



Intel® RAID Smart Battery AXXRSBBU3

Technical Product Specification

Intel order number D84273-006

Revision 1.6

March 2009

Enterprise Platforms and Services Marketing

Revision History

Date	Revision Number	Modifications
November 2006	1.0	initial Release.
July 2007	1.1	Added Intel® RAID Controller SRCASJV support.
February 2008	1.2	Added Intel® RAID Controller SRCASPH16I support.
July 2008	1.3	Updated Battery pack information.
December 2008	1.4	Added Intel® Integrated RAID Controller SROMBSASMR support.
February 2009	1.5	Removed 27-inch cable from the shipping package.
March 2009	1.6	Replaced all Intel® Integrated RAID Controller SROMBSASMR references with Intel® Integrated RAID Module SROMBSASMR; Listed Intel® Workstation Board S5520SC as a supported board.

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Table of Contents

1. Overview	1
2. Hardware	4
2.1 Electrical and Mechanical Details	4
2.2 Functional Block Diagram	5
2.3 Clamshell Holder	5
2.4 Connecting Cables	6
2.5 Smart Refresh Circuit Board	7
2.6 Connector Cable	8
2.7 Battery Pack	8
2.7.1 Battery States	8
3. RAID Firmware Interaction	10
4. Software	11
4.1 Intel® RAID BIOS Console 2	11
4.2 Intel® RAID Web Console 2	11
4.3 Intel® RAID Command Line Tool 2 Utility	11

List of Figures

Figure 1. Intel® RAID Smart Battery AXXRSBBU3	2
Figure 2. Block Diagram	5
Figure 3. Clamshell Holder	5

List of Tables

Table 1. Electrical and Mechanical Details	4
Table 2. Cable Compatibility	6
Table 3. Interface Connector Pin-out	6
Table 4. Connector Pin-outs	8

1. Overview

This document describes the key hardware components, firmware, and software utilities for the Intel® RAID Smart Battery AXXRSBBU3. The Smart Battery AXXRSBBU3 provides data integrity for the RAID (Redundant Array of Inexpensive Disks) solution by ensuring that the data passing through the cache is written to the hard drives.

The Smart Battery supports RAID controllers/modules that use a standard Dual In-Line Memory Module (DIMM). It is available as an accessory for selected RAID controllers/modules and to support RAID-on-Motherboard (ROMB) solutions used on the following Intel® server boards and systems.

- Intel® Server Board S5520UR
- Intel® Server Board S5520HC/S5500HCV
- Intel® Server Board S5500WB
- Intel® Workstation Board S5520SC
- Intel® Server System SR1600UR
- Intel® Server System SR1625UR
- Intel® Server System SR2600UR
- Intel® Server System SR2625UR
- Intel® Server System SR4850HW4
- Intel® Server System SR6850HW4
- Intel® Server System SR4850HW4/M
- Intel® Server System SR6850HW4/M
- Intel® Server Board S5000PSL
- Intel® Server Board S5000PAL (and Intel® Server Systems with this server board installed)

Intel® RAID Smart Battery AXXRSBBU3 contains the following components:

- Plastic clamshell holder: This works with Intel® Server Chassis that have clamshell attach points. The battery pack is installed in the clamshell, which mounts inside the server chassis.
- Connecting cables: Two different 20-pin connector cables are provided to work with each specific RAID product.
- Smart Refresh Circuit: This 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*.
- 5-pin connector cable: The connector is used for communicating between the Smart Refresh Circuit board and Battery pack.
- Battery pack: This includes a circuit logic board and attached Li-Ion (Lithium Ion) batteries. The logic board provides sensing and management logic to support the battery charge, discharge, and monitoring functions.

- **Software:** This monitors and informs the user of any issues or actions for the Intel® Smart Battery AXXRSBBU3. Monitoring is accomplished through the Intel® RAID BIOS Console 2, Intel® RAID Web Console 2, or Intel® RAID Command Line Tool 2 utilities.

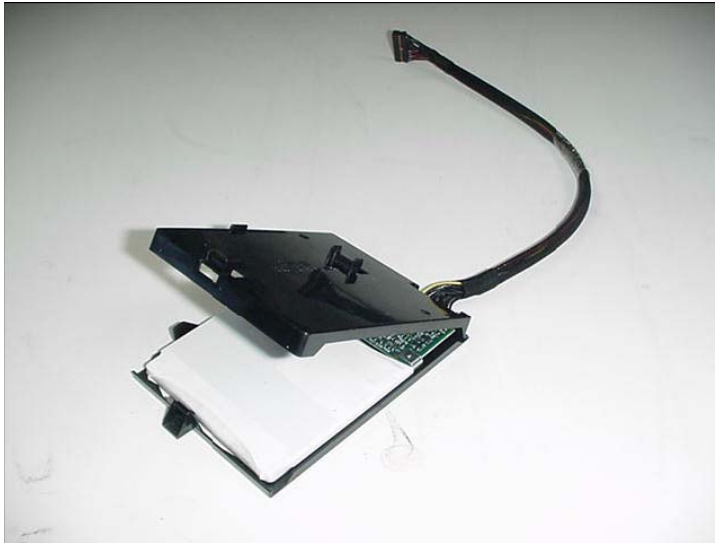


Figure 1. Intel® RAID Smart Battery AXXRSBBU3

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/module 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/module can be lost if the AC power fails before it is written to the storage device. The Smart Battery mitigates this risk by providing battery power to the RAID controller/module if AC power is lost.

