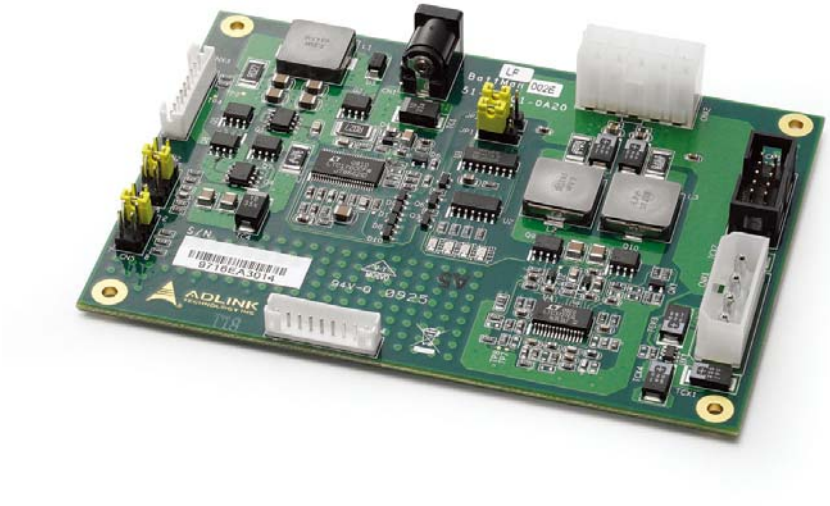


BattMan

Smart Battery Management Reference System

Manual Revision: 2.00

Revision Date: October 19, 2010

Part Number: 50-1J031-1000

ADLINK TECHNOLOGY INC.

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Revision History

Release	Date	Change
2.00	2010/10/19	Initial Release

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Preface

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Environmental Responsibility (RoHS & WEEE)

ADLINK is committed to fulfill its social responsibility to global environmental preservation through compliance with the European Union's Restriction of Hazardous Substances (RoHS) directive and Waste Electrical and Electronic Equipment (WEEE) directive. Environmental protection is a top priority for ADLINK. We have enforced measures to ensure that our products, manufacturing processes, components, and raw materials have as little impact on the environment as possible. When products are at their end of life, our customers are encouraged to dispose of them in accordance with the product disposal and/or recovery programs prescribed by their nation or company.

Electrostatic Sensitive Device (ESD)



Always ground yourself to remove any static charge before touching the module or carrier board. Modern electronic devices are very sensitive to static electric charges. Use a grounding wrist strap at all times. Place all electronic components on a static-dissipative surface or in a static-shielded bag when they are not installed in a chassis.

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Conventions

Take note of the following conventions used throughout this manual to make sure that users perform certain tasks and instructions properly.



Additional information, aids, and tips that help users perform tasks.



Information to prevent *mino*r physical injury, component damage, data loss, and/or program corruption when trying to complete a task.



Information to prevent *serious* physical injury, component damage, data loss, and/or program corruption when trying to complete a specific task.

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Important Safety Instructions

For user safety, please read and follow all instructions, warnings, cautions, and notes marked in this manual and on the associated equipment before handling/operating the equipment.

- Read these safety instructions carefully.
- Keep this user's manual for future reference.
- Read the specifications section of this manual for detailed information on the operating environment of this equipment.
- When installing/mounting or uninstalling/removing equipment:

  - Turn off power and unplug any power cords/cables.

- To avoid electrical shock and/or damage to equipment:

  - Keep equipment away from water or liquid sources;
  - Keep equipment away from high heat or high humidity;
  - Keep equipment properly ventilated (do not block or cover ventilation openings);
  - Make sure to use recommended voltage and power source settings;
  - Always install and operate equipment near an easily accessible electrical socket-outlet;
  - Secure the power cord (do not place any object on/over the power cord);
  - Only install/attach and operate equipment on stable surfaces and/or recommended mountings; and,
  - If the equipment will not be used for long periods of time, turn off and unplug the equipment from its power source.

- Never attempt to fix the equipment. Equipment should only be serviced by qualified personnel.
- A Lithium-type battery may be provided for uninterrupted, backup or emergency power.



Risk of explosion if battery is replaced by an incorrect type. Dispose of used batteries according to the instructions.

