get your 1553BBC product to market faster. The kit consists of a 1553BBC board, example design, and software drivers to exercise the board.

Core1553BBC DevKit Documentation

The Core1553BBC DevKit includes a printed and online version of the *Core1553BBC DevKit Quick Start Guide*, which contains information and procedures for using the Core1553BBC. The guide is in PDF format on the CD-ROM in the "*\doc*" directory. To view the online manual, you must have Adobe® Acrobat Reader® installed. The Reader is included on the Designer and Libero IDE CD-ROMs.

1

Core1553BBC DevKit Quick Start Guide

The Core 1553BBC DevKit is a starter kit for working with Actel Core1553BBC products and is intended to help you get your 1553BBC product to market faster. Intended uses are as follows:

1. To provide a hardware platform for software driver development specific to your system.
2. To provide hardware functionality to complement the simulation test bench.
3. To provide the ability to test modifications and enhancements made to the Core1553BBC core (IP and additional devices sold separately).

Overview

The 1553B BC development kit contains an Actel Core1553BBC Demonstration Board, reference design and software to support the card.

The board implements a PCI to 1553B Bus Controller function, the block diagram is shown in Figure 1-1.

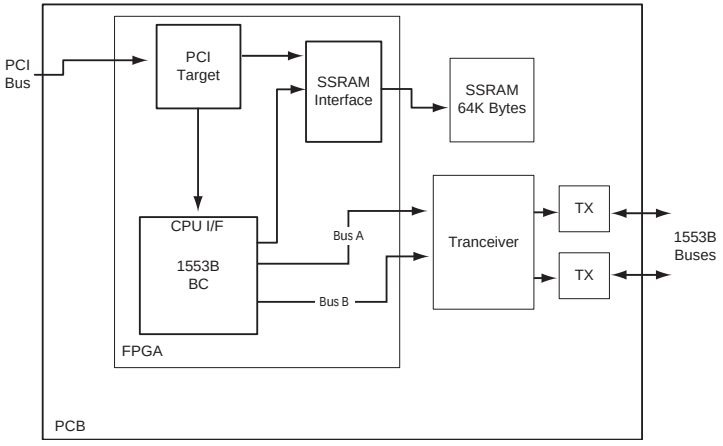

Figure 1-1. PCI to 1553B BC Controller Function Block Diagram

The FPGA contains three main blocks: the PCI Target, 1553B BC, and the SSRAM interface.

The PCI target is a standard implementation of the Actel CorePCI Target IP core (version 5.31). The SSRAM interface allows both the CorePCI and Core1553BBC to access the same external memory.

What's Included

The following is included with your new Core1553BBC Development Kit.

Core1553BBC Demo Board

- 1553BBC card
- Socketed 54SX32A device implementing the Core1553BBC and CorePCI function
- 1533B transceivers and transformers wired for direct coupling
- Header strips for backend observation
- Silicon Explorer connector for viewing internal nodes

CD with Software Drivers and Design Files

- Actel 1553BBC Demo application software for either Win98, NT, XP, or Windows 2000 systems
- VHDL source code for the chip-level wrapper, refer to Appendix B for more information

IP Cores (CorePCI and Core1553BBC) are sold separately.

Software Installation

Note: **You must install your software before you install the PCI Demo Card.**

To install the 1553BBC demonstration driver and software:

1. **Log in as Administrator.**
2. **Insert the Core1553BBC software CD; installation starts automatically.** Follow the instructions on the screen. If installation does not start automatically, run

   ```
   <CDdrive>:\DEMO software\Setup.EXE
   ```

Installing the 1553BBC Demo Card

WARNING: An SDRAM memory must not be fitted to the SDRAM DIMM socket.

To install the hardware:

1. **Turn the computer power off.**
2. **Install 1553BBC Development Card using static-safe procedures.**
3. **Boot your PC and login as Administrator if required.** When/if the New Hardware Wizard pops up click “Next” and then select “Display list of the known drivers”. Click “Next” again.
4. **Select “Show compatible hardware drivers”.**
5. **Select “Actel Development Board”.** Click “Next” and “Next” again.
6. **Click “Finish”.** Installation is now complete.

