



Intel® RAID Smart Battery AXXRSBBU4

Technical Product Specification

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Enterprise Platforms and Services Marketing

Revision History

Date	Revision Number	Modifications
April 2007	0.8	Initial Release
July 2007	1.0	Update AXXRSBBU4 picture
December 2007	1.1	Update supported RAID devices
July 2008	1.2	Update Battery pack information

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1. Overview

This document describes the key hardware components, firmware, and software utility requirements for the Intel® RAID (Redundant Array of Inexpensive Disks) Smart Battery AXXRSBBU4. The AXXRSBBU4 provides data integrity for the RAID solution by ensuring that the data passing through the cache is written to the hard drives.

The Intel® RAID Smart Battery AXXRSBBU4 supports RAID controllers that use a standard 256 MB or 512 MB DDR2 DIMM (Dual In-Line Memory Module). It is available as an accessory for selected RAID controllers and to support the ROMB (RAID-on-Motherboard) solutions used on the following Intel® products:

- Intel® Server RAID Controller SRCSASRB
- Intel® Server RAID Controller SRCSATAWB
- Intel® Server System S7000FC4UR with a SAS riser card

The Intel® Smart Battery AXXRSBBU4 contains the following components:

- Board-to-board connector: The AXXRSBBU4 can connect to the base controller through the connector as a daughter card to the base controller.
- Smart Battery circuit board: Ensures that the battery is maintained at optimal performance and charge levels. This circuit is based on the Texas Instruments bq2060A SBS v1.1-compliant gas gauge IC*.
- Battery pack: The battery pack is mounted to the circuit board. It includes a separate, internal circuit logic board and LiON (Lithium Ion) batteries. The logic board provides sensing and management logic to support battery charge, discharge, and monitoring.
- Cable: A small cable connects the battery to the Smart Battery circuit board.
- Monitoring / notification software: Monitoring is accomplished through the Intel® RAID BIOS Console 2, Intel® RAID Web Console 2, or Intel® RAID Command Line Utility 2 utilities. Software notifies the user of failures or corrective actions.



Figure 1. Intel® RAID Smart Battery AXXRSBBU4

The battery pack charges automatically and communicates battery status information, such as voltage, temperature, and current to the host computer system.

Because it is faster to write data to the RAID adapter's cache memory than it is to write it directly to a storage device, data is first written to the cache memory. These write operations are completed quickly at the software application level. The RAID controller then writes the cached data to the storage device when system activity is low or when the cache is full.

This method of writing data carries a risk. Cached data on the RAID controller can be lost if the AC power fails before the data is written to the storage device. The Intel® RAID Smart Battery AXXRSBBU4 mitigates this risk by providing battery power to the RAID controller if AC power is lost.

The Intel® RAID Smart Battery AXXRSBBU4 monitors the voltage level of the DRAM modules on the RAID controller. If the voltage drops below a predefined level, the Smart Battery switches the memory power source from the RAID controller to the battery pack. The battery pack provides power for the memory until the voltage returns to an acceptable level, at which time the Smart Battery circuit board switches the power source back to the RAID controller. Cached data is then written to the storage devices with no loss of data. The Smart Battery provides additional fault tolerance when used with a UPS.

The battery pack cache-memory hold time depends on the size and configuration of the RAID controller memory. Retention time depends on memory capacity and the number of memory components on the DIMM to support the capacity. An estimated battery backup retention time is 72 hours (three days).

