

# 4-ch RAID0 by SATA Host-IP Demo Instruction

Rev1.0 24-Nov-16

This document describes the instruction to run 4-ch RAID0 SATA Host-IP demo on FPGA development board and AB09-FMCRAID/AB12-HSMCRAID adapter board. The demo is designed to write/verify data with four SATA-III devices. User can control test operation through NiosII command shell.

## 1 Environment Requirement

To run demo SATA Host RAID0 demo on FPGA board, please prepare the following hardware/software.

- 1) Altera board: Altera ArriaV GX Starter board/Altera Arria10 SoC Development board
- 2) PC with QuartusII programmer and NiosII command shell software
- 3) AB09-FMCRAID for Arria10 SoC board or AB12-HSMCRAID for ArriaV GX Starter board
- 4) Four SATA-III devices connection at CN0-CN3 of FMCRAID/HSMCRAID board
- 5) Altera Power adapter and ATX power supply for SSD
- 6) A cable for programming FPGA and NiosII command shell connecting between FPGA board and PC,
  - USB Type-B cable in case of ArriaV GX Starter board
  - micro USB cable in case of Arria10 SoC Development board

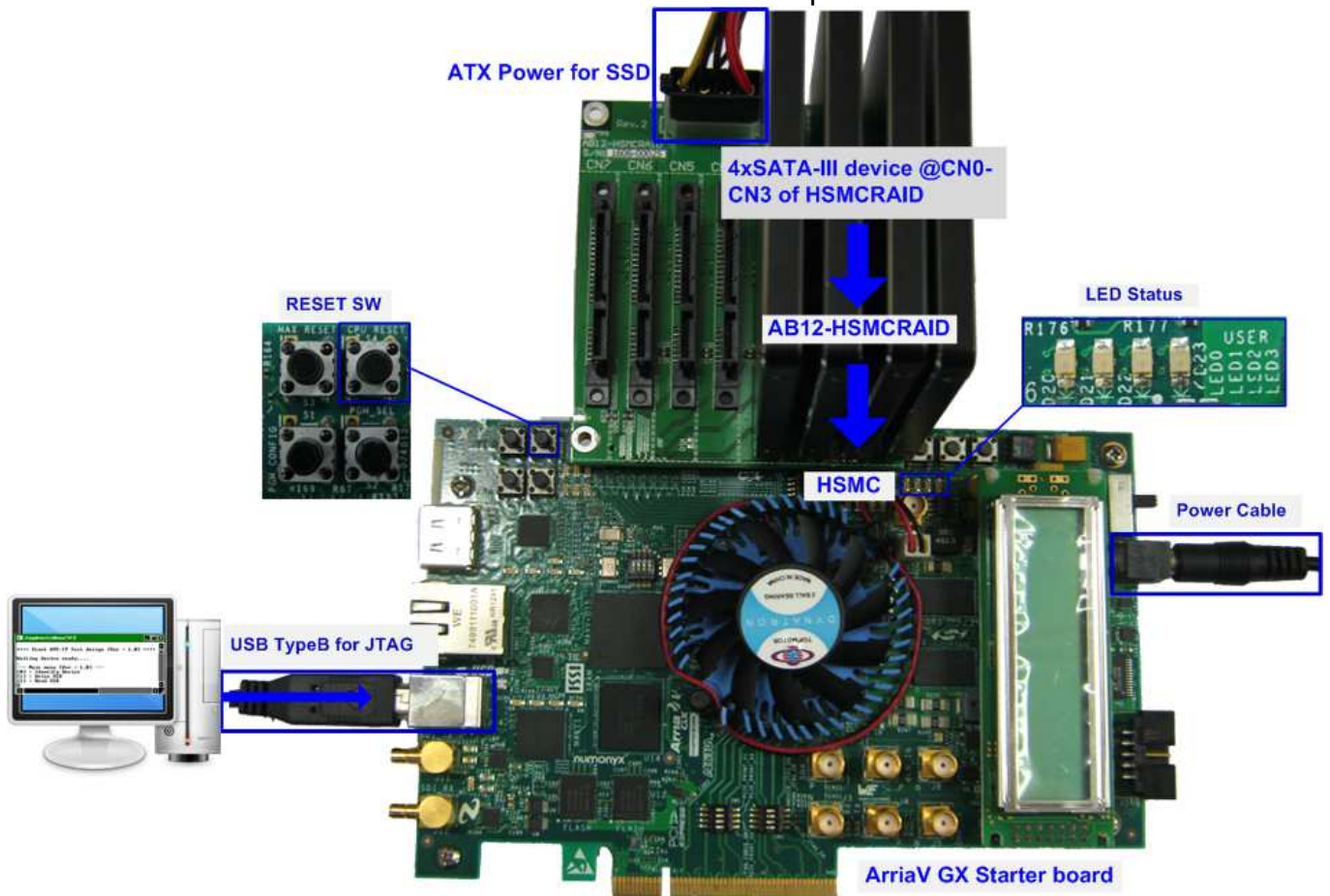


Figure 1-1 SATA Host RAID0 Demo Environment Setup on ArriaV GX Starter Board



Figure 1-2 SATA Host RAID0 Demo Environment Setup on Arria10 SoC Development Board

## 2 Demo setup

- 1) Power off system.
- 2) Setup board option.
  - a) For ArriaV GX Starter board only, set bit1 of SW4 to OFF position.