Refer to “Core1553BBC DevKit Contents” on page 33 for instructions on how to remove the 1553B demo card.

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Using the Core1553BBC Demo Card

The 1553BBC development PCB is supplied with a basic Windows utility that enables you to load, peek, poke, fill, and display the PCI/BC memory.

Exercising the 1553BBC Demo Card

This development kit provides you a demo application to exercise basic PCI access to the 1553BBC memory. The demo application allows basic reads and writes to the SSRAM.

Run Demo Software

To execute the demo application, select the ActelPCI program from the Start menu (from the Start menu, select Programs > Actel > ActelPCI).

Select the 1553B Bus Controller Card

When the ActelPCI software starts it scans the PCI bus for all Actel PCI cards fitted into the system. A card selection window appears (Figure 2-1).

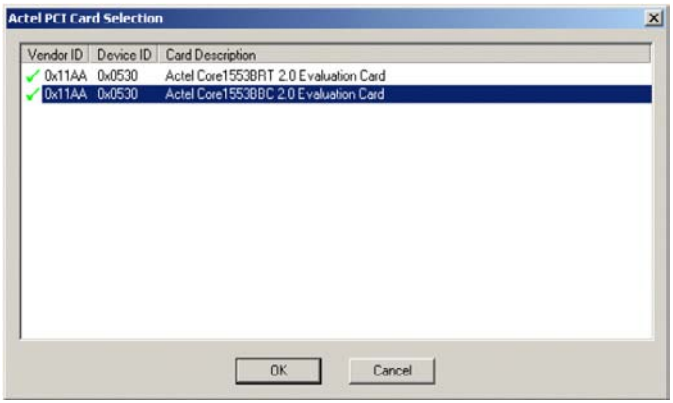

Figure 2-1. Actel PCI Card Selection Dialog Box

The “Actel Core1553BBC 2.0 Evaluation Card” line should be selected, and then click on the OK button.

Demo Application Operations Window

The Operations window of the demo application is shown in Figure 2-2.

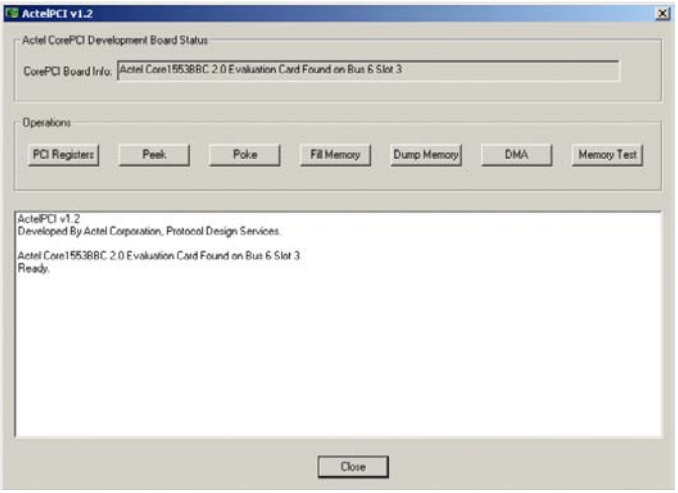

Figure 2-2. Demo Program Operations Window

PCI Configuration Space

To access the PCI configuration space click the PCI Registers button in the Operations window (Figure 2-2). The PCI Configuration Register dialog box appears, as shown in Figure 2-3. Click OK to continue.