2. Hardware

2.1 Electrical and Mechanical Details

Table 1. Electrical and Mechanical Details

Feature	Description
Data retention	Up to 72 hours
Chemistry	LiON
Dimensions	Maximum 3.595-inches by 2.055- inches
Weight	95 Grams
Operating temperature	10 to 45° C dry bulb temperature (the maximum dry bulb temperature shall be derated by 3.3° C per 1000 m above 500 m)
Operating humidity	20% - 80 %, non-condensing
Storage temperature	Greater than 90 days at 0 to 30 degrees Celsius 30 to 90 days at 0 to 40° C Less than 30 days at 0 to 50 degrees Celsius
Storage humidity	20% to 80 %, non-condensing
Battery capacity	1050 mAH
Voltages	Nominal OCV: 3.7 V
Fast charge current	512 mAH
Battery voltage conditioning	Less than 3.0 V
Battery charge time	Typical: ~6 hours to charge from 3.6 V OCV to 4.2 V OCV Worst case: 10 hours if pack is completely depleted of charge
Date retention times	72 hours for 256 MB standard cache, using 256 Mbit x 16 DDR2
MTBF (electrical components)	3,251,335 hours at 40° C
Battery shelf life	1 year
Battery operational life	500 recharges cycles. Note: Intel recommends replacing the battery yearly.

2.2 Functional Block Diagram

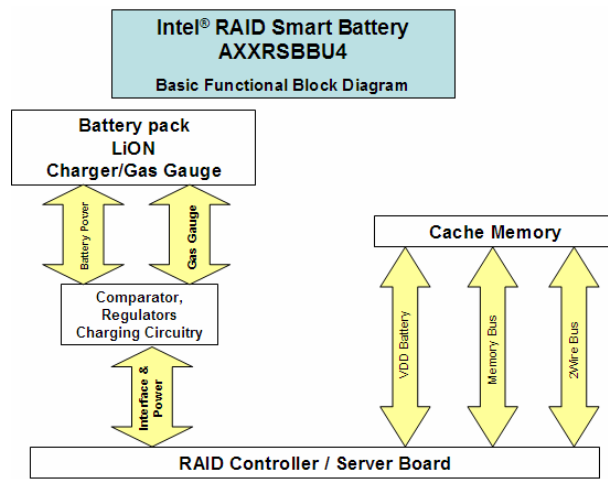


Figure 2. Block Diagram

2.3 Board-to-board connector

The Intel® RAID Smart Battery AXXRSBBU4 is connected through the board-to-board connector.

Table 2. Board-to-Board Interface Connector Pin-out

Pin	Signal Name	Signal Type
1	VBB_DDR_MEM	Output
2	GND	GND
3	+12 V	Input
4	GND	GND
5	PFAIL#	Output
6	BBEN	Input
7	+1.8V	Input
8	BBU_DET	Output
9	3.3v_AUX	Input
10	GND	GND
11	GND	GND
12	+3.3V	Input
13	SCL	Input / output
14	GND	GND
15	SDA	Input / output
16	BBSTATUS	Output
17	GND	GND
18	BBSTROBE	Input
19	GND	Input
20	VBB_DRR_MEM	Output

2.4 Connecting Cable

A 5-pin connector cable connects the battery pack to the Smart Battery circuit board.

Table 3. Interface Connector Pin-out

Pin	Signal Name	I/O	Description
1	VBATP	Input	Battery positive terminal
2	THERMISTOR SENSE	Output	Sense contact of the thermistor
3	GND	Input	Battery negative terminal
4	SCL	Output	I ² C Clock for pack monitoring
5	SDA	Input	I ² C Data for pack monitoring

2.5 Circuit Logic Board

The Intel® RAID Smart Battery AXXRSBBU4 is based on the Texas Instruments bq2060A SBS v1.1-compliant Gas Gauge IC*. The SBS v1.1 IC maintains an accurate record of the available charge. It monitors the amount of charge input in to or removed from the Intel® RAID Smart Battery AXXRSBBU4 to determine the battery capacity.

The bq2060A measures battery voltage, temperature, and current; estimates battery self-discharge; and monitors the battery for low-voltage thresholds. It measures charge and discharge activity by monitoring the voltage across a small-value series sense resistor between the battery's negative terminal and the negative terminal of the battery pack. The battery charge is determined by monitoring this voltage and correcting the measurement for environmental and operating conditions.

See the Texas Instruments website for more information about the Texas Instruments bq2060A SBS v1.1-compliant Gas Gauge IC*.