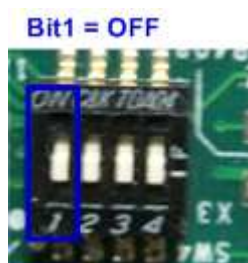


Figure 2-1 Set SW to select clock input for ArriaV GX Starter board

- 3) Setup RAID adapter board.
  - i. Connect AB09-FMCRAID/AB12-HSMCRAID to FMC#/HSMC connector on Altera board.
  - ii. Connect four SATA-III devices to CN0-CN3 on AB09/AB12.
  - iii. Connect power to power connector on AB09/AB12



Figure 2-2 AB09/AB12 connection to FPGA board

- 4) Connect USB Type A or micro USB cable from FPGA board to PC for JTAG programming and JTAG UART.

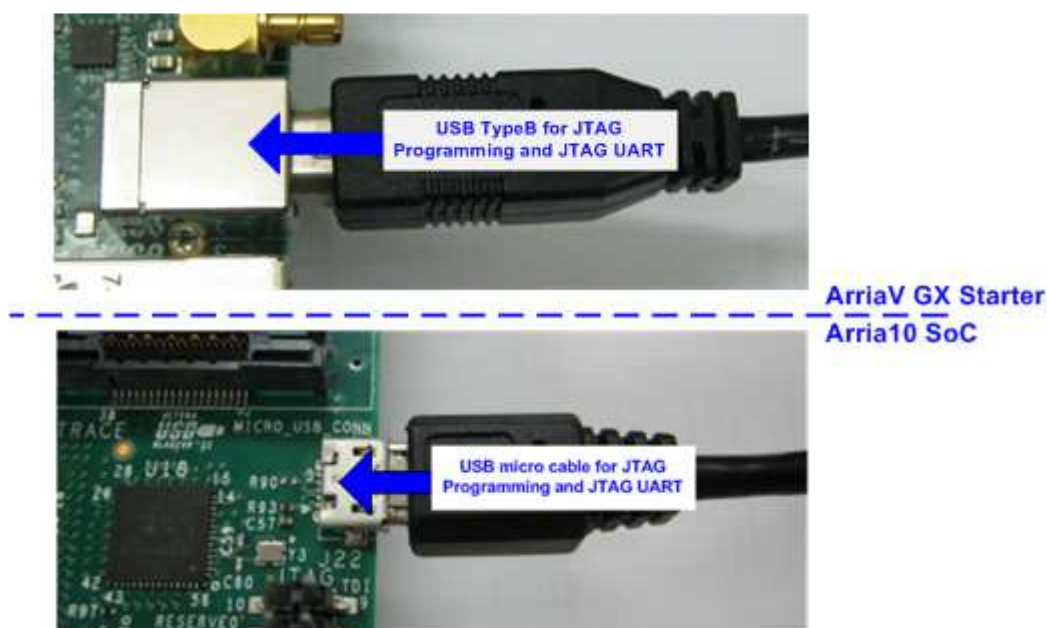


Figure 2-3 USB cable for JTAG connection

- 5) Power on FPGA development board and power supply for SATA device.
- 6) Open “Clock Control” application to program 150 MHz clock for Altera board.
  - a) For ArriaV GX Starter board only, select 1<sup>st</sup> tab (U4), set CLK0 frequency = 150 MHz, and click “Set New Frequency” button.

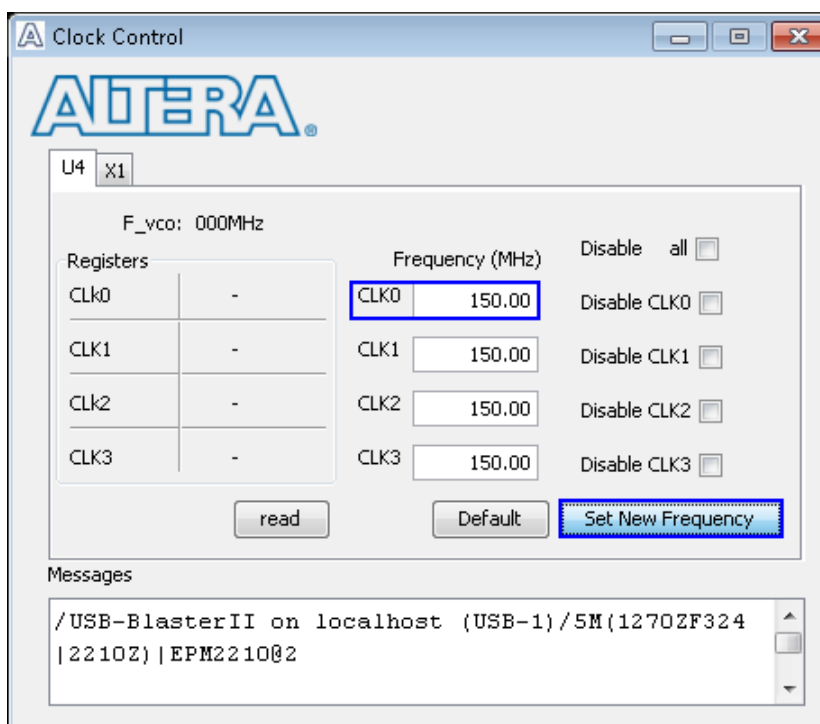


Figure 2-4 Set clock frequency for ArriaV GX board

7) Use QuartusII Programmer to program “HSATARaid0x4.sof” file, as shown in Figure 2-5.