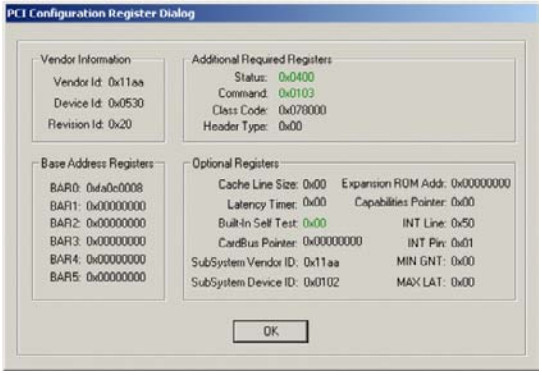

Figure 2-3. PCI Configuration Register Dialog

BAR0 is used for the Core1553BBC memory space. If you click the Status or Command registers the Demo displays the register settings.

Memory Test

Click the Memory Test button in the Operations window to perform a memory test (Figure 2-2). The Memory Test button opens a dialog box (Figure 2-4). Set the Memory Device/Range to BAR0.

Figure 2-4. Memory Test Dialog Box

The memory test fails at addresses 20000 hex and upwards since these locations are used by the control registers and do not return what was written.

Warning: When you run the memory test it corrupts the Bus Controller control registers. These should all be reloaded before any 1553B messages are transmitted.

To write a specific value to a specified location inside the memory, click the Poke button in the in the Operations window (Figure 2-2). This displays the Memory Value Dialog box, as shown in Figure 2-5.

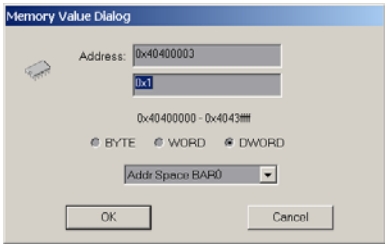

Figure 2-5. Memory Value Dialog Box - Poke

Provide the addresses, value, and the address space, then click OK to perform a memory write.

Peek

Click the Peek button in the Operations window to read a specified memory location (Figure 2-2). The Memory Value Dialog box appears.

Figure 2-6. Memory Value Dialog Box - Peek

Provide the read address and specify the address space, then click OK. The message box appears to report the data for all the requested addresses.

Memory Fill and Load

Use the Memory Fill button in the Operations window to write a specified value to a consecutive memory location. Click the Memory Fill button to open the Memory Fill Dialog box (Figure 2-7).

Figure 2-7. Memory Fill Dialog Box

Provide a starting address, location numbers, value and address space, and then click OK to write the specified value.

The fill dialog also allows an Intel Hex formatted data file to be loaded into the PCI memory. Click on “Load File” and locate the required Intel hex file and set the address space that it is to be loaded into.

Memory Dump

Click the Memory Dump button in the Operations window to dump consecutive memory locations. The Memory Dialog box appears (Figure 2-8).

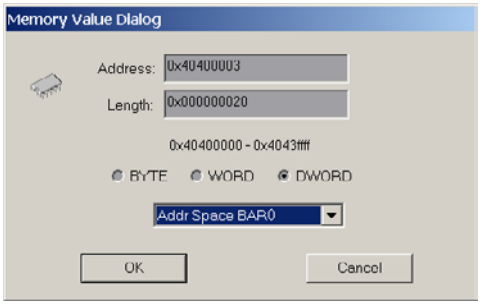

Figure 2-8. Memory Value Dialog Box - Memory Dump

To read out the serial memory (dump memory), provide the starting address, the length, and the address space, then click OK.

3

Using the Bus Controller

The Core1553BBC DevKit can be used to test modifications you made to the core or can be used to test custom backends using a daughter card strategy. For either case, a new device can be programmed and inserted into the socket.

For the daughter card strategy, it is essential to ensure that the synchronous SSRAMs are configured so that they will not drive data. The simplest mechanism for doing this is to ensure that the signal “RAM_CEn” be held high by the FPGA. A daughter card can then be connected through the backend header pins and will not be affected by the SSRAM devices.

Board Description

The 1553BBC demo board is illustrated in Figure 3-1. The main components on the board are the socketed FPGA 1553B transceivers and transformers, the backend SSRAM, the Silicon Explorer connector, and the backend header strips. The RS-232 translator and SDRAM DIMM interface are not used in the 1553BBC design. The board includes the 64-bit PCI extension; however, the extension is not used.

