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# **ADSP-21371 EZ-KIT Lite® Evaluation System Manual**

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Analog Devices, Inc.  
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## Regulatory Compliance

The ADSP-21371 EZ-KIT Lite is designed to be used solely in a laboratory environment. The board is not intended for use as a consumer end product or as a portion of a consumer end product. The board is an open system design which does not include a shielded enclosure and therefore may cause interference to other electrical devices in close proximity. This board should not be used in or near any medical equipment or RF devices.

The ADSP-21371 EZ-KIT Lite has been certified to comply with the essential requirements of the European EMC directive 2004/108/EC and therefore carries the “CE” mark.

The ADSP-21371 EZ-KIT Lite has been appended to Analog Devices, Inc. EMC Technical File (EMC TF) referenced **DSPTOOLS1** and was declared CE compliant by an appointed Notified Body (No.0673) as listed below.

Notified Body Statement of Compliance: Z600ANA2.040 dated June 22 2010.



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The EZ-KIT Lite evaluation system contains ESD (electrostatic discharge) sensitive devices. Electrostatic charges readily accumulate on the human body and equipment and can discharge without detection. Permanent damage may occur on devices subjected to high-energy discharges. Proper ESD precautions are recommended to avoid performance degradation or loss of functionality. Store unused EZ-KIT Lite boards in the protective shipping package.





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# PREFACE

Thank you for purchasing the ADSP-21371 EZ-KIT Lite<sup>®</sup>, Analog Devices, Inc. evaluation system for SHARC<sup>®</sup> processors.

SHARC processors are based on a 32-bit super Harvard architecture that includes a unique memory architecture comprised of two large on-chip, dual-ported SRAM blocks coupled with a sophisticated I/O processor, which gives a SHARC processor the bandwidth for sustained high-speed computations. SHARC processors represents today's de facto standard for floating-point processing, targeted toward premium audio applications.

The evaluation system is designed to be used in conjunction with the CrossCore<sup>®</sup> Embedded Studio (CCES) and VisualDSP++<sup>®</sup> development environments to test capabilities of the ADSP-21371 SHARC processors. The development environment aids advanced application code development and debug, such as:

- Create, compile, assemble, and link application programs written in C++, C, and ADSP-21371 assembly
- Load, run, step, halt, and set breakpoints in application program
- Read and write data and program memory
- Read and write core and peripheral registers
- Plot memory

Access to the ADSP-21371 processor from a personal computer (PC) is achieved through a USB port or an external JTAG emulator. The USB interface provides unrestricted access to the ADSP-21371 processor and

## Product Overview

evaluation board peripherals. Analog Devices JTAG emulators offer faster communication between the host PC and target hardware. Analog Devices carries a wide range of in-circuit emulation products. To learn more about Analog Devices emulators and processor development tools, go to <http://www.analog.com/dsp/tools>.

The ADSP-21371 EZ-KIT Lite provides example programs to demonstrate capabilities of the evaluation board.

## Product Overview

The board features:

- Analog Devices ADSP-21371 processor
  - 208-pin MQFP package
  - 266 MHz core clock speed
- Synchronous dynamic random access memory (SDRAM)
  - 1M x 32-bit x 4 banks
- Flash memory
  - 1M x 8-bit
- Serial peripheral interface (SPI) flash memory
  - 2M bit

- Analog audio interface
  - Analog Devices AD1835A audio codec
  - 4 x 2 RCA phono jack for four channels of stereo output
  - 2 x 1 RCA phono jack for one channel of stereo input
  - 3.5 mm headphone jack for one channel stereo output
- Universal asynchronous receiver/transmitter (UART)
  - ADM3202 RS-232 driver/receiver
  - DB9 female connector
- National Instruments Educational Laboratory Virtual Instrumentation Suite (ELVIS) Interface
  - LabVIEW™-based virtual instruments
  - Multifunction data acquisition device
  - Bench-top workstation and prototype board
- LEDs
  - Eleven LEDs: one power (green), one board reset (red), one USB monitor (amber), and eight general-purpose (amber)
- Push buttons
  - Five push buttons: one reset, two connected to DAI, and two connected to the FLAG pins of the processor
- Expansion interface (type A)
  - Parallel port, FLAG pins, DPI, DAI

## Purpose of This Manual

- Other features
  - JTAG ICE 14-pin header
  - Test points for processor current measurement
  - DPI header
  - DAI header

The EZ-KIT Lite board has a total of 1 MB of parallel flash memory and 2M bit of SPI flash memory. Flash memories can store user-specific boot code and allow the board to run as a standalone unit. For more information, see [“External Memory” on page 1-12](#) and [“Boot Mode and Clock Ratio Select Switch \(SW2\)” on page 2-9](#). The board has 16 MB of SDRAM, which can be used at runtime or from which code can be executed.