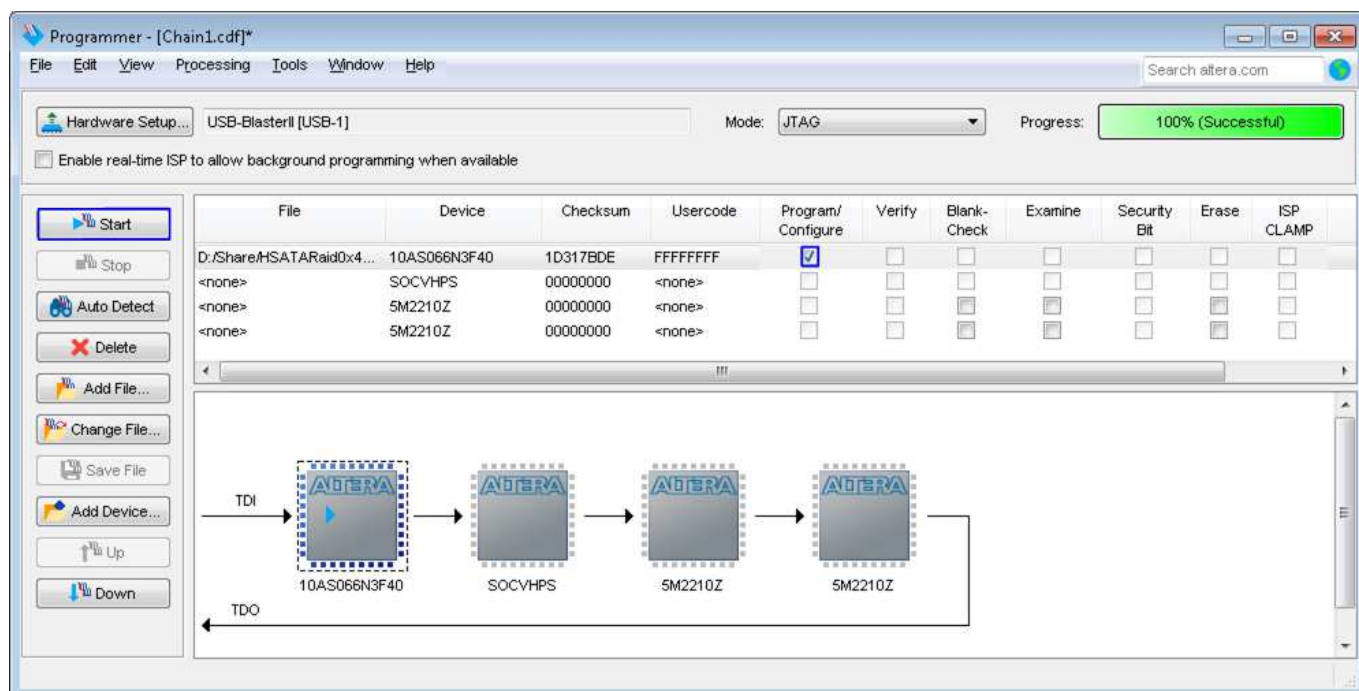


Figure 2-5 Programmed by QuartusII Programmer

8) Open NiosII Command Shell and run nios2-terminal command. Boot message will be displayed.

“Waiting device ready” message is displayed during system initialization.

“SATA Gen3 Device Detect” shows SATA speed after complete RAID0 initialization.

Main menu will be displayed to receive command from user.

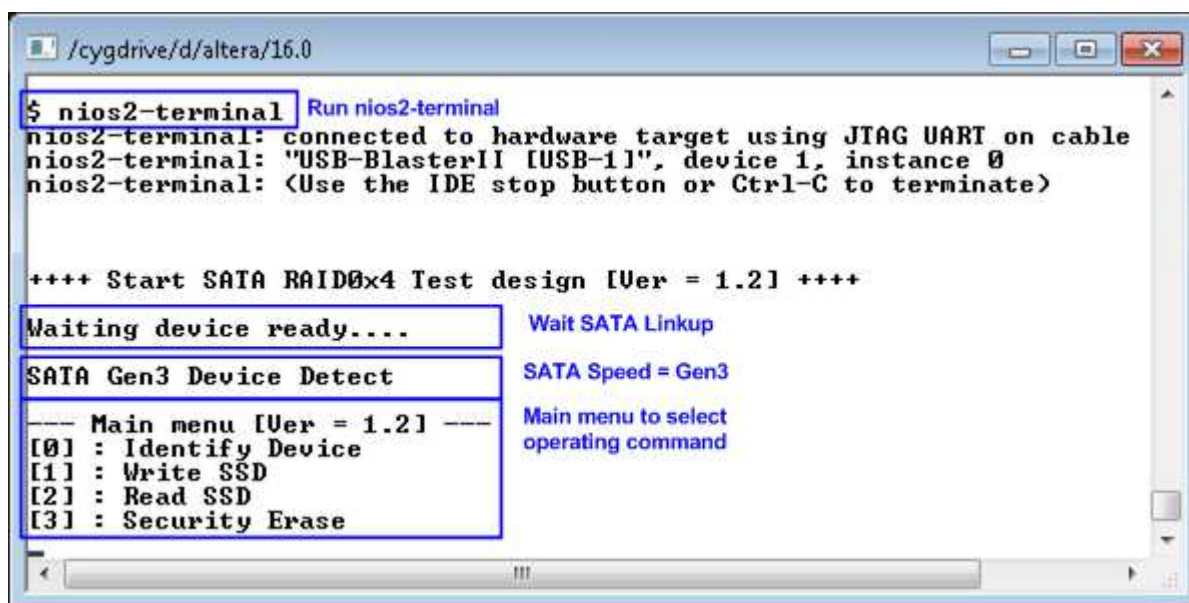


Figure 2-6 NiosII Terminal

- 9) If some SATA devices cannot be detected, error message that “CHX Not Detect” will be displayed as shown in Figure 2-7. Please check SATA device in error channel.