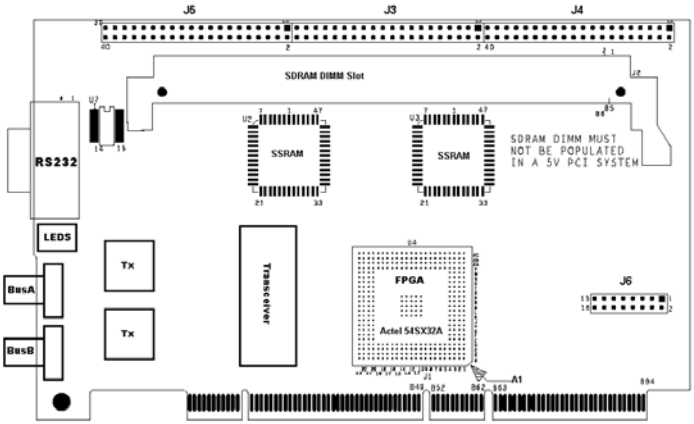

Figure 3-1. 1553BBC Demo Board

The following table describes the 1553BBC demo board components.

Table 3-1. 1553BBC Demo Board Legend

J2	SDRAM DIMM INTERFACE - DO NOT FIT AN SDRAM!
J3	Header strip
J4	Header strip
J5	Header strip
U4	Actel 54SX32A FPGA
U2	SSRAM
U3	SSRAM
U6	1553B Transceiver
T1/T2	1553B Transformers
U7	RS-232 Transceiver
J6	Silicon Explorer Connection

1553BBC Demo Card Back Panel Connections

Four LEDs on the 1553BBC demo card are shown in Figure 3-2.

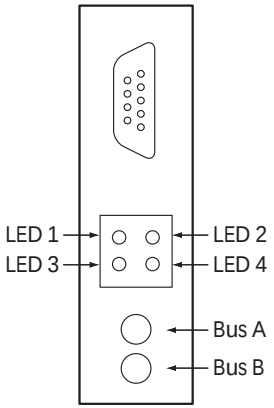

Figure 3-2. LEDs on the BC Demo Card

Table 3-2 summarizes the function of the LEDs on the BC demo card.

Table 3-2. LED Function Description

1	Busy	Indicates that the 1553BBC is processing a message list
2	Interrupt	Indicates that core has activated its interrupt output
3	Not Used	
4	Memory Fail	Indicates that the 1553BBC failed to access the SSRAM as required, this should never occur.

Signals and Connections

The tables on the following pages provide connection information among the FPGA, the 1553BBC bus, and the backend header strips. When applicable, SSRAM signals are included.

This is the PCI Bus Signal Connections table.

Table 3-3. PCI Bus Signal Connection Table

PCI Signal	SX32A Pin Number	PCI Signal	SX32A Pin Number
CLK	AB13	AD23	C15
RST	D18	AD24	B16
AD0	B4	AD25	C16
AD1	B5	AD26	D16
AD2	A5	AD27	A17
AD3	D6	AD28	B17
AD4	C6	AD29	C17
AD5	B6	AD30	D17
AD6	A6	AD31	A18
AD7	D7	CBE0	C7
AD8	B7	CBE1	D10
AD9	D8	CBE2	C13
AD10	C8	CBE3	A16
AD11	B8	DEVSELN	B11
AD12	D9	FRAMEN	A12
AD13	C9	GNTN	C18

Table 3-3. PCI Bus Signal Connection Table (Continued)

PCI Signal	SX32A Pin Number	PCI Signal	SX32A Pin Number
AD14	B9	IDSEL	D15
AD15	A9	INTAN	R2
AD16	D13	IRDYN	C12
AD17	A14	PAR	C10
AD18	B14	PERRN	A10
AD19	C14	REQN	B18
AD20	D14	SERRN	B10
AD21	A15	STOPN	C11
AD22	B15	TRDYN	A11