The DAI port of the processor is connected to the AD1835A audio codec and an external phase lock loop (PLL). The DAI interface facilitates development of digital and analog audio signal-processing applications. See [“Analog Audio” on page 1-14](#) for more information.

The DPI port of the processor is connected to the UART and SPI interfaces. The UART interface can connect to a standard RS-232, while the SPI connects to the 2M bit of serial flash memory.

Additionally, the EZ-KIT Lite board provides access to all of the processor’s peripheral ports. Access is provided in the form of a three-connector expansion interface. See [“Expansion Interface” on page 2-7](#) for details.

## Purpose of This Manual

The *ADSP-21371 EZ-KIT Lite Evaluation System Manual* provides instructions for installing the product hardware (board). The text describes operation and configuration of the board components and

provides guidelines for running your own code on the ADSP-21371 EZ-KIT Lite. Finally, a schematic and a bill of materials are provided for reference.

## Intended Audience

The primary audience for this manual is a programmer who is familiar with Analog Devices processors. This manual assumes that the audience has a working knowledge of the appropriate processor architecture and instruction set.

Programmers who are unfamiliar with Analog Devices processors can use this manual but should supplement it with other texts that describe your target architecture. For the locations of these documents, see [“Related Documents”](#).

Programmers who are unfamiliar with CCES or VisualDSP++ should refer to the online help and the user’s manuals.

## Manual Contents

The manual consists of:

- Chapter 1, [“Using the ADSP-21371 EZ-KIT Lite”](#) on page 1-1  
Describes EZ-KIT Lite functionality from a programmer’s perspective and provides an easy-to-access memory map.
- Chapter 2, [“ADSP-21371 EZ-KIT Lite Hardware Reference”](#) on page 2-1  
Provides information on the EZ-KIT Lite hardware components.

## What's New in This Manual

- Appendix A, “[ADSP-21371 EZ-KIT Lite Bill of Materials](#)” on [page A-1](#)  
Provides a list of components used to manufacture the EZ-KIT Lite board.
- Appendix B, “[ADSP-21371 EZ-KIT Lite Schematic](#)” on [page B-1](#)  
Provides the resources to allow board-level debugging or to use as a reference guide. Appendix B is part of the online help.

## What's New in This Manual

This is revision 1.1 of the *ADSP-21371 EZ-KIT Lite Evaluation System Manual*. The manual has been updated to include CCES information. In addition, modifications and corrections based on errata reports against the previous manual revision have been made.

For the latest version of this manual, please refer to the Analog Devices Web site.

## Technical Support

You can reach Analog Devices processors and DSP technical support in the following ways:

- Post your questions in the processors and DSP support community at EngineerZone®:  
<http://ez.analog.com/community/dsp>
- Submit your questions to technical support directly at:  
<http://www.analog.com/support>

- E-mail your questions about processors, DSPs, and tools development software from **CrossCore Embedded Studio** or **VisualDSP++**:

Choose **Help > Email Support**. This creates an e-mail to [processor.tools.support@analog.com](mailto:processor.tools.support@analog.com) and automatically attaches your **CrossCore Embedded Studio** or **VisualDSP++** version information and `license.dat` file.

- E-mail your questions about processors and processor applications to:  
[processor.support@analog.com](mailto:processor.support@analog.com) or  
[processor.china@analog.com](mailto:processor.china@analog.com) (Greater China support)
- In the **USA only**, call **1-800-ANALOGD** (1-800-262-5643)
- Contact your Analog Devices sales office or authorized distributor. Locate one at:  
[www.analog.com/adi-sales](http://www.analog.com/adi-sales)
- Send questions by mail to:  
Processors and DSP Technical Support  
Analog Devices, Inc.  
Three Technology Way  
P.O. Box 9106  
Norwood, MA 02062-9106  
USA

## Supported Processors

The ADSP-21371 EZ-KIT Lite evaluation system supports Analog Devices ADSP-21371 SHARC processors.