Figure 2-7 Error message when some devices cannot be detected

- 10) Check LED status on FPGA board. The description of LED is follows.

Table 1 LED Definition

GPIO LED	ON	OFF
0	Normal operation	System is in reset condition
1	System is busy	Idle status
2	Error detect	Normal operation
3	Data verification fail	Normal operation

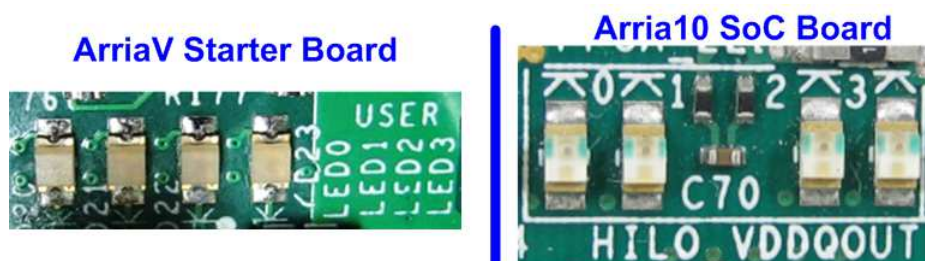


Figure 2-8 4-bit LED Status for user output

After programming completely, LED[0] and LED[1] will be ON during RAID0 initialization process. Then, LED[1] will be OFF to show that RAID0 completes initialization process and now system is ready to receive command from user.

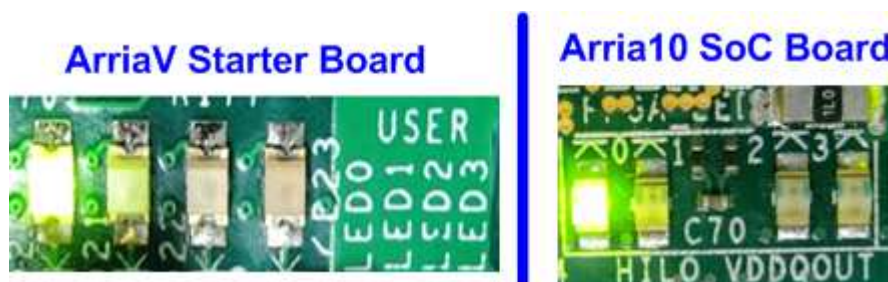


Figure 2-9 LED status after program configuration file and RAID0 initialization complete

### 3 Test Menu

#### 3.1 Identify Device

Select '0' to send Identify device command to SATA Device. When operation is completed, four information will be displayed on the console, i.e.

- 1) SSD Model number
- 2) Security feature set is supported or not. If any device is not supported, user must not use menu 3 for the test.
- 3) Normal Erase Mode Time: This is estimation time to complete security erase command. Minimum valid value is 2 minutes. This information will be displayed when the device can support Security feature set.
- 4) SSD capacity which is output value from RAID0 block. The value will be equal to four times of SATA CH#0 capacity.

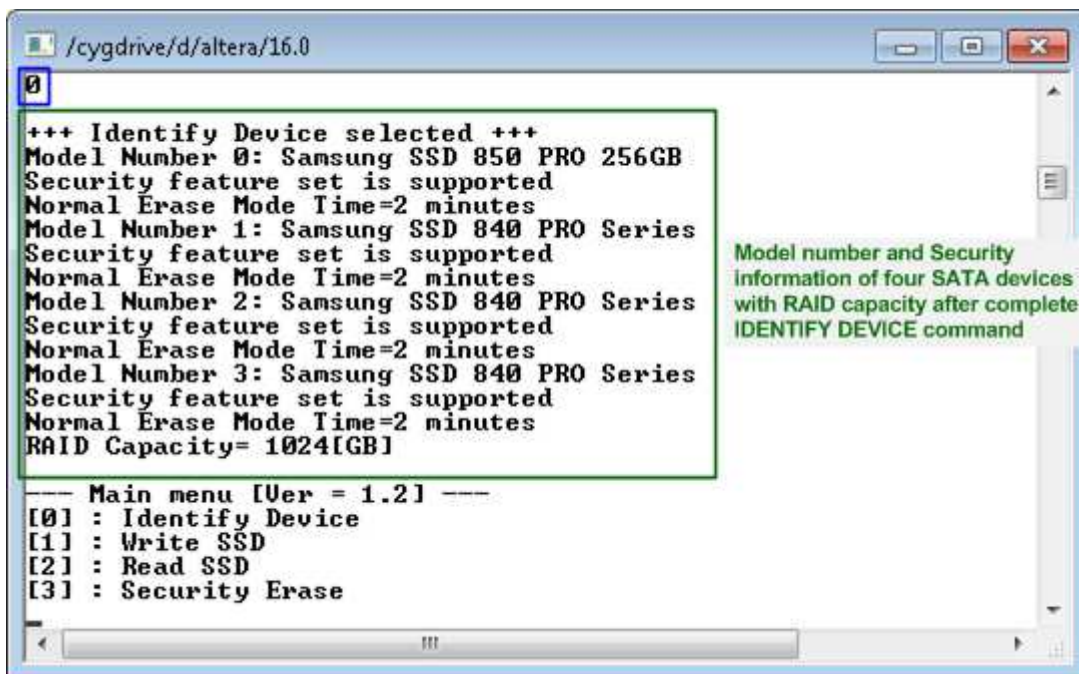


Figure 3-1 Result from Identify Device menu

### 3.2 Write SSD

Select '1' to send Write command to RAID0. Three inputs are required for this menu.