Table 3-4. Header Strip J3

Header Pin	Signal	FPGA Pin	Header Pin	Signal	FPGA Pin
1	P3_3V	na	2	GND	na
3	Unused	Y9	4	Unused	AA9
5	Unused	AB9	6	Unused	Y10
7	Unused	U20	8	Unused	M22
9	Unused	Y16	10	Unused	Y11
11	Unused	AA11	12	Unused	AC11
13	Unused	AA12	14	Unused	AB12
15	Unused	AC12	16	Unused	AA13
17	Unused	AC13	18	Unused	Y14
19	Unused	AA14	20	Unused	AB14
21	Unused	AA15	22	Unused	AB15
23	Unused	AB18	24	Unused	AC18
25	Unused	AB17	26	Unused	AC17
27	Unused	Y18	28	Unused	AA18
29	Unused	Y19	30	Unused	AA18
31	Unused	AB19	32	Unused	AA19
33	Unused	AB20	34	Unused	AC19
35	Unused	AB21	36	Unused	AB23
37	Unused	Y21	38	Unused	AA22
39	Unused	Y22	40	Unused	Y23

Table 3-5. Header Strip J4 (BC Address Setting)

Header Pin	Signal	FPGA Pin	Header Pin	Signal	FPGA Pin
1	P5V_R	na	2	GND	na
3	Unused	T1	4	Unused	T2
5	Unused	T3	6	Unused	R4
7	Unused	U1	8	Unused	U2
9	Unused	V2	10	Unused	T4
11	Unused	V3	12	Unused	V4
13	Unused	W1	14	Unused	W2
15	Unused	W3	16	Unused	W4
17	Unused	Y2	18	Unused	Y3
19	Unused	AA2	20	Unused	AA4
21	Unused	AB1	22	Unused	AB3
23	Unused	AB4	24	Unused	AC4
25	Unused	Y5	26	Unused	AA5
27	Unused	AB5	28	Unused	AA6
29	Unused	Y6	30	Unused	AC5
31	Unused	AB6	32	Unused	AC6
33	Unused	Y7	34	Unused	AA7
35	Unused	AB7	36	Unused	AC7
37	Unused	Y8	38	Unused	AA8
39	Unused	AB8	40	Unused	AC10

Table 3-6. Header Strip J5

Header Pin	Signal	FPGA Pin	Header Pin	Signal	FPGA Pin
1	PCI_VI0	na	2	GND	na
3	Unused	W20	4	Unused	W21
5	Unused	W22	6	Unused	V23
7	Unused	V20	8	Unused	V21
9	Unused	V22	10	Unused	U23
11	Unused	T20	12	Unused	T21
13	Unused	T22	14	Unused	T23
15	Unused	R20	16	Unused	R21
17	Unused	R22	18	Unused	R23
19	Unused	P20	20	Unused	P21
21	Unused	P22	22	Unused	P23
23	Unused	N21	24	Unused	N22
25	Unused	N23	26	Unused	M21
27	Unused	C5	28	Unused	na
29	Unused	D5	30	Unused	na
31	Unused	B19	32	Unused	E21
33	Unused	C19	34	Unused	F20
35	Unused	D19	36	Unused	F21
37	Unused	D23	38	Unused	G20
39	Unused	E20	40	Unused	G21

1553BBC Bus Connections

The 1553BBC development card uses DIRECT 1553B connections. You can convert the card to a transformer coupling by removing the four 50R resistors and fitting links to connect the transformers directly to the 1553B connectors. Please contact Actel customer support for help if this is required.

1553BBC Demo Card Address Map

The 1553B BC demo card uses a single PCI BAR register, BAR0, and requires 256K bytes of memory (00000hex-3FFFFhex). The lower half of this address directly addresses the 128K bytes of SSRAM memory. The upper 128K is used to access the Core1553BBC CPU registers.

Core1553BBC Memory

The 128K bytes of SSRAM memory is directly mapped to PCI addresses 000000 to 01FFFF hex. When accessed from the PCI bus this memory supports byte addressing as per the PCI specification. When the bus controller accesses the memory it uses its word addressing mechanism. This means that the PCI address 0200 hex maps to the bus controller address 0100 hex etc.