- Equipment must be serviced by authorized technicians when:

  - The power cord or plug is damaged;
  - Liquid has penetrated the equipment;
  - It has been exposed to high humidity/moisture;
  - It is not functioning or does not function according to the user's manual;
  - It has been dropped and/or damaged; and/or,
  - It has an obvious sign of breakage.

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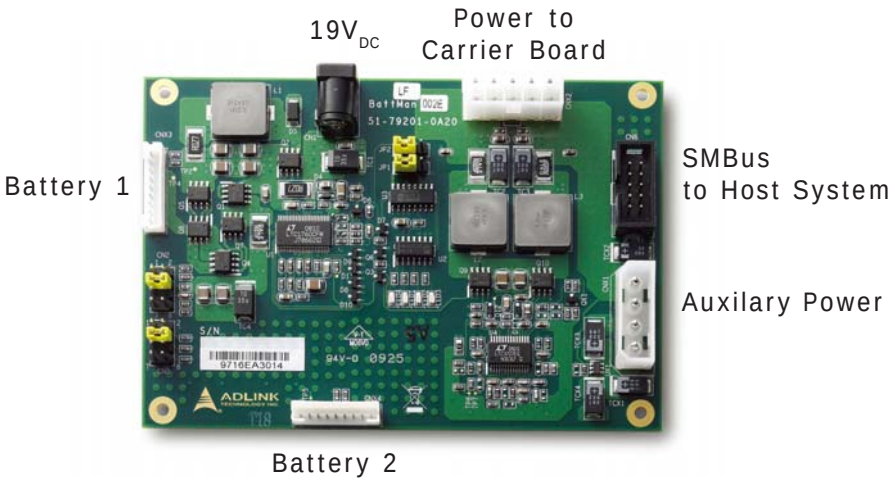
1 Introduction

ADLINK's BattMan (Battery Management) module is a Smart Battery Management System that supports two Smart Batteries and provides ATX power for a mobile embedded system. The BattMan Smart Battery Reference System is a proof-of-concept battery power subsystem that allows for quick development and integration of battery power into a COM Express system in the following ways:

- To emulate the battery power subsystem functionality of your prototype system during the design phase
- As a ready-made battery power subsystem for your customized system
- As a reference design to integrate a battery power subsystem into your custom-designed carrier (schematic provided)

The BattMan Smart Battery Reference System is compliant with the Smart Battery Manager Specification and uses the System Management Bus (SMBus) for communications between the battery power subsystem, Smart Batteries and host system (COM module and carrier). The BattMan module is ACPI compliant and provides complete battery management under a supporting operating system. ADLINK's COM Express modules feature a BIOS that fully supports all Smart Battery communications using existing interfaces defined in the COM Express specification and are fully compatible with the BattMan module.

The BattMan module delivers power output to a standard ATX 20-pin connector and provides an Auxiliary Power 4-pin Molex connector for storage devices. Power input is from a 19V AC/DC adapter. When not connected to a host system, the BattMan module can function as a stand-alone battery charger.



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2 Electrical Specification

The Battman module is a single or dual Smart Battery Manager. The module supports a standard 2.5 mm DC Input Jack for connection of a standard 19V AC/DC power adapter. The battery charger output voltage is configurable to adapt it to battery packs consisting of 2, 3, 4 or 5 Li-ion battery cells*. The module can work in either notebook mode (ACPI) or as stand-alone battery charger.

NOTE: * Battery packs with 2 or 3 cells cannot provide 12V output and will not support the requirements of COM Express systems.

2.1 Input Power

	AC/DC Adapter Input	Battery**
Voltage	19 V	14.8 V nominal
Max. Current	4.74 A	4.2 A (2.5 A nominal)
Power	90 W	n.a.

NOTE: **The battery packs provided with the BattMan module have 4 Li-ion cells in series, 2 cells in parallel

2.2 Output Power

	12 V***	5 Vsb	5 V (Aux. Power)	Charger
Voltage	12.2	5.1	5.1	n.a.
Current (max.)	7.2 A	4.5 A	2 A	4.1 A
Spike current <10 sec	9 A	9 A	4.5 A	n.a.
Power	87.8 W	22.9 W	10.2 W	50 W

NOTE: *** 12V output requires battery packs with 4 or 5 cells.

2.3 Functional Characteristics

