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PowerSmart

Importance of Full SBData Implementation

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Introduction

The Smart Battery Data (SBData) Specification was developed to allow a consistent set of battery data to be used by a power management system in order to improve battery life and system run-time while providing the user with accurate information.

This was accomplished by incorporating fixed, measured, calculated, and predicted values, along with charging and alarm messages, with a simple communications mechanism between a Host system, Smart Batteries, and a Smart Charger.

Introduction

Compliance with the SBData Specification insures compatibility within the SBS system. Failure to fully implement SBData (or any SBS spec) risks inter-operability, safety, reliability and performance.

A simple example is that of a Smart Charger expecting Smart Battery ChargingVoltage and ChargingCurrent broadcasts. Without these, the Smart Charger fails to operate and the system interoperability breaks

Contents

- Definitions of Full Implementation
  - Execution of all 34 data values
  - Accuracy and Granularity requirements
  - SMBus timing and data protocols
- Benefits of Full Implementation
- Safety, Reliability, and Performance

Definition

"Full Implementation"

- Complete execution of all 34 data values and their individual requirements
- Minimum accuracy and granularity requirements must be met
- Proper SMBus timing and protocols used

34 Data Value Groups

- Measurements
  - Voltage, Temperature, and Current
- Capacity Information
  - State-of-Charge, Remaining Capacity

  - Time to Empty, Time to Full, Time At Rates
- Alarms and Broadcasts
  - End of Charge and Discharge, Charging instructions
- Mode, Status, and Error
  - Communication & Calculation Errors, Status
- Historical and Identification
  - Cycle count, Manufacturer ID and history

Critical Aspects of SBData Values

Measurements

Voltage, Temperature, and Current

Must occur at reasonable sample rates (depending on operating mode of the device) without significant latency from the time of measurement (ideally < 1 second)

Critical Aspects of SBData Values

Capacity Information

State-of-Charge, Remaining Capacity

Must be able to report in **mAmp-Hours** and **mWatt-Hours** via control flags in BatteryMode register (allows pack-size independent power management)

Critical Aspects of SBData Values

Time Remaining

Time to Empty, Time to Full, Time At Rates

AtRate functions must be supported

AtRate must support **mA** and **mW** units

Critical Aspects of SBData Values

Alarms and Broadcasts

End of Charge and Discharge; Charging instructions

Broadcasts of ChargingVoltage & ChargingCurrent required

Alarms and Charging info must not conflict

RemainingCapacityAlarm must support **mAmp-Hours** and **mWatt-Hours**

Low nibble of AlarmWarning set high

Critical Aspects of SBData Values

Mode, Status, and Error

Communication & Calculation Errors, Status

CAPACITY_MODE and CHARGER_MODE control bits in BatteryMode register must be

Default and Reset states for BatteryMode control bits must be supported

Other control bits in BatteryMode are optional

Critical Aspects of SBData Values

<u>Historical and Identification</u>

Cycle count, Manufacturer ID and history

DesignCapacity must support **mAmp-Hours** and **mWatt-Hours**

Unique identification information must be provided in all fields

Cycle Count as defined in specification

Accuracy

Voltage

- Accuracy: +/- 1% of pack Design Voltage
- Requires 72mV, 108mV, and 120mV for standard size packs

- Accuracy: +/- 1% of pack Design Capacity
- Requires 18mA and 28mA for standard size packs

- Accuracy: +/- 3°C absolute

Granularity

Voltage

Granularity: +/- 0.2% of pack Design Voltage

Requires 14.4mV, 21.6mV, and 24mV for standard size packs

Granularity: +/- 0.2% of pack Design Capacity

Requires 3.6mA and 5.6mA for standard size packs

Granularity: +/- 0.5°C

SMBus Timing

- Full support of SMBus/I2C arbitration and collision avoidance and recovery
  - No 'Master Only' implementations
- Calculation Latency
  - $T_{LOW:SEXT}$ < 25 mSec
  - $T_{TIMEOUT}$ > 25 mSec but < 35 mSec

SMBus Protocols

- Read Word
- Write Word
  - AlarmWarning and Charging broadcasts
- Read Block
- Optional: Write Block

- Valid ACK/NACK and STOP conditions

Benefits

- System-wide interoperability
- Legal protection
- Interchangeability
- Integrity of future SBS standards

(See references to ACPI and Win9x benefits in other presentations this week.)

Safety, Reliability, and Performance

- Non-compliance risks safety

  (Though safety is still the responsibility of the battery pack)
- Latent failure modes are more probable with less than full implementations.
- Accuracy (and Granularity) can impact user dissatisfaction due to poor