Core1553BBC CPU Registers

The Core1553BBC CPU registers are directly mapped to PCI addresses 020000-02001C hex and above. Each register is as described in the Core1553BBC core datasheet, and is mapped to the lower 16-bits of the 32-bit PCI data word (Table 3-7).

Table 3-7. Core1553BBC CPU Registers

Address	Register
20000	Control and Status
20004	SETUP

Table 3-7. Core1553BBC CPU Registers (Continued)

Address	Register
20008	LISTPTR
2000C	MSGPTR
20010	CLOCK
20014	ASYNCPTR
20018	STACKPTR
2001C	INTERRUPT

The address decoding logic is incomplete, for instance the Control register also is at addresses 0x020020, 0x20040 through to 0x3FFE0.

Initializing the 1553 Bus Controller Memory

You must initialize the 1553B memory block and set up the CPU registers to use the bus controller. Once this is done, you can start the bus controller by writing to the CPU CONTROL register.

The memory block must contain a message list, message descriptors, and data blocks. Setting this up requires writing to many memory locations. The easiest way to do this is to create an Intel Hex file and load it into the memory using the “Fill Memory” function in the PCI support software.

To simplify creation of the Intel hex file a simple utility program (utility/cmdtohex.exe) is provided that creates an Intel hex file from a command file. The command file contains a sequence of commands that initialize memory and allow you to write the CPU registers. The following command file creates a message list, message descriptors and data blocks. It also writes to the CPU SETUP and LISTPTR register and then starts the bus controller.

```
# Set up the list pointer list
MEM #0000 #0001 #0100;
….
MEM #001A #0001 #0440;
MEM #001C #0004 #0055;
```

```
# BC to RT Message
MEM #0100 #00F0  1.0.1.10 #0000 #0120 #0000 #0000 #0000;
FILL #0120 #1000 32 1

# RT to BC Message
MEM #0140 #00F1  1.1.1.10 #0000 #0160 #0000 #0000 #0000;

# Mode Code With Data RT RX
MEM #0180 #00F2  1.0.0.17 #0000 #1234 #0000 #0000 #0000;
…….
# Now start the bus controller
SETUP #5700
LISTPTR #0000
START
```

The complete list of commands supported by the “cmdtohex” program is provided in “cmdtohex Utility” on page 31.

Using the Bus Controller

Once a command file has been created you can convert it and download it to the bus controller. An example command file (bcsetup.txt) is provided in the utility directory.

To convert a command file and load it into the bus controller:

1. **Convert the command file to hex format.** Start a MSDOS window and change to the utility directory and execute “cmdtohex -txt bcsetup”. This reads the bcsetup.txt file and creates an Intel hex file called bcsetup.hex.

   OR

   Start Windows Explorer and change to the *utility* directory. Double-click the dobc.exe shortcut; this automatically converts the bcsetup.txt file.

2. **Start the Actel PCI Support Software.** In the Windows start menu select Actel > ActelPCI.

3. **Select the 1553B bus controller from the card selection window.**

4. **Click the “Fill Memory Button”, select BAR0 and click “Load File”. Select the “bcsetup.hex” file from the utility directory.**
   The file is downloaded to the bus controller. Since the command file has a start command at the end the bus controller automatically starts and processes the message list.

Actel recommends that you connect a 1553B bus tester to the bus controller and that it emulates remote terminals 1 and 2 because the bcsetup.cmd file contains messages that will be sent to both remote terminals.

A

cmdtohex Utility

```
Cmdtohex  -in filename.txt -out filename.hex
Cmdtohex   -txt filename
Cmdtohex   -help
```

The input source file must be specified; use either the -in or -txt switch. When you use the -in switch the output file must be also be specified using the -out switch. If you use the -txt switch then the input file is filename.txt and the output file name is filename.hex.

The command file may contain the commands shown in Table A-1.

