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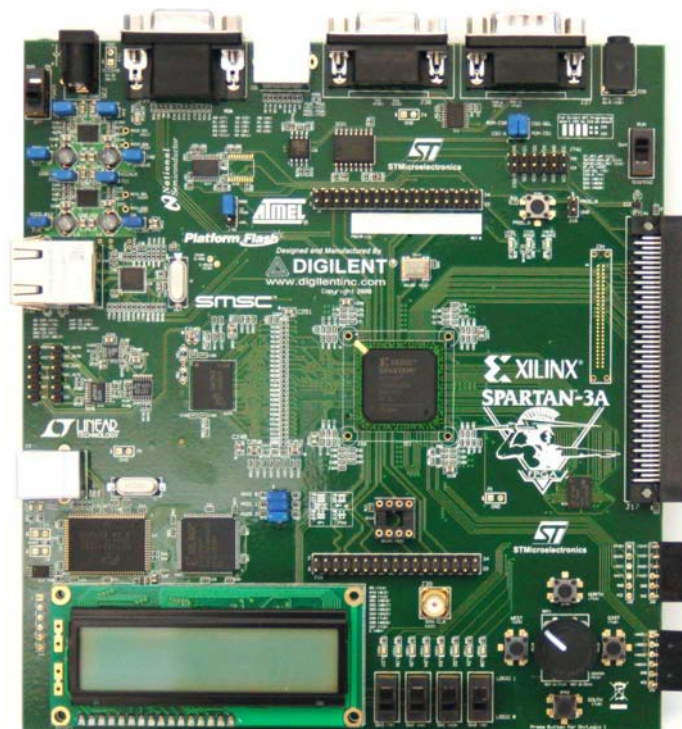
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# Spartan-3A FPGA Starter Kit Board User Guide

*For Revision C Board*

UG330 (v1.3) June 21, 2007



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## Revision History

The following table shows the revision history for this document.

Date	Version	Revision
12/05/06	1.0	Initial release.
02/15/07	1.1	Updated to reflect production version of the board, including updated photographs.
04/15/07	1.2	Added additional detail to “Getting Started,” page 13. Added new section, “Operating the Default Demonstration Design,” page 15. Added information on both Direct and Indirect programming methods to “SPI Flash PROM Programming Options,” page 97. Added sections on “Special Layout Recommendations,” page 116 and “Improving Revision ‘C’ Board Performance beyond 266 Mbps,” page 116 for the DDR2 SDRAM interface. Added section on “Measuring Power Across Voltage Supply Jumpers,” page 141. Updated content throughout.
06/21/07	1.3	Updated to limit to Revision C board and refer to UG334 for Revision D board.

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## About This Guide

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This user guide provides basic information on the Revision C Spartan™-3A FPGA Starter Kit board capabilities, functions, and design. It includes general information on how to use the various peripheral functions included on the board. For detailed reference designs, including VHDL or Verilog source code, please visit the following web link.

- **Spartan-3A FPGA Starter Kit Board Web Page**  
<http://www.xilinx.com/s3astarter>

The Spartan-3A FPGA Starter Kit Board is offered in a newer version, Revision D. The Revision D board is almost identical but has a different silkscreen. The Revision D board is the basis for the [Spartan-3AN FPGA Starter Kit Board](#) and the [Spartan-3A FPGA DDR2 SDRAM Interface Development Kit](#). If you have either of these kits or the Revision D version of the Spartan-3A FPGA Starter Kit board, please refer to UG334 instead:

- **Spartan-3A/3AN FPGA Starter Kit Board User Guide**  
<http://www.xilinx.com/bvdocs/userguides/ug334.pdf>

Figure 1-1 highlights where to find the board revision code.

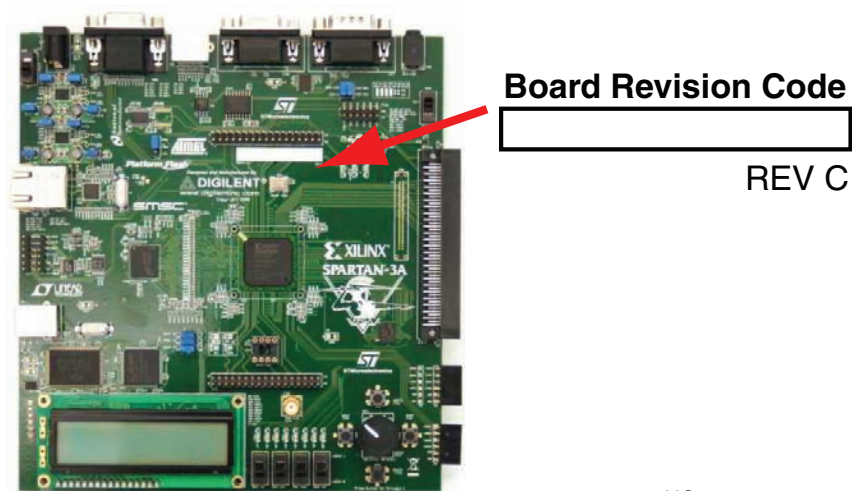


Figure 1-1: Spartan-3A Starter Kit Board, Revision Code

## Acknowledgments

Xilinx wishes to thank the following companies for their support of the Spartan-3A Starter Kit board:

- STMicroelectronics for the 32 Mbit parallel NOR Flash and 16 Mbit SPI serial Flash memories
- Atmel for the 16 Mbit SPI serial DataFlash memory
- Linear Technology for the SPI-compatible A/D and D/A converters and the programmable pre-amplifier
- SMSC for the 10/100 Ethernet PHY
- National Semiconductor for the four-rail voltage regulators that power the FPGA and all peripheral components
- Xilinx, Inc. Configuration Solutions Division for the XCF04S Platform Flash PROM and support for the embedded USB programmer

## Guide Contents

This manual contains the following chapters:

- [Chapter 1, “Introduction and Overview,”](#) provides an overview of the key features of the Spartan-3A Starter Kit board.
- [Chapter 2, “Switches, Buttons, and Rotary Knob,”](#) defines the switches, buttons, and knobs present on the Spartan-3A Starter Kit board.
- [Chapter 3, “Clock Sources,”](#) describes the various clock sources available on the Spartan-3A Starter Kit board.
- [Chapter 4, “FPGA Configuration Options,”](#) describes the configuration options for the FPGA on the Spartan-3A Starter Kit board.
- [Chapter 5, “Character LCD Screen,”](#) describes the functionality of the character LCD screen.
- [Chapter 6, “VGA Display Port,”](#) describes the functionality of the VGA port.
- [Chapter 7, “RS-232 Serial Ports,”](#) describes the functionality of the RS-232 serial ports.
- [Chapter 8, “PS/2 Mouse/Keyboard Port,”](#) describes the functionality of the PS/2 mouse and keyboard port.
- [Chapter 9, “Digital-to-Analog Converter \(DAC\),”](#) describes the functionality of the D/A converter.
- [Chapter 10, “Analog Capture Circuit,”](#) describes the functionality of the A/D converter with a programmable gain pre-amplifier.
- [Chapter 11, “Parallel NOR Flash PROM,”](#) describes the functionality of the STMicroelectronics parallel NOR PROM.
- [Chapter 12, “SPI Serial Flash,”](#) describes the functionality of the SPI Serial Flash memory interface.
- [Chapter 13, “DDR2 SDRAM,”](#) describes the functionality of the DDR2 SDRAM memory interface.
- [Chapter 14, “10/100 Ethernet Physical Layer Interface,”](#) describes the functionality of the 10/100Base-T Ethernet physical layer interface.
- [Chapter 15, “Expansion Connectors,”](#) describes the various connectors available on the Spartan-3A Starter Kit board.

- [Chapter 16, "Miniature Stereo Audio Jack,"](#) describes the audio interface.
- [Chapter 17, "Voltage Supplies,"](#) describes the board's power distribution system.

## Additional Resources

To find additional documentation, see the Xilinx website at:

<http://www.xilinx.com/literature>.

To search the Answer Database of silicon, software, and IP questions and answers, or to create a technical support WebCase, see the Xilinx website at:

<http://www.xilinx.com/support>.



## Introduction and Overview

Thank you for purchasing the Xilinx Spartan™-3A FPGA Starter Kit. The board is invaluable to develop a Spartan-3A FPGA application. This document is for Revision C of the Spartan-3A FPGA Starter Kit. If using Revision D of the Spartan-3A FPGA Starter Kit, or the Spartan-3A FPGA DDR Starter Kit or the Spartan-3AN FPGA Starter Kit, see [UG334](#).

### Getting Started

The Spartan-3A Starter Kit board is ready for action, right out of the box. The design stored in Flash exercises the various I/O devices such as the VGA display, serial ports, and so on, plus demonstrates new Spartan-3A FPGA features such as selectable MultiBoot and the power-saving Suspend mode.

To start using the board, follow the simple steps outlined in [Figure 1-1](#).

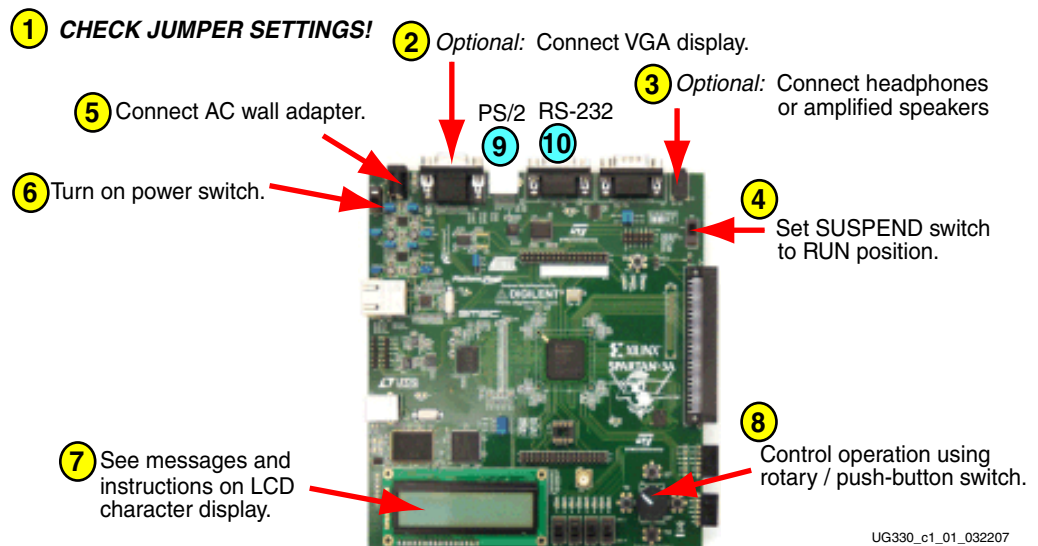


Figure 1-1: Powering Up the Spartan-3A Starter Kit Board

1. Double-check the position of the board jumpers, as shown in [Figure 1-2, page 14](#). These settings are required for the demonstration design to configure correctly.
2. Optionally connect a VGA display device. The display device can be a CRT, a flat-panel, or even a projector.
3. Optionally connect headphones or amplified speakers to the audio jack.
4. Set the SUSPEND switch to the “RUN” position.

5. Connect the included AC adapter to wall power and also to the board. The AC adapter also includes attachments to support world-wide locals.
6. Turn on the power switch.
7. The character LCD and VGA display, if connected, display various informational messages and instructions. If an audio device is connected, the board offers words of welcome in a variety of languages.
8. Use the rotary/pushbutton switch to control various board functions.
9. Optionally connect a PS/2-style keyboard to support one of the included demonstrating designs.
10. Optionally connect a PC directly to the board using a standard 9-pin serial cable.