- 1) Start LBA: Input start address of RAID0 in sector unit. The input can be decimal unit or add prefix "0x" for hexadecimal unit.
- 2) Sector Count: Input total transfer size in sector unit. The input can be decimal unit or add prefix "0x" for hexadecimal unit.
- 3) Test pattern: Select test pattern of test data for writing to RAID0. Four types can be used, i.e. 32-bit increment, 32-bit decrement, all 0, and all 1.

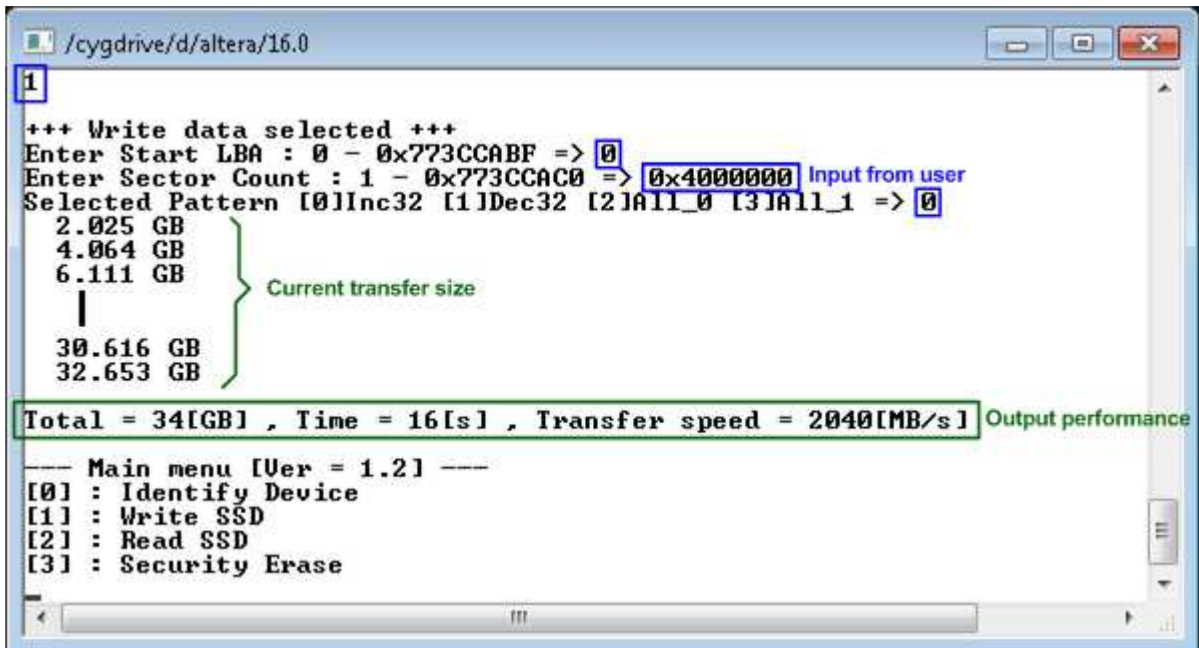


Figure 3-2 Input and result of Write SSD menu

As shown in Figure 3-2, if all inputs are valid, the operation will be started. During writing data, current transfer size will be printed out to the console to show that system still be alive. Finally, test performance with the size and time usage will be displayed on the console.

Figure 3-3 – Figure 3-5 shows error message when user input is invalid. "Invalid input" message will be displayed on the console, and then return to main menu to receive new command.