Table A-1. Supported Commands

Command	Description
MEM ADDR DATA [DATA] … [DATA]	Fills memory locations starting from ADDR with DATA values
FILL ADDR DATA N INC	Fills N memory locations starting ADDR with DATA and incrementing by INC
REG N DATA	Writes to DATA to CPU register N
CONTROL DATA	Writes data to the bus controller CONTROL register
SETUP DATA	Writes data to the bus controller SETUP register
LISTPTR DATA	Writes data to the bus controller LISTPTR register
MSGPTR DATA	Writes data to the bus controller MSGPTR register
CLOCK DATA	Writes data to the bus controller CLOCK register
ASYNCPTR DATA	Writes data to the bus controller ASYNCPTR register
STACKPTR DATA	Writes data to the bus controller STACKPTR register
INTERRUPT DATA	Writes data to the bus controller INTERRUPT register
START	Starts the bus controller by writing to bit 0 of the CONTROL register

Table A-1. Supported Commands

Command	Description
STOP	Stops the bus controller by writing to bit 1 of the CONTROL register
ABORT	Aborts the bus controller operation by writing to bit 2 of the CONTROL register
ASYNC	Starts the bus controller Asynchronous operation by writing to bit 3 of the CONTROL register
#	Line is Comment

Address values specified in the command file are word addresses as interpreted by the bus controller, not the byte addresses used by PCI. The command below would write 16-bit words 0800 and 0001 hex to bus controller address 0100 and 0101 hex.

```
MEM #0100 #0800 #0001
```

It will actually write the 0800 hex to the PCI address 0200 hex, and 0001 hex to PCI address 0202 hex. If this was a message list the LISTPTR register should be programmed with 0100 hex. When started the bus controller will process a message descriptor from word address 0800 hex. The message descriptor is stored at PCI address 1000 hex.

Data values can be entered in several formats, as shown in Table A-2.

Table A-2. Data Formats

Data Format	Description
1234	Decimal value
#1234	Hexadecimal value
A123	Hexadecimal value
1.1.12.20	1553B Command word using decimal values
#1F.0.#00.#20	1553B Command word using hexadecimal values

B

Core1553BBC DevKit Contents

The contents of the Core1553BBC Development Kit are shown in Figure B-1.

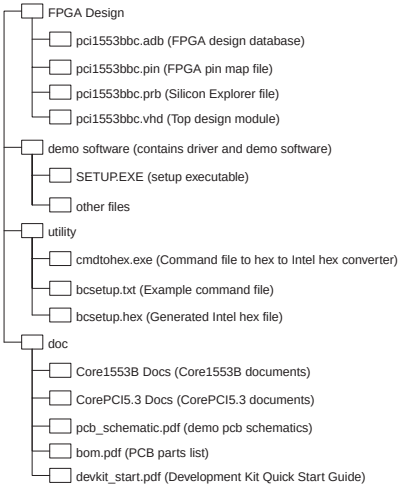

Figure B-1. Core1553BBC DevKit Contents

Removing the 1553BBC Demo Card

To uninstall the demo card:

1. **Shut down your PC.**
2. **Remove the PCI Development Card using static-safe procedures.**
3. **Boot your PC.** Login as Administrator (if required).
4. **Remove the software.** Go to Control Panel -> Add Remove Programs and select “Actel CorePCI Device Driver and Application” and click “Remove”.
5. **Reboot if required.**

C

Product Support

Actel backs its products with various support services including Customer Service, a Customer Technical Support Center, a web site, an FTP site, electronic mail, and worldwide sales offices. This appendix contains information about contacting Actel and using these support services.

Actel U.S. Toll-Free Line

Use the Actel toll-free line to contact Actel for sales information, technical support, requests for literature, Customer Service, investor information, and using the Action Facts service.

The Actel toll-free line is (888) 99-ACTEL.

Customer Service

Contact Customer Service for non-technical product support, such as product pricing, product upgrades, update information, order status, and authorization.