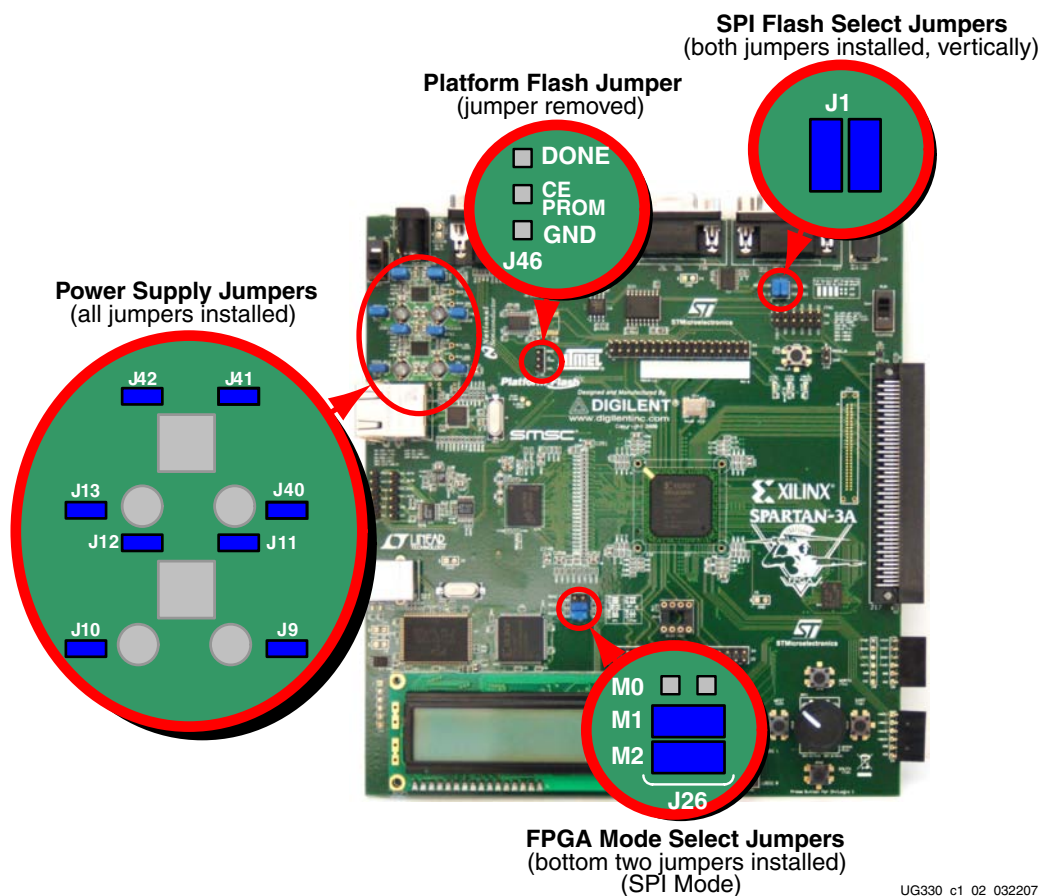


Figure 1-2: Default Jumper Settings for Spartan-3A Starter Kit Board

For more information on the demonstration design, visit the Spartan-3A Design Examples web page.

- **Spartan-3A Starter Kit Demo Design Overview**  
[www.xilinx.com/products/boards/s3astarter/reference\\_designs.htm#demo](http://www.xilinx.com/products/boards/s3astarter/reference_designs.htm#demo)
- **Restoring the “Out of the Box” Flash Programming**  
[www.xilinx.com/products/boards/s3astarter/reference\\_designs.htm#out](http://www.xilinx.com/products/boards/s3astarter/reference_designs.htm#out)

## Operating the Default Demonstration Design

The demonstration design programmed onto the Spartan-3A Starter Kit board provides various output information, depending on what I/O or display devices are connected. The VGA and audio ports provide the richest experience.

### VGA Display

If a VGA display is connected to the board, then the Spartan-3A Starter Kit board displays graphics similar to that shown in [Figure 1-3](#).

Until one of the four push-buttons around the rotary knob ([Figure 2-5, page 27](#)) are pressed, the display automatically rotates a graphic image and zooms in and out around the image. This is called “AutoPilot” mode. A brief text overview describing the board appears along the left edge. Blue text at the bottom of the screen presents the menu system.