The following lists the Intel® RAID Smart Battery features:

- The Smart Battery circuit integrated into the battery pack
- Reduced host CPU intervention
- Shares I²C bus with the onboard EEPROM (Electrically Erasable Programmable Read-Only Memory) for memory
- Real-time battery status information
- Low charge warning
- Instantaneous voltage, current, and temperature warnings
- Battery charge percentage remaining and at-rate information
- Broadcasts event alarms to the host:
 - Out-of-temperature
 - Terminate charge
 - Terminate discharge

- Low capacity
- Manufacturing information
- Smart Charger Protocol for improved battery maintenance, calibration, and charging performance

2.6 Battery Pack

2.6.1 Battery Life and Data Retention Time

The Intel® RAID Smart Battery software utilities use a counter to show the number of times the battery has been recharged. When you replace the Intel® RAID Smart Battery AXXRSBBU4, run the Intel® RAID BIOS Console 2 utility and reset this counter to zero for the new battery.

Intel recommends that you replace the Intel® RAID Smart Battery AXXRSBBU4 once a year or after 500 recharging cycles, whichever comes first. The Smart Battery has a one-year warranty.

The Smart Battery can retain data for about 72 hours (three days). This is approximate and can vary due to several factors, including capacity of the battery pack, the battery load, the ambient temperature, the age of the battery, and the number of discharge cycles associated with the battery.

2.6.2 Battery States

The battery pack includes sensing logic that checks the battery voltage levels and recognizes the battery state.

2.6.2.1 Initialized State

The battery is in the initialized state during a normal power-up sequence. In RAID firmware, there are two levels of initialization:

- During boot loader execution
- During a RAID firmware boot

2.6.2.2 Discharging State

The battery voltage is drained as part of a relearn cycle.

2.6.2.3 Fully Charged State

A battery that is not fully charged has a low-voltage level that indicates the level of charge. Charging begins when the battery logic detects low voltage and power is supplied.

Once a new battery is fully charged, a relearn cycle is initiated. Relearn is the process of taking a fully charged battery through the discharge-charge cycle to update the gas gauge capacity parameters. The relearn cycle takes up to 24 hours to fully-discharge and recharge the battery pack. After the relearn cycle is completed, information from the battery accurately provides the state of charge, capacity, and other parameters.

These parameters determine the health of the battery.

- The relearn cycle can be set at a user-definable interval. The default is a one-month (30 days) interval.
- A relearn cycle is initiated when a new battery is inserted, even if the battery was fully charged previously.
- Some applications can start a relearn, or a relearn can be manually started.

2.6.2.4 Fully-discharged State

The fully-discharged state is detected as a low voltage parameter. The charger detects a fully-discharged battery state and starts charging the cells when sufficient power is available, and when the firmware has completed initializing the pack.

3. RAID Firmware Interaction

The RAID firmware detects the battery status and logs the following events:

- Battery is present
- Battery is not present
- A new battery is detected
- Battery has been replaced
- Battery temperature is high
- Battery voltage is low
- Battery is charging
- Battery is discharging
- Battery voltage is normal
- Battery needs replacement: SOH bad
- Battery needs replacement: Battery is three years old
- Battery needs replacement: Charger is not working
- Relearn has started
- Relearn is in progress
- Relearn completed
- Relearn timed out
- Relearn pending: Battery is under charge.
- Relearn postponed
- Relearn will start in four days
- Relearn will start in two days
- Relearn will start in one day
- Relearn will start in five hours

4. Software

4.1 Intel® RAID BIOS Console 2

The system BIOS loads the RAID option ROM that is resident on the RAID controller flash. Press <Ctrl> + <G> when prompted during POST (Power On Self Test) to use this utility. The option ROM checks for the presence of the battery and informs the user if the battery is missing or not fully charged. The Intel® RAID BIOS Console 2 utility can be used to monitor charge cycle count and voltage levels. It displays the number of fast battery charges and discharges.

4.2 Intel® RAID Web Console 2

The Intel® RAID Web Console 2 is an operating system-based utility for supported Microsoft Windows* and Linux* operating systems. This utility can monitor battery status, charge level, and the number of recharge cycles.

4.3 Intel® RAID Command Line Utility 2

The Intel® RAID Command Line Utility 2 is a text-based command-line utility (CLU) for Microsoft Windows* and Linux* operating systems. It shows battery status and can be used to initiate a relearn.