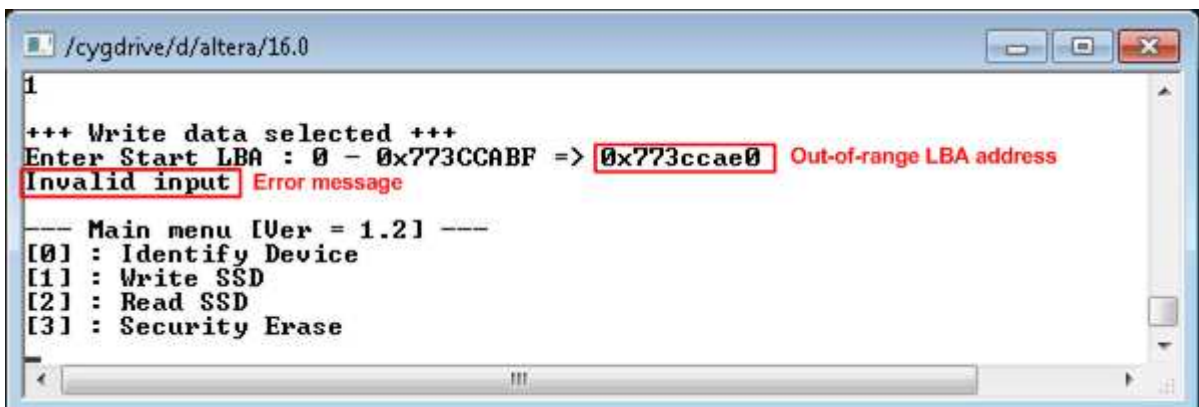


Figure 3-3 Invalid Start LBA input



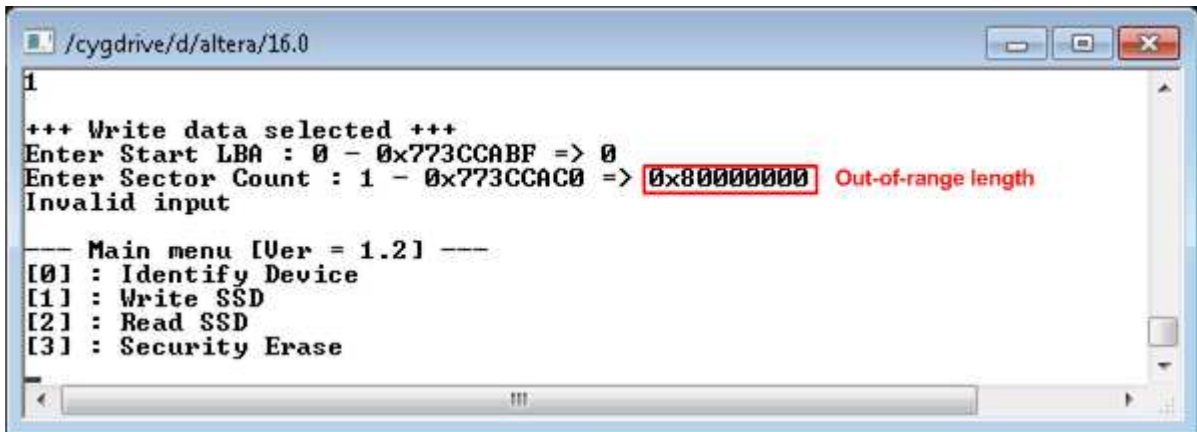


Figure 3-4 Invalid Sector count input



Figure 3-5 Invalid Test pattern input

### 3.3 Read SSD

Select '2' to send Read command to RAID0. Three inputs are required for this menu.

- 1) Start LBA: Input start address of RAID0 in sector unit. The input can be decimal unit or add prefix "0x" for hexadecimal unit.
- 2) Sector Count: Input total transfer size in sector unit. The input can be decimal unit or add prefix "0x" for hexadecimal unit.
- 3) Test pattern: Select test pattern to verify data from RAID0. Test pattern must be matched with write test. Four types can be used, i.e. 32-bit increment, 32-bit decrement, all 0, and all 1.

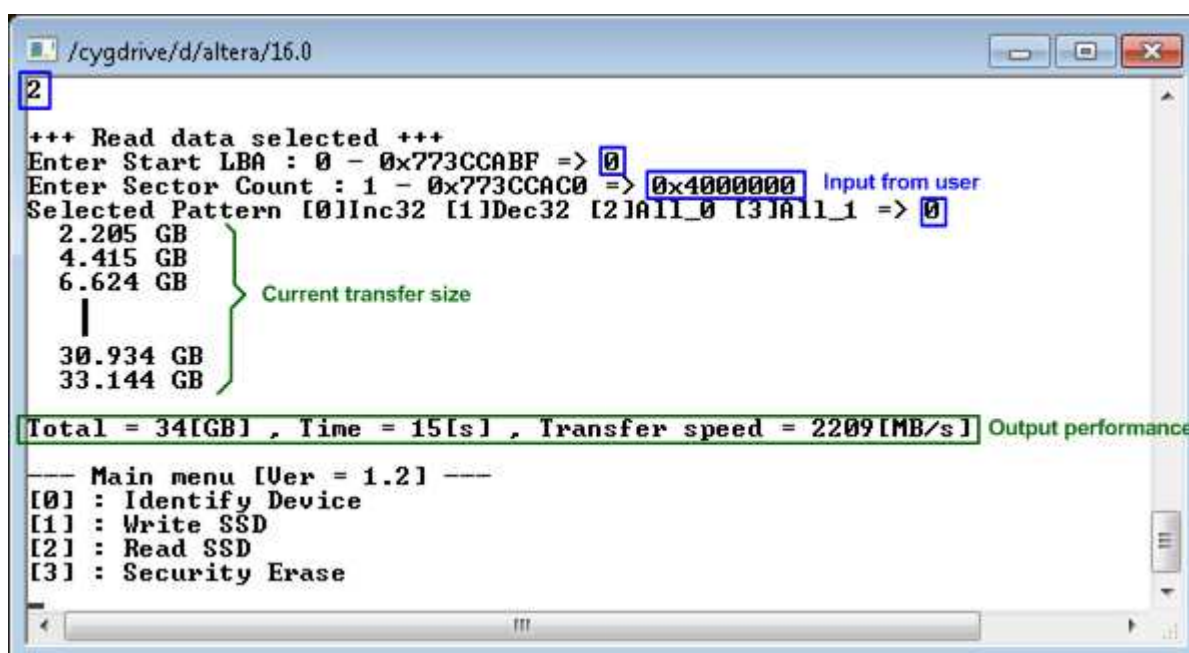


Figure 3-6 Input and result of Read SSD menu

Similar to write test if all inputs are valid, the operation will be started and test performance will be displayed when end of transfer. "Invalid input" will be displayed if any input value is out-of-range.