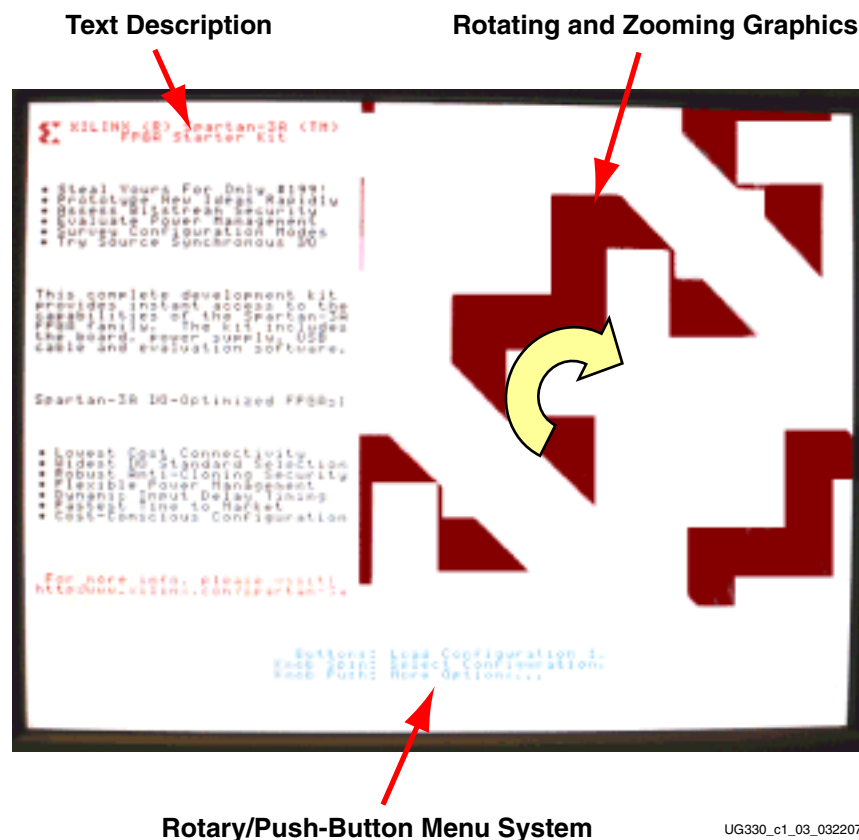


Figure 1-3: Rotating/Zooming Graphics, Menu System Displayed on VGA Screen

### Rotary Knob/Push-button Menu System

The Spartan-3A Starter Kit board demonstration design uses the rotary knob and surrounding push-button switches, shown in [Figure 2-5, page 27](#), to implement a menu system. The menu display appears in blue text at the bottom of the VGA output. The menu functions are highlighted in [Table 1-1](#) and [Figure 1-4](#).



Table 1-1: Function of Each Menu Control

Press Knob	Rotate Knob	Press Push-Button
Move to next menu selection, next mode.	Depends on current mode, as shown in Figure 1-4.	Depends on current mode, as shown in Figure 1-4.

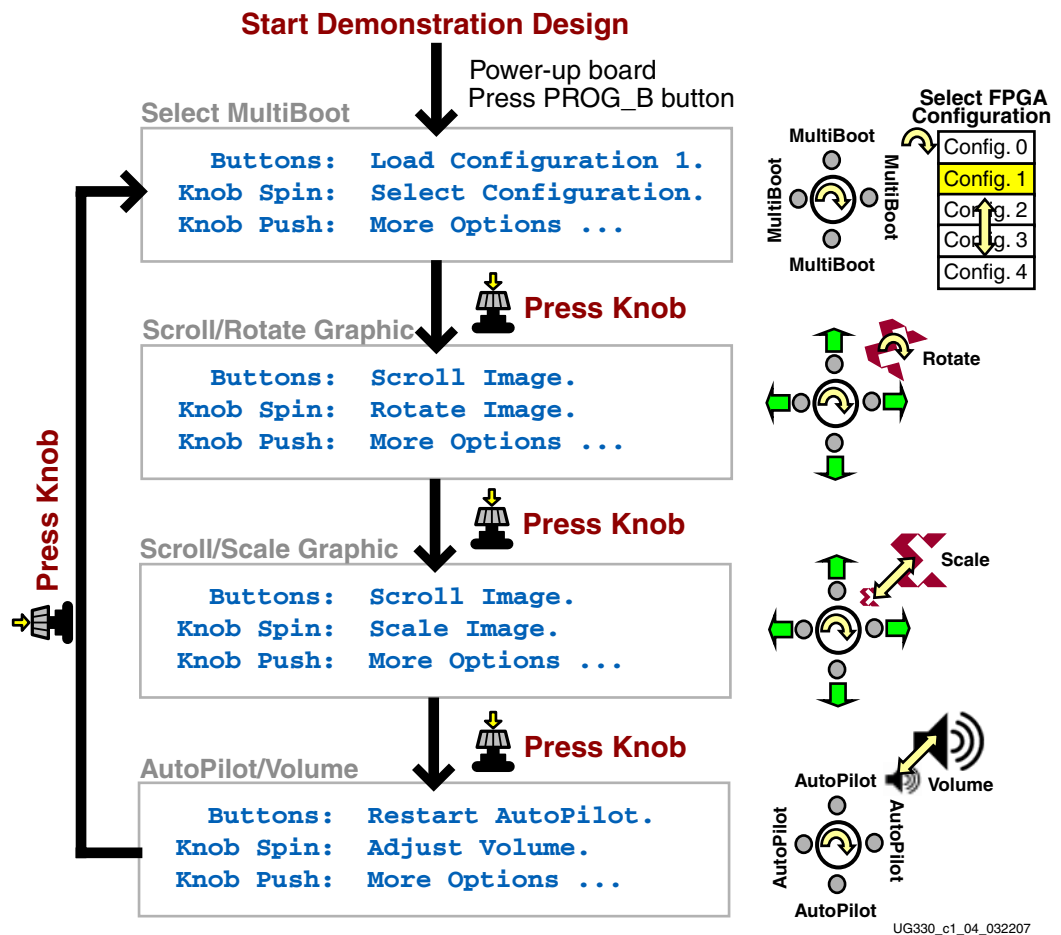


Figure 1-4: Rotary Knob/Push-button Menu System

## Select MultiBoot Configuration Image

Spartan-3A FPGAs support a selectable MultiBoot configuration interface. If the FPGA configures in one of its Master configuration modes, then the FPGA always loads the configuration image stored at address 0 in Flash at power-up, or whenever the PROG\_B button is pressed.

Spin the rotary knob to select a new FPGA configuration image. The blue text at the bottom of the display updates with each click of the rotary knob. For example, the application displays “Buttons: Load Configuration x” where ‘x’ corresponds to the bitstream image listed in Table 1-2. Table 1-2 describes the bitstreams preloaded on the board.

After selecting the desired image, press one of the four push-button switches that surround the rotary knob. This action causes the FPGA to load the selected image from Flash memory.

To change to the “Scroll or Rotate Graphic” mode, press the rotary knob.