# Product Information

Product information can be obtained from the Analog Devices Web site and the online help system.

## Analog Devices Web Site

The Analog Devices Web site, [www.analog.com](http://www.analog.com), provides information about a broad range of products—analogue integrated circuits, amplifiers, converters, and digital signal processors.

To access a complete technical library for each processor family, go to [http://www.analog.com/processors/technical\\_library](http://www.analog.com/processors/technical_library). The manuals selection opens a list of current manuals related to the product as well as a link to the previous revisions of the manuals. When locating your manual title, note a possible errata check mark next to the title that leads to the current correction report against the manual.

Also note, [myAnalog](#) is a free feature of the Analog Devices Web site that allows customization of a Web page to display only the latest information about products you are interested in. You can choose to receive weekly e-mail notifications containing updates to the Web pages that meet your interests, including documentation errata against all manuals. [myAnalog](#) provides access to books, application notes, data sheets, code examples, and more.

Visit [myAnalog](#) (found on the Analog Devices home page) to sign up. If you are a registered user, just log on. Your user name is your e-mail address.

## EngineerZone

EngineerZone is a technical support forum from Analog Devices. It allows you direct access to ADI technical support engineers. You can search FAQs and technical information to get quick answers to your embedded processing and DSP design questions.

Use EngineerZone to connect with other DSP developers who face similar design challenges. You can also use this open forum to share knowledge and collaborate with the ADI support team and your peers. Visit <http://ez.analog.com> to sign up.

## Related Documents




For additional information about the product, refer to the following publications.

Table 1. Related Processor Publications

Title	Description
<i>ADSP-21371/ADSP-21375 SHARC Processor Data Sheet</i>	General functional description, pinout, and timing of the processor
<i>ADSP-2137x SHARC Processor Hardware Reference</i>	Description of the internal processor architecture, registers, and all peripheral functions
<i>SHARC Processor Programming Reference</i>	Description of all allowed processor assembly instructions

# Notation Conventions

Text conventions used in this manual are identified and described as follows.

Example	Description
Close command (File menu)	Titles in reference sections indicate the location of an item within the development environment's menu system (for example, the <b>Close</b> command appears on the <b>File</b> menu).
{this   that}	Alternative required items in syntax descriptions appear within curly brackets and separated by vertical bars; read the example as <i>this</i> or <i>that</i> . One or the other is required.
[this   that]	Optional items in syntax descriptions appear within brackets and separated by vertical bars; read the example as an optional <i>this</i> or <i>that</i> .
[this,...]	Optional item lists in syntax descriptions appear within brackets delimited by commas and terminated with an ellipse; read the example as an optional comma-separated list of <i>this</i> .
.SECTION	Commands, directives, keywords, and feature names are in text with letter gothic font.
<i>filename</i>	Non-keyword placeholders appear in text with italic style format.
	<b>Note:</b> For correct operation, ... A Note provides supplementary information on a related topic. In the online version of this book, the word <b>Note</b> appears instead of this symbol.
	<b>Caution:</b> Incorrect device operation may result if ... <b>Caution:</b> Device damage may result if ... A Caution identifies conditions or inappropriate usage of the product that could lead to undesirable results or product damage. In the online version of this book, the word <b>Caution</b> appears instead of this symbol.
	<b>Warning:</b> Injury to device users may result if ... A Warning identifies conditions or inappropriate usage of the product that could lead to conditions that are potentially hazardous for the devices users. In the online version of this book, the word <b>Warning</b> appears instead of this symbol.

# 1 USING THE ADSP-21371 EZ-KIT LITE

This chapter provides specific information to assist you with development of programs for the ADSP-21371 EZ-KIT Lite evaluation system.

The information appears in the following sections.

- [“Package Contents” on page 1-2](#)  
Lists items contained in your EZ-KIT Lite package.
- [“Default Configuration” on page 1-3](#)  
Shows the default configuration of the EZ-KIT Lite board.
- [“CCES Install and Session Startup” on page 1-4](#)  
Instructs how to start a new or open an existing EZ-KIT Lite session using CCES.
- [“VisualDSP++ Install and Session Startup” on page 1-8](#)  
Instructs how to start a new or open an existing EZ-KIT Lite session using VisualDSP++.
- [“CCES Evaluation License” on page 1-10](#)  
Describes the CCES demo license shipped with the EZ-KIT Lite.
- [“VisualDSP++ Evaluation License” on page 1-11](#)  
Describes the VisualDSP++ demo license shipped with the EZ-KIT Lite.
- [“External Memory” on page 1-12](#)  
Defines the memory map of the EZ-KIT Lite; describes how to access external memory.