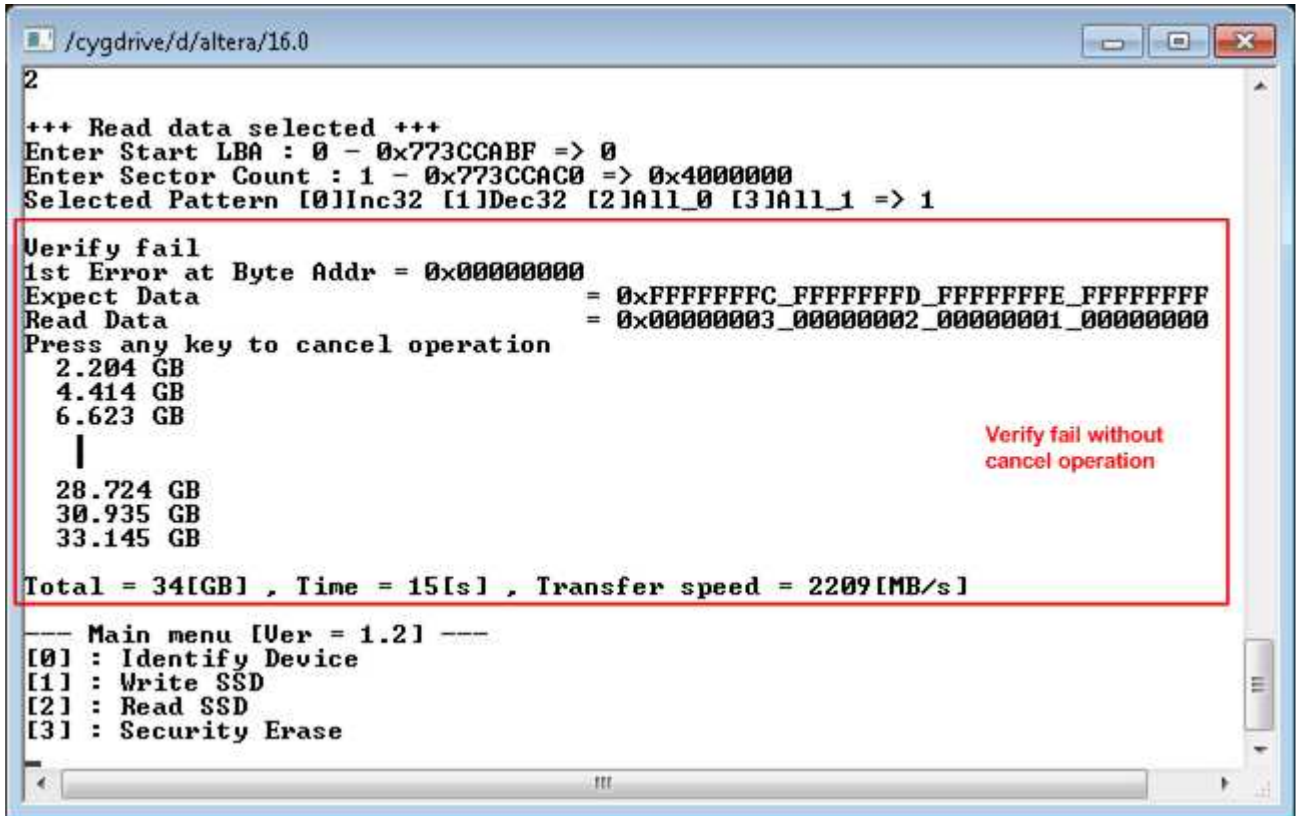


Figure 3-7 Data verification is failed, but wait until read complete

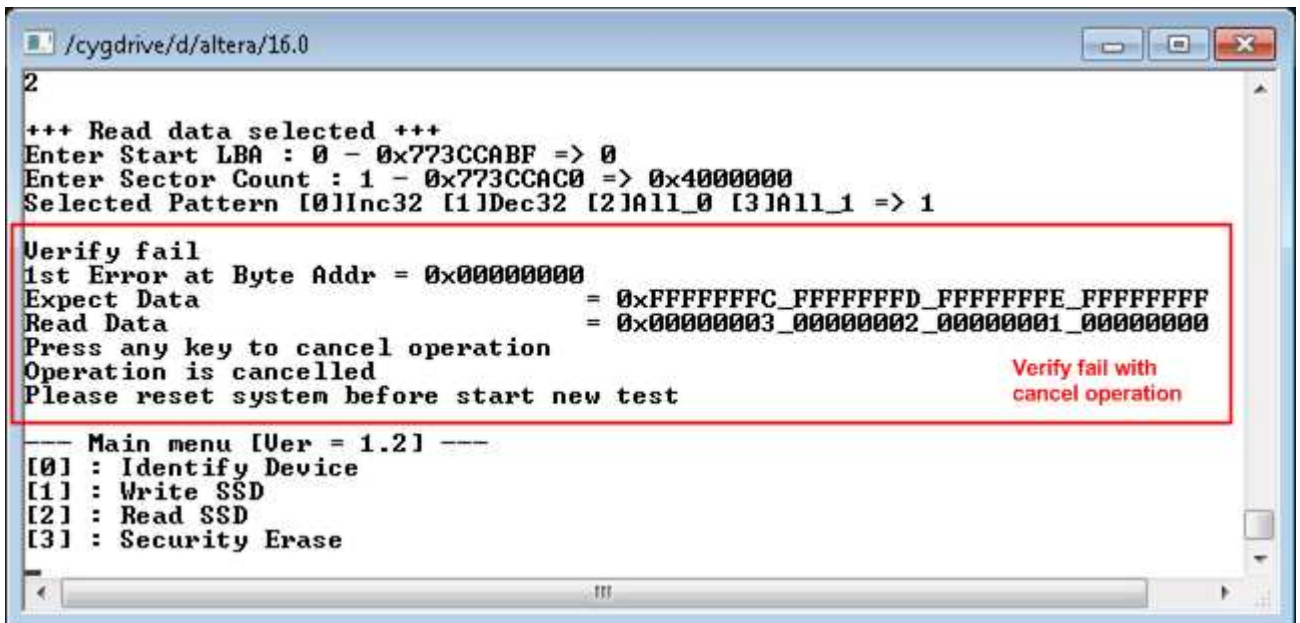


Figure 3-8 Data verification is failed, and press key to cancel operation

Figure 3-7 and Figure 3-8 show the error message when data verification is failed. “Verify fail” message will be displayed with error address, expected data, and read data. User can press any key to cancel read operation or wait until all read process complete. “RESET” button should be pressed to restart the system when user cancel the operation.