Table 1-2: FPGA Configuration Bitstreams Preprogrammed on the Spartan-3A Starter Kit Board

FPGA Configuration Bitstream	FPGA Application/Reference Design Example
0 (default)	Spartan-3A Starter Kit board demonstration design. Loaded at power-up. <a href="http://www.xilinx.com/products/boards/s3astarter/reference_designs.htm#demo">www.xilinx.com/products/boards/s3astarter/reference_designs.htm#demo</a>
1	<b>Device DNA Reader:</b> Reads the FPGA's unique Device ID value and displays it on the character LCD screen. <a href="http://www.xilinx.com/products/boards/s3astarter/reference_designs.htm#dna_reader">www.xilinx.com/products/boards/s3astarter/reference_designs.htm#dna_reader</a>
2	<b>Fractal Generator:</b> Computes fractal images in real time and displays on the VGA port. A user-contributed design by Matthias Alles. Rotate knob to zoom fractal image; press surrounding push-buttons to scroll the image. <a href="http://www-user.rhrk.uni-kl.de/~alles/fpga/files.htm">www-user.rhrk.uni-kl.de/~alles/fpga/files.htm</a>
3	<b>ASCII Terminal:</b> Implements a text terminal using an attached VGA display and PS/2 keyboard and will communicate with HyperTerminal on a PC via an RS-232 serial connection. Source included in <a href="http://www.xilinx.com/products/boards/s3astarter/reference_designs.htm#out">www.xilinx.com/products/boards/s3astarter/reference_designs.htm#out</a> .
4	<b>STMicro M29DW323DT Parallel Flash Programmer:</b> Communicates to a PC using HyperTerminal via an RS-232 serial connection. Programs, erases, and reads the STMicro M29DW323DT parallel Flash PROM on the Starter Kit board. <a href="http://www.xilinx.com/products/boards/s3astarter/reference_designs.htm#parallel_flash_programmer">www.xilinx.com/products/boards/s3astarter/reference_designs.htm#parallel_flash_programmer</a>

## Scroll or Rotate Graphic

In this mode, rotate the knob to rotate the graphic image clockwise or counterclockwise.  
Use the four push-button switches to scroll the graphic image up, down, left, or right.  
Press the rotary knob to change to the “[Scroll or Scale Graphic](#)” mode.

## Scroll or Scale Graphic

In this mode, rotate the knob to scale the size of the graphic image, zooming in and out.  
Use the four push-button switches to scroll the resulting graphic image up, down, left, or right.  
Press the rotary knob to change to the “[Restart AutoPilot, Speaker Volume Control](#)” mode.

## Restart AutoPilot, Speaker Volume Control

In this mode, rotate the knob to control the speaker output volume.  
Press any of the four push-button switches to restart the AutoPilot function.  
Press the rotary knob to change to the “[Select MultiBoot Configuration Image](#)” mode.

## LCD Screen Control Option

While the demonstration design operates best with an attached VGA display, the on-board LCD screen tracks similar functionality, as shown in [Figure 1-5](#). If no VGA display is attached, then the “[Scroll or Rotate Graphic](#)”, “[Scroll or Scale Graphic](#)”, and “[Restart](#)

AutoPilot, Speaker Volume Control” modes offer little to no functionality, the exception being the volume control assuming that a speaker is attached to the audio jack.