## Package Contents

- [“ELVIS Interface” on page 1-13](#)  
Describes the on-board National Instruments Educational Laboratory Virtual Instrumentation Suite (NI ELVIS) interface.
- [“Analog Audio” on page 1-14](#)  
Describes how to set up and communicate with the on-board audio codec.
- [“LEDs and Push Buttons” on page 1-15](#)  
Describes the board’s general-purpose I/O pins and buttons.
- [“Example Programs” on page 1-17](#)  
Provides information about example programs included in the evaluation system.
- [“Board Design Database” on page 1-17](#)  
Highlights the available technical resources for the design, layout, fabrication, and assembly of the EZ-KIT Lite.

For information on the graphical user interface, including the boot loading, target options, and other facilities of the EZ-KIT Lite system, refer to the online help.

For detailed information on how to program the ADSP-21371 SHARC processor, refer to the documents referenced in [“Related Documents”](#).

## Package Contents

Your ADSP-21371 EZ-KIT Lite evaluation system package contains the following items.

- ADSP-21371 EZ-KIT Lite board
- Universal 7V DC power supply
- USB 2.0 cable

- 3.5 mm stereo headphones
- 6-foot RCA audio cable
- 6-foot 3.5 mm/RCA x 2 Y-cable

If any item is missing, contact the vendor where you purchased your EZ-KIT Lite or contact Analog Devices, Inc.

## De fa ult C onfig ura tio n

The EZ-KIT Lite evaluation system contains ESD (electrostatic discharge) sensitive devices. Electrostatic charges readily accumulate on the human body and equipment and can discharge without detection. Permanent damage may occur on devices subjected to high-energy discharges. Proper ESD precautions are recommended to avoid performance degradation or loss of functionality. Store unused EZ-KIT Lite boards in the protective shipping package.



The ADSP-21371 EZ-KIT Lite board is designed to run outside your personal computer as a standalone unit. You do not have to open your computer case.

When removing the EZ-KIT Lite board from the package, handle the board carefully to avoid the discharge of static electricity, which may damage some components. [Figure 1-1](#) shows the default jumper settings, DIP switch, connector locations, and LEDs used in installation. Confirm that your board is set up in the default configuration before continuing.