The Smart Battery monitors the voltage level of the DRAM (Dynamic Random Access Memory) modules on the RAID controller/module. If the voltage drops below a predefined level, the Smart Battery switches the memory power source from the RAID controller/module 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/module. 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/module memory. Retention time depends on memory capacity and the number of memory components on the DIMM to support the capacity. Estimated battery backup retention time is up to 72 hours (three days) for 128 MB memory.

2. Hardware

2.1 Electrical and Mechanical Details

The battery pack is rated at a nominal voltage of 3.7 V with a typical capacity of 1050 mAH.

Table 1. Electrical and Mechanical Details

Feature	Description
RAID controller/module	Intel® RAID Controller SRCSAS144E Intel® RAID Controller SRCSASJV Intel® RAID Controller SRCSASPH16I Intel® Integrated RAID Controller SROMBU42E Intel® Integrated RAID Controller SROMBSAS18E Intel® Integrated RAID Controller SROMBSASMP2 Intel® Integrated RAID Module SROMBSASMR (AXXROMBSASMR)
Data retention	Up to 72 hours (three days) for 128 MB memory
Chemistry	Li-Ion
Dimensions	Maximum 2.749 inches by 2.63 inches
Weight	Cells / GG card / battery logic and charger (90 grams typical)
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	Depends on storage time: <ul style="list-style-type: none"> ▪ < 30 days: 0-50°C ▪ 30-90 days: 0-40°C ▪ > 90 days: 0-30°C
Storage humidity	20% - 80 %, non-condensing
Capacity	1050 mAH
Voltages	Nominal OCV: 3.7 V
Fast charge current	512 mA
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
MTBF (Electrical Components)	4,403,153 hours at 40 degrees Celsius
Battery shelf life	1 year
Battery operational life	500 recharges cycles Note: Intel recommends replacing the battery yearly.

2.2 Functional Block Diagram

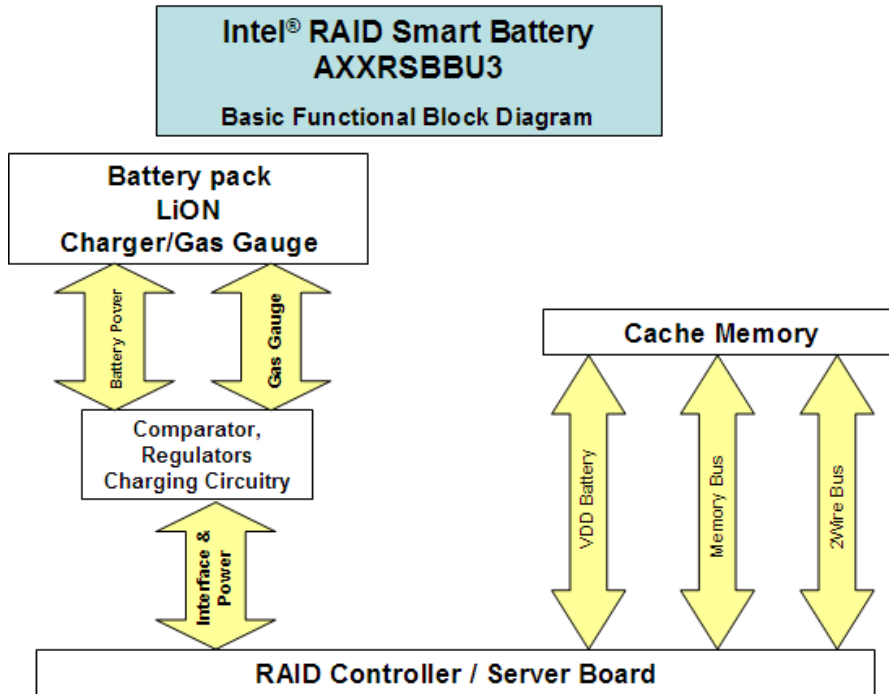


Figure 2. Block Diagram

2.3 Clamshell Holder

The clamshell holder eases installation and retention of the battery pack in the server chassis. The battery pack is shipped pre-installed in the plastic clamshell holder.



Figure 3. Clamshell Holder

2.4 Connecting Cables

An 11-inch and a 20-inch cable are included with the product, but a 27-inch cable is no longer included. Please contact your local technical support if you need assistance. The following table shows cable compatibility with both RAID controllers/modules and integrated RAID solutions.

Note: The 20-pin cable connector is keyed for proper orientation during insertion and can only go in one way. Before inserting into the connector, note the keyed orientation of this plug and avoid forcing it into the connector upside down, as doing so may damage the connector and battery circuitry.