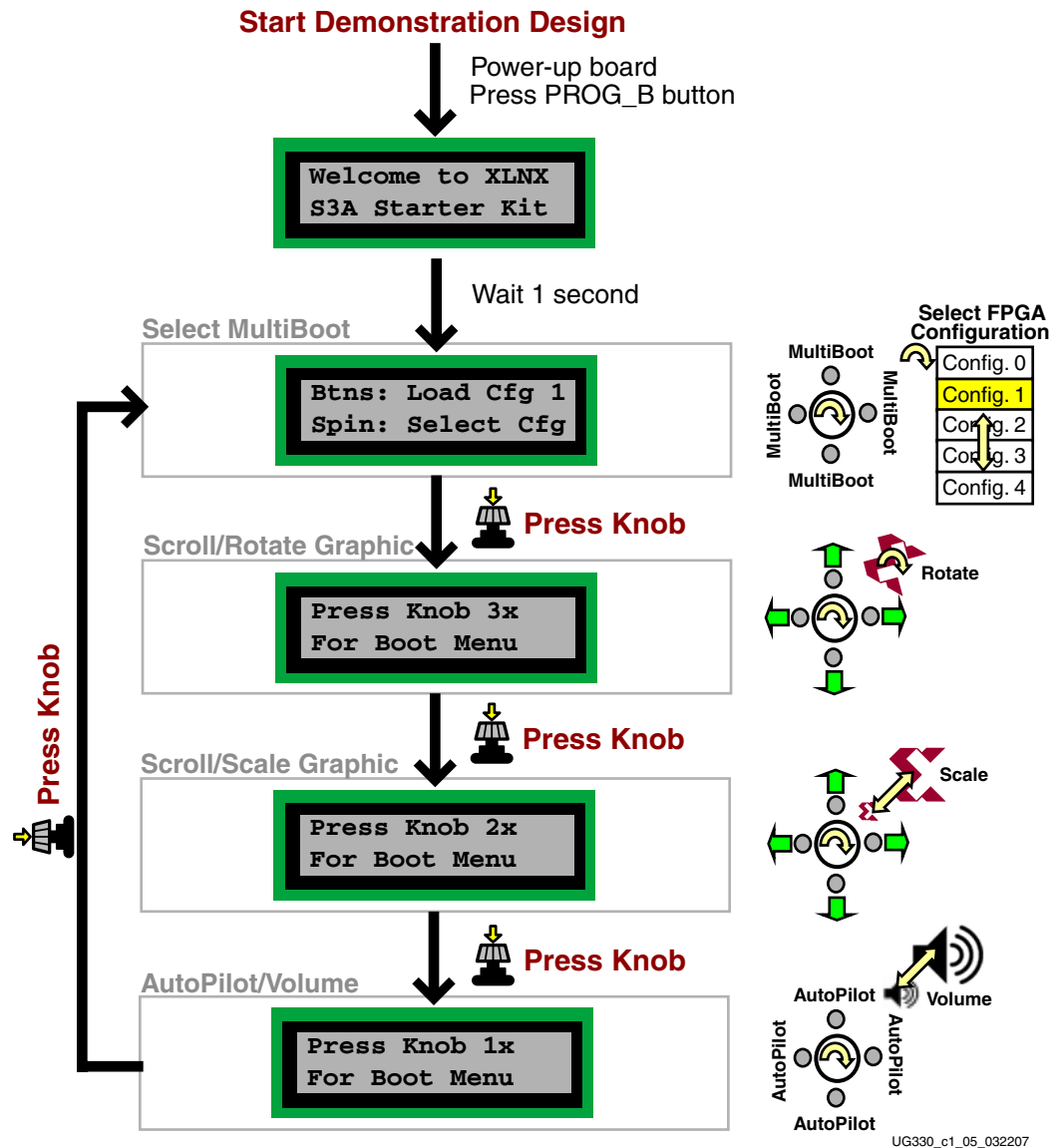


Figure 1-5: LCD Screen Output using Menu System

## Power-Saving Suspend Mode

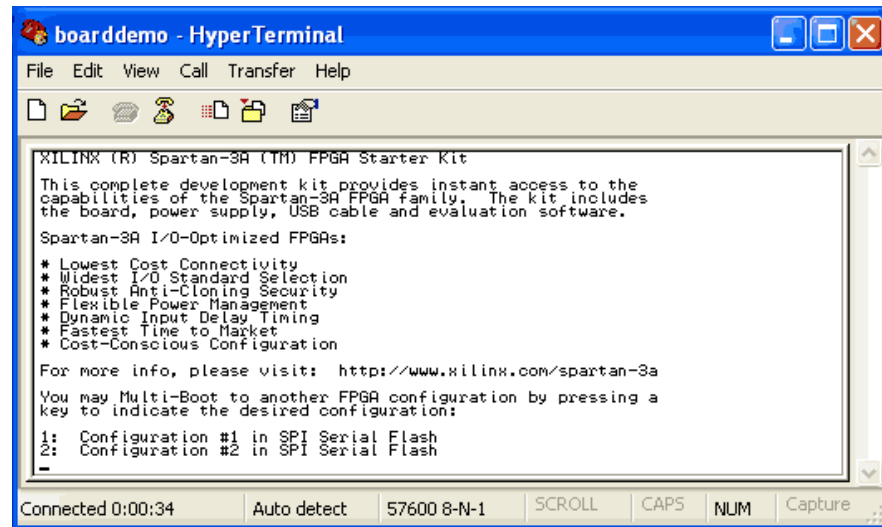
All five of the preloaded FPGA configuration bitstreams have the power-saving Suspend mode enabled. Suspend mode reduces FPGA power consumption while preserving the present state of the FPGA application and the FPGA’s configuration data. Set the SUSPEND switch to RUN or SUSPEND as described in “SUSPEND Switch,” page 26.

Using one or two external multimeters, measure the corresponding difference in current consumption, as described in “Measuring Power Across Voltage Supply Jumpers,” page 141.

**Caution!** Do not set the SUSPEND switch to “SUSPEND” while programming the parallel NOR Flash PROM using configuration bitstream #4, as described in Table 1-2.

## RS-232 Serial Port Control Option

Optionally, control the demonstration design using a serial port connection to a PC or workstation. On a PC, use the HyperTerminal program to communicate to the FPGA application, as shown in [Figure 1-6](#). Using a standard, straight-through 9-pin serial cable, connect the PC's 9-pin RS-232 port to the board's DCE connector, shown in [Figure 7-1](#), [page 65](#).



UG330\_c1\_06\_032207

**Figure 1-6: Use HyperTerminal and a Standard Serial Cable to Connect to Board**

When the demonstration design begins operating, it transmits a message using the serial port.

Press a number key on the PC to load the associated MultiBoot bitstream listed in [Table 1-2](#).

## Key Components and Features

The key features of the Spartan-3A Starter Kit board are:

- Xilinx 700K-gate XC3S700A [Spartan-3A FPGA](#) in the Pb-free 484-ball BGA package (FGG484)
- 4 Mbit Xilinx [Platform Flash configuration PROM](#)
- 64 MByte (512 Mbit) of DDR2 SDRAM, 32Mx16 data interface
- 4 MByte (32 Mbit) of parallel NOR Flash
  - ◆ FPGA configuration storage
  - ◆ [MicroBlaze](#) code storage/shadowing
  - ◆ x8 or x16 data interface after configuration
- Two 16 Mbit SPI serial Flash
  - ◆ STMicroelectronics and Atmel DataFlash serial architectures
  - ◆ FPGA configuration storage
    - Supports single configuration bitstream or multiple MultiBoot configuration bitstreams
  - ◆ Nonvolatile data storage

- ◆ MicroBlaze code shadowing
- Two-line, 16-character LCD screen
- PS/2 port
  - ◆ Supports PS/2-compatible mouse or keyboard
  - ◆ Supports both mouse and keyboard using a Y-splitter cable (not included)
- VGA display port, 12-bit color
- 10/100 Ethernet PHY (requires Ethernet MAC in FPGA)
- Two nine-pin RS-232 ports (DTE- and DCE-style)
- On-board USB-based programming solution
  - ◆ FPGA download/debug
  - ◆ SPI serial Flash in-system direct programming
- 50 MHz clock oscillator
- 8-pin DIP socket for second oscillator
- SMA connector for clock inputs or outputs
- 100-pin Hirose FX2 expansion connector with up to 43 FPGA user I/Os
  - ◆ Compatible with [Digilent FX2 add-on cards](#)
- High-speed differential I/O connectors
  - ◆ Receiver: Six data channels or five data channels plus clock
  - ◆ Transmitter: Six data channels or five data channels plus clock
  - ◆ Supports multiple differential I/O standards, including LVDS, RSDS, mini-LVDS
  - ◆ Also supports up to 24 single-ended I/O
  - ◆ Uses widely available 34-conductor cables
- Two six-pin expansion connectors for [Digilent Peripheral Modules](#)
- Four-output, SPI-based Digital-to-Analog Converter (DAC)
- Two-input, SPI-based Analog-to-Digital Converter (ADC) with programmable-gain pre-amplifier
- Stereo audio jack using digital I/O pins
- [ChipScope](#)<sup>TM</sup> analyzer SoftTouch debugging port
- Rotary-encoder with push-button shaft
- Eight discrete LEDs
- Four slide switches
- Four push-button switches

## Design Trade-Offs

A few system-level design trade-offs were required in order to provide the Spartan-3A Starter Kit board with the most functionality.