From Northeast and North Central U.S.A., call (408) 522-4480.
From Southeast and Southwest U.S.A., call (408) 522-4480.
From South Central U.S.A., call (408) 522-4434.
From Northwest U.S.A., call (408) 522-4434.
From Canada, call (408) 522-4480.
From Europe, call (408) 522-4252 or +44 (0) 1276 401500.
From Japan, call (408) 522-4743.
From the rest of the world, call (408) 522-4743.
Fax, from anywhere in the world (408) 522-8044.

Actel Customer Technical Support Center

Actel staffs its Customer Technical Support Center with highly skilled engineers who can help answer your hardware, software, and design questions. The Customer Technical Support Center spends a great deal of time creating application notes and answers to FAQs. So, before you contact us, please visit our online resources. It is very likely we have already answered your questions.

Actel Technical Support

Visit the Actel Customer Support website (http://www.actel.com/custsup/search.html) for more information and support. Many answers available on the searchable web resource include diagrams, illustrations, and links to other resources on the Actel web site.

Web Site

Actel has a World Wide Web home page where you can browse a variety of technical and non-technical information. The URL is http://www.actel.com.

Visit the Actel IP website at http://www.actel.com/ip.

Contacting the Customer Technical Support Center

Highly skilled engineers staff the Technical Support Center from 7:00 A.M. to 6:00 P.M., Pacific Time, Monday through Friday. Several ways of contacting the Center follow:

Electronic Mail

You can communicate your technical questions to our e-mail address and receive answers back by e-mail, fax, or phone. Also, if you have design problems, you can e-mail your design files to receive assistance. We constantly monitor the e-mail account throughout the day. When sending your request to us, please be sure to include your full name, company name, and your contact information for efficient processing of your request.

The technical support e-mail address is **tech@actel.com**.

Telephone

Our Technical Support Center answers all calls. The center retrieves information, such as your name, company name, phone number and your question, and then issues a case number. The Center then forwards the information to a queue where the first available application engineer receives the data and returns your call. The phone hours are from 7:00 A.M. to 6:00 P.M., Pacific Time, Monday through Friday. The Technical Support numbers are:

(408) 522-4460
(800) 262-1060

Customers needing assistance outside the US time zones can either contact technical support via email (tech@actel.com) or contact a local sales office. Please see our list of Worldwide Sales Offices.

Worldwide Sales Offices

Headquarters

Actel Corporation
955 East Arques Avenue
Sunnyvale, California 94086
Toll Free: 888.99.ACTEL

Tel: 408.739.1010
Fax: 408.739.1540

US Sales Offices

California

Bay Area
Tel: 408.328.2200
Fax: 408.328.2358

Irvine
Tel: 949.727.0470
Fax: 949.727.0476

Newbury Park
Tel: 805.375.5769
Fax: 805.375.5749

Colorado

Tel: 303.420.4335
Fax: 303.420.4336

Florida

Tel: 407.977.6846
Fax: 407.977.6847

Georgia

Tel: 770.277.4980
Fax: 770.277.5896

Illinois

Tel: 847.259.1501
Fax: 847.259.1575

Massachusetts

Tel: 978.244.3800
Fax: 978.244.3820

Minnesota

Tel: 651.917.9116
Fax: 651.917.9114

New Jersey

Tel: 609.517.0304

North Carolina

Tel: 919.654.4529
Fax: 919.674.0055

Pennsylvania

Tel: 215.830.1458
Fax: 215.706.0680

Texas

Tel: 972.235.8944
Fax: 972.235.965

International Sales Offices

Canada

235 Stafford Rd. West,
Suite 106
Nepean, Ontario K2H 9C1

Tel: 613.726.7575
Fax: 613.726.8666

France

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Fax: +33 (0)1.40.94.11.04

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85375 Neufahrn

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Tel: 852-22735712

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United Kingdom

Dunlop House,
Riverside Way
Camberley,
Surrey GU15 3YL

Tel: +44 (0)1276.401452
Fax: +44 (0)1276.401490