## CCES Install and Session Startup

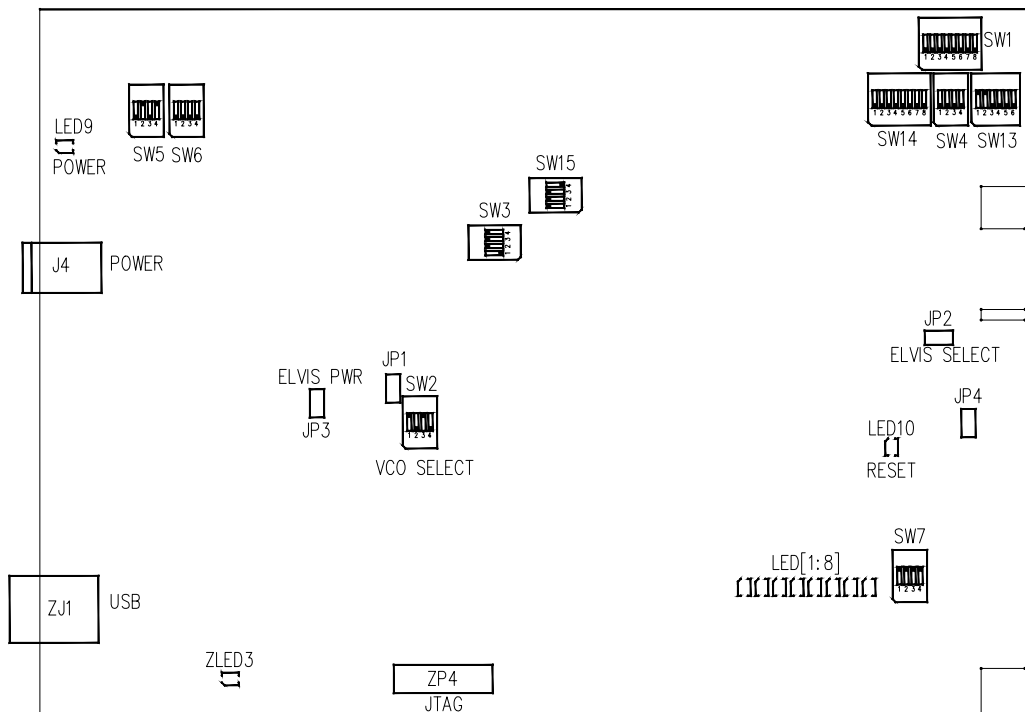


Figure 1-1. EZ-KIT Lite Hardware Setup

## CCES Install and Session Startup

For information about CCES and to download the software, go to [www.analog.com/CCES](http://www.analog.com/CCES). A link for the ADSP-21371 EZ-KIT Lite Board Support Package (BSP) for CCES can be found at <http://www.analog.com/SHARC/EZKits>.

Follow these instructions to ensure correct operation of the product software and hardware.

**Step 1:** Connect the EZ-KIT Lite board to a personal computer (PC) running CCES using one of two options: an Analog Devices emulator or via the debug agent.

### Using an Emulator:

1. Plug one side of the USB cable into the USB connector of the emulator. Plug the other side into a USB port of the PC running CCES.
2. Attach the emulator to the header connector ZP4 (labeled JTAG) on the EZ-KIT Lite board.

### Using the on-board Debug Agent:

1. Plug one side of the USB cable into the USB connector of the debug agent ZJ1 (labeled USB).
2. Plug the other side of the cable into a USB port of the PC running CCES.

**Step 2:** Attach the provided cord and appropriate plug to the 7V power adaptor.

1. Plug the jack-end of the power adaptor into the power connector J4 on the EZ-KIT Lite board.
2. Plug the other side of the power adaptor into a power outlet. The power LED (labeled LED9) is lit green when power is applied to the board.
3. Power the emulator (if used). Plug the jack-end of the assembled power adaptor into the emulator and plug the other side of the power adaptor into a power outlet. The enable/power indicator is lit green when power is applied.



## CCES Install and Session Startup

**Step 3 (if connected through the debug agent):** Verify that the yellow USB monitor LED (labeled ZLED3) and the green power LED (labeled ZLED9) on the debug agent are both on. This signifies that the board is communicating properly with the host PC and ready to run CCES.

### Session Startup

It is assumed that the CrossCore Embedded Studio software is installed and running on your PC.



Note: If you connect the board or emulator first (before installing CCES) to the PC, the Windows driver wizard may not find the board drivers.

1. Navigate to the CCES environment via the **Start** menu.

Note that CCES is not connected to the target board.


2. Use the system configuration utility to connect to the EZ-KIT Lite board.

If a debug configuration exists already, select the appropriate configuration and click **Apply and Debug** or **Debug**. Go to step 8.

To create a debug configuration, do one of the following:

- Click the down arrow next to the little bug icon, select **Debug Configurations**
- Choose **Run > Debug Configurations**.

The **Debug Configuration** dialog box appears.

3. Select **CrossCore Embedded Studio Application** and click  (New launch configuration).

The **Select Processor** page of the **Session Wizard** appears.

4. Ensure **Blackfin** is selected in **Processor family**. In **Processor type**, select **ADSP-21371**. Click **Next**.

The **Select Connection Type** page of the **Session Wizard** appears.

5. Select one of the following:
  - For standalone debug agent connections, **EZ-KIT Lite** and click **Next**.
  - For emulator connections, **Emulator** and click **Next**.

The **Select Platform** page of the **Session Wizard** appears.

6. Do one of the following:
  - For standalone debug agent connections, ensure that the selected platform is **ADSP-21371 EZ-KIT Lite** via **Debug Agent**.
  - For emulator connections, choose the type of emulator that is connected to the board.
7. Click **Finish** to close the wizard.

The new debug configuration is created and added to the program(s) to load list.

8. In the **Program(s) to load** section, choose the program to load when connecting to the board. If not loading any program upon connection to the target, do not make any changes.

Note that while connected to the target, there is no way to choose a program to download. To load a program once connected, terminate the session.