### Configuration Methods Galore!

A typical FPGA application uses a single nonvolatile memory to store configuration images. To demonstrate new Spartan-3A capabilities, the starter kit board has four different configuration memory sources that all must function well together. The extra configuration functions make the starter kit board more complex than typical Spartan-3A applications.

The starter kit board also includes an on-board USB-based JTAG programming interface. The on-chip circuitry simplifies the device programming experience. In typical applications, the JTAG programming hardware resides off-board or in a separate programming module, such as the Xilinx Platform USB cable.

### Voltages for all Applications

The Spartan-3A Starter Kit board showcases a quadruple-output regulator developed by National Semiconductor specifically to power Spartan-3, Spartan-3E, and Spartan-3A FPGAs. This regulator is sufficient for most standalone FPGA applications.

## Spartan-3A Starter Kit Design Examples

Visit the Spartan-3A Starter Kit Design Examples web page to download and use the latest applications that specifically target the starter kit board.

- **Spartan-3A Starter Kit Design Examples Web Page**

[www.xilinx.com/products/boards/s3astarter/reference\\_designs.htm](http://www.xilinx.com/products/boards/s3astarter/reference_designs.htm)

The list of designs is ever growing and the applications are often updated to the latest software releases. The following list provides a sample of design examples.

- **Spartan-3A Starter Kit Demo Design Overview**

[www.xilinx.com/products/boards/s3astarter/reference\\_designs.htm#demo](http://www.xilinx.com/products/boards/s3astarter/reference_designs.htm#demo)

This describes the out-of-the box demo design shipped with the board. Includes how to set up and operate the demonstration, evaluating Spartan-3A MultiBoot and Suspend, plus demo technical details.

- **Restoring the “Out of the Box” Flash Programming**

[www.xilinx.com/products/boards/s3astarter/reference\\_designs.htm#out](http://www.xilinx.com/products/boards/s3astarter/reference_designs.htm#out)

Provides a short overview of what the Spartan-3A Starter Kit does “out of the box” and includes instructions on how to restore the board to the original “out of the box” state. The ZIP file includes the “golden” MCS files that are pre-programmed into Flash memory before the board is shipped. The PDF file contains instructions for restoring the board to its original settings using these MCS files in case any of the configuration memories were overwritten during normal use.

- **Spartan-3A Starter Kit Board Verification Design**

[www.xilinx.com/products/boards/s3astarter/reference\\_designs.htm#test](http://www.xilinx.com/products/boards/s3astarter/reference_designs.htm#test)

This example includes the board test specification and the board test design. This design was used during initial board verification and some functions are used during production test. It is provided to test out a board if something is not working as expected. The design files may also be of general interest. The ZIP file has the design source, a script to run them, and the resulting compiled files.

- **Programmer for the ST Microelectronics M29DW323DT Parallel NOR Flash**

[www.xilinx.com/products/boards/s3astarter/reference\\_designs.htm#parallel\\_flash\\_programmer](http://www.xilinx.com/products/boards/s3astarter/reference_designs.htm#parallel_flash_programmer)

This design transforms the XC3S700A FPGA into a programmer for the 32Mbit ST Microelectronics M29DW323DT parallel NOR Flash memory. This memory optionally holds configuration images for the Spartan-3A FPGAs and provides general nonvolatile storage for other applications implemented within the Spartan-3A FPGA. Using a simple terminal program, this application provides the following capabilities.

- Erase the memory in part or in full
- Read the memory to verify contents
- Download complete configuration images using standard MCS files
- Manually program individual bytes
- Display the device identifier and 64-bit unique device numbers

- **Spartan-3A “Device DNA” Reader**

[www.xilinx.com/products/boards/s3astarter/reference\\_designs.htm#dna\\_reader](http://www.xilinx.com/products/boards/s3astarter/reference_designs.htm#dna_reader)

This design uses a PicoBlaze™ processor to read the unique “Device DNA” identifier embedded in each Spartan-3A and then display it on the LCD screen.

## Choose a Spartan-3 Generation Starter Kit Board for your Needs

The Spartan-3A Starter Kit board is best for prototyping Spartan-3A FPGA applications. Depending on specific requirements, however, Xilinx and third-party companies offer development boards that better suit other needs.

### Spartan-3A FPGA Features and Embedded Processing Functions

The Spartan-3A Starter Kit board highlights the unique features of the Spartan-3A FPGA family and provides a convenient development board for embedded processing applications. The board highlights these features:

- Spartan-3A specific features
  - ◆ Parallel NOR Flash configuration
  - ◆ SPI serial Flash configuration using either the STMicroelectronics or Atmel DataFlash architectures
  - ◆ MultiBoot FPGA configuration from both Parallel NOR and SPI serial Flash PROMs
- Embedded development
  - ◆ [MicroBlaze™](#) 32-bit embedded RISC processor
  - ◆ [PicoBlaze™](#) eight-bit embedded controller
- Power management using the Spartan-3A Suspend mode feature
- DDR2 SDRAM memory interfaces

### Other Spartan-3 Generation Development Boards

The Spartan-3A Starter Kit board demonstrates the full capabilities of the Spartan-3A FPGA family and the Xilinx ISE™ development software. Also consider two other products based on the same board::

- **Spartan-3AN FPGA Starter Kit Board (HW-SPAR3AN-SK-UNI-G)**  
[www.xilinx.com/s3anstarter](http://www.xilinx.com/s3anstarter)
- **Spartan-3A FPGA DDR2 SDRAM Interface Starter Kit Board (HW-SPAR3ADDR2-DK-UNI-G)**  
[www.xilinx.com/s3addr2](http://www.xilinx.com/s3addr2)

For a development board specific to the Spartan-3E FPGA family, consider the Spartan-3E Starter Kit board. There are multiple ordering codes, depending on the included power supply.

- **Spartan-3E Starter Kit Board (HW-SPAR3E-SK\_XX)**  
[www.xilinx.com/s3estarter](http://www.xilinx.com/s3estarter)

For MicroBlaze development, consider the XC3S1600E Embedded Development board.

- **XC3S1600E Embedded Development Board (DO-SP3E1600E-DK-UNI-G)**  
[www.xilinx.com/sp3e1600e](http://www.xilinx.com/sp3e1600e)

For PCI EXPRESS® applications, consider the Spartan-3 PCI EXPRESS Starter Kit.

- **Spartan-3 PCI EXPRESS Starter Kit (HW-S3PCIE-DK)**  
[www.xilinx.com/s3pcie](http://www.xilinx.com/s3pcie)



For simple Spartan-3 FPGA applications, consider the fairly basic Spartan-3 Starter Kit board.

- **Spartan-3 Starter Kit (HW-SPAR3-SK-UNI-G)**  
[www.xilinx.com/s3starter](http://www.xilinx.com/s3starter)

Also consider the capable boards offered by Xilinx partners:

- **Spartan-3 Generation Board Interactive Search**  
[www.xilinx.com/products/devboards/index.htm](http://www.xilinx.com/products/devboards/index.htm)

## Related Resources

Refer to the following links for additional information:

- **Spartan-3A Starter Kit**  
[www.xilinx.com/s3astarter](http://www.xilinx.com/s3astarter)
  - ◆ Example User Constraints File (UCF)  
[www.xilinx.com/products/boards/s3astarter/files/s3astarter.ucf](http://www.xilinx.com/products/boards/s3astarter/files/s3astarter.ucf)
  - ◆ Board schematics (annotated)  
[www.xilinx.com/bvdocs/userguides/s3astarter\\_schematic.pdf](http://www.xilinx.com/bvdocs/userguides/s3astarter_schematic.pdf)
  - ◆ Bill of materials (BOM) list  
[www.xilinx.com/bvdocs/userguides/s3astarter\\_bom.xls](http://www.xilinx.com/bvdocs/userguides/s3astarter_bom.xls)
  - ◆ Link to design examples  
[www.xilinx.com/products/boards/s3astarter/reference\\_designs.htm](http://www.xilinx.com/products/boards/s3astarter/reference_designs.htm)
- **Xilinx MicroBlaze Soft Processor**  
[www.xilinx.com/microblaze](http://www.xilinx.com/microblaze)
- **Xilinx PicoBlaze Soft Processor**  
[www.xilinx.com/picoblaze](http://www.xilinx.com/picoblaze)
- **Xilinx Embedded Development Kit**  
[www.xilinx.com/ise/embedded\\_design\\_prod/platform\\_studio.htm](http://www.xilinx.com/ise/embedded_design_prod/platform_studio.htm)
- **Xilinx Software Tutorials**  
[www.xilinx.com/support/techsup/tutorials/](http://www.xilinx.com/support/techsup/tutorials/)
- **Xilinx Technical Support**  
[www.xilinx.com/support](http://www.xilinx.com/support)

## Switches, Buttons, and Rotary Knob

### Slide Switches

#### Locations and Labels

The Spartan™-3A FPGA Starter Kit board has four slide switches, as shown in [Figure 2-1](#). The slide switches are located in the lower right corner of the board and are labeled SW3 through SW0. Switch SW3 is the left-most switch, and SW0 is the right-most switch.

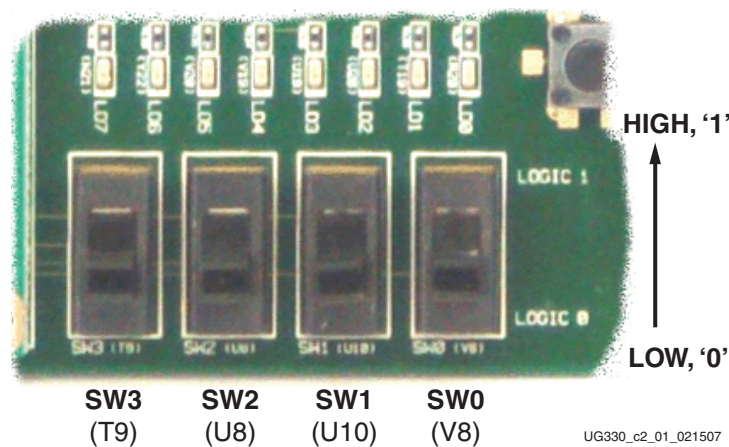


Figure 2-1: Four Slide Switches

#### Operation

When in the UP or ON position, a switch connects the FPGA pin to 3.3V, a logic High. When DOWN or in the OFF position, the switch connects the FPGA pin to ground, a logic Low. The switches typically exhibit about 2 ms of mechanical bounce. There is no active debouncing circuitry, although such circuitry could easily be added to the FPGA design programmed on the board.

#### UCF Location Constraints

[Figure 2-2](#) provides the UCF constraints for the four slide switches, including the I/O pin assignment and the I/O standard used. The PULLUP resistor is not required, but it defines the input value when the switch is in the middle of a transition.