Table 2. Cable Compatibility

Intel® RAID Controller/Module or Server System	11-inch Cable	20-inch Cable	27-inch Cable
Intel® RAID Controller SRCSAS144E		X	
Intel® RAID Controller SRCSASJV		X	
Intel® RAID Controller SRCSASPH16I		X	
Intel® Integrated RAID Module SROMBSASMR		X	
Intel® Server System S5000PSL (Product Code: S5000PSLROMB)	X		
Intel® Server System SR1550AL with Integrated RAID	X		
Intel® Server System SR2500AL with Integrated RAID	X		
Intel® Server System SR4850HW4 with Intel® Integrated RAID SROMBU42E	X		
Intel® Server System SR6850HW4 with Intel® Integrated RAID SROMBU42E	X		
Intel® Server System SR4850HW4/M with Intel® Integrated RAID SROMBSAS18E			X
Intel® Server System SR6850HW4/M with Intel® Integrated RAID SROMBSAS18E			X

Table 3. Interface Connector Pin-out

Pin #	Signal	Description
1	P12V_STBY	+12Vdc Standby
2	GND	Ground
3	P12V_STBY	+12Vdc Standby
4	GND	Ground
5	P1V8	+1.8Vdc
6	GND	Ground
7	P3V3	+3.3Vdc
8	GND	Ground
9	P1V8_BB	Sideband 1
10	GND	Ground
11	P3V3_STBY	+3.3Vdc Standby
12	GND	Ground

Pin #	Signal	Description
13	BBU_SMBCL	I2C Clock
14	GND	Ground
15	BBU_SMBDA	I2C Data
16	TM_PFAIL	Battery Backup Power Fail Detect
17	GND	Ground
18	BBE	Battery Backup Enable
19	BBSTROBE	Battery Backup Strobe
20	TM_STATUS	Battery Backup Status

2.5 Smart Refresh Circuit Board

The Intel® RAID Smart Battery AXXRSBBU3 is based on the Texas Instruments bq2060A SBS v1.1-compliant Gas Gauge IC. The following are the key features of the SBS v1.1 IC:

- Provides accurate measurement of available charge
- Supports SBS Smart Battery Data Specification v1.1
- Reports voltages
- Provides voltage, temperature, and current measurements
- Measures charge flow using a V-to-F converter with an offset of less than 16 μ V after calibration

The bq2060A SBS-compliant Gas Gauge IC for the battery pack maintains an accurate record of the available charge. It determines battery capacity by monitoring the amount of charge available to or removed from a rechargeable battery.

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 available battery charge is determined by monitoring this voltage and correcting the measurement for environmental and operating conditions.

For more information about the Texas Instruments bq2060A SBS v1.1-compliant Gas Gauge IC, refer to the manufacturer web site.

The following are the features of the Intel® RAID Smart Battery AXXRSBBU3:

- Integrates into the battery pack
- Reduces host CPU (Central Processing Unit) intervention
- Shares I²C bus with the on-board EEPROM (Electrically Erasable Programmable Read-Only Memory) for memory
- Provides real-time battery status information
- Displays a low charge warning
- Provides instantaneous voltage, current, and temperature information
- Provides remaining battery charge percentage and at-rate information

- Broadcasts event alarms to the host:
 - Out-of-temperature
 - Terminate charge
 - Terminate discharge
 - Low capacity
- Displays manufacturing information
- Provides Smart Charger Protocol for improved battery maintenance, calibration, and charging performance

2.6 Connector Cable

A 5-pin connector cable connects the battery pack to the Intel® RAID Smart Battery AXXRSBBU3 circuit board.

Table 4. Connector Pin-outs

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

2.7 Battery Pack

The cache-memory hold time depends on the size and configuration of the RAID controller/module memory. Retention time varies depending on memory capacity and the number of memory components used on the DIMM to support that capacity. Estimates for battery backup retention time with different configurations of DDR2 memory are listed:

- 256 MB (256 Mb devices) = 46 hours
- 512 MB (256 Mb devices) = 23 hours
- 512 MB (512 Mb devices) = 46 hours

2.7.1 Battery States

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

2.7.1.1 Initialized State

The battery is in the initialized state during a normal power-up sequence. In RAID firmware, initialization occurs during the following times:

- During boot loader execution
- During RAID firmware boot

2.7.1.2 Discharging State

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

2.7.1.3 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 complete, 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 initiates on a newly-inserted battery, even if the battery was previously fully charged.
- Some applications can start a relearn, or a relearn can be manually started.

2.7.1.4 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 finished initializing the battery pack.

3. RAID Firmware Interaction

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

- Battery is present
- Battery is not present
- 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 is 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 charging
- 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 resides on the Intel® RAID Controller/Intel® RAID Module flash. Run this utility by pressing <Ctrl> + <G> when prompted during POST (Power-on Self Test). 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.

4.2 Intel® RAID Web Console 2

This operating system-based utility for the Microsoft Windows* and Linux* operating systems is supported by the active RAID solution. It can be used to monitor battery status, charge level, and the number of recharge cycles.

4.3 Intel® RAID Command Line Tool 2 Utility

This text-based command-line utility (CLU) is available for Microsoft Windows* and Linux* operating systems. It can be used to view battery status and to initiate a relearn.