### 3.4 Security Erase

Select '3' to send Security Erase command to SATA Device. Please confirm that SATA device can support Security Erase feature firstly by using Identify device menu. The estimation of operation time to run security erase is also displayed in Identify device menu.

After selecting the menu, warning message will be displayed on the console. User can input 'y' or 'Y' to continue security erase operation or input other keys to cancel operation.

Number will be displayed on the console every second to show the status that system still run the command. After complete operation, total operation time will be displayed as shown in Figure 3-9.

Figure 3-10 shows the example when user inputs other keys to cancel the command.

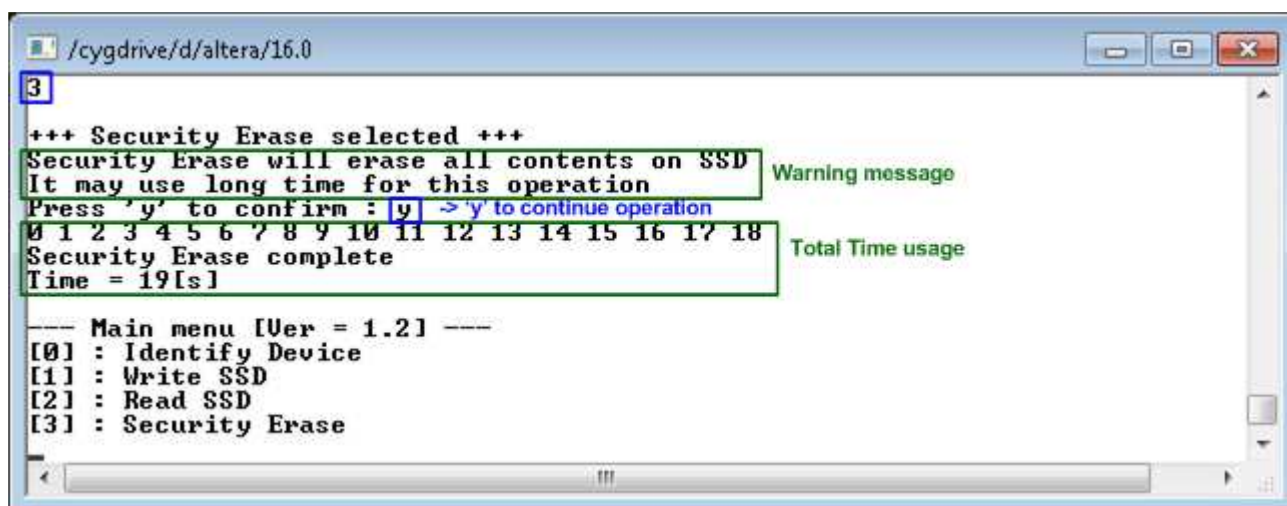


Figure 3-9 Result from Security Erase command

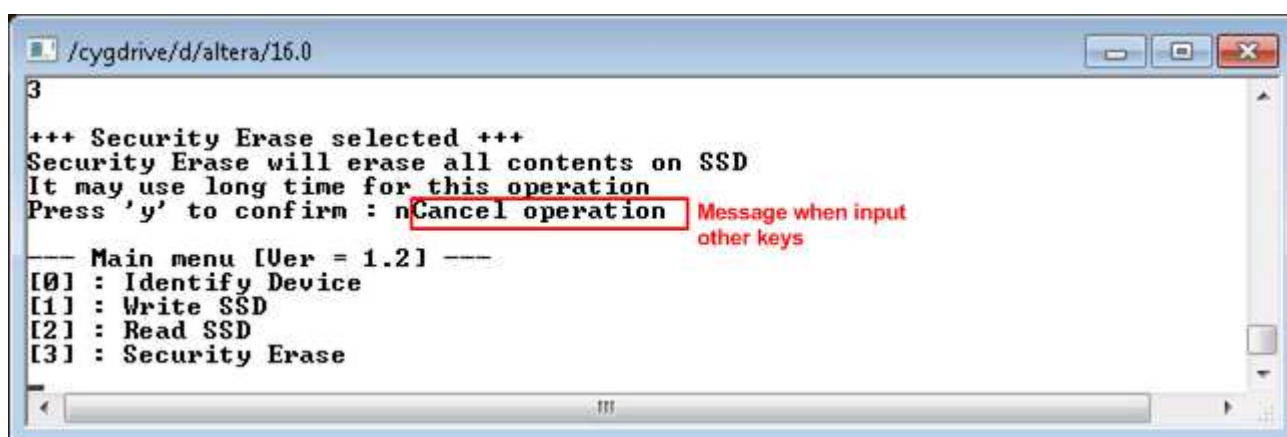


Figure 3-10 Cancel Security Erase command

## 4 Revision History

Revision	Date	Description
1.0	24-Nov-16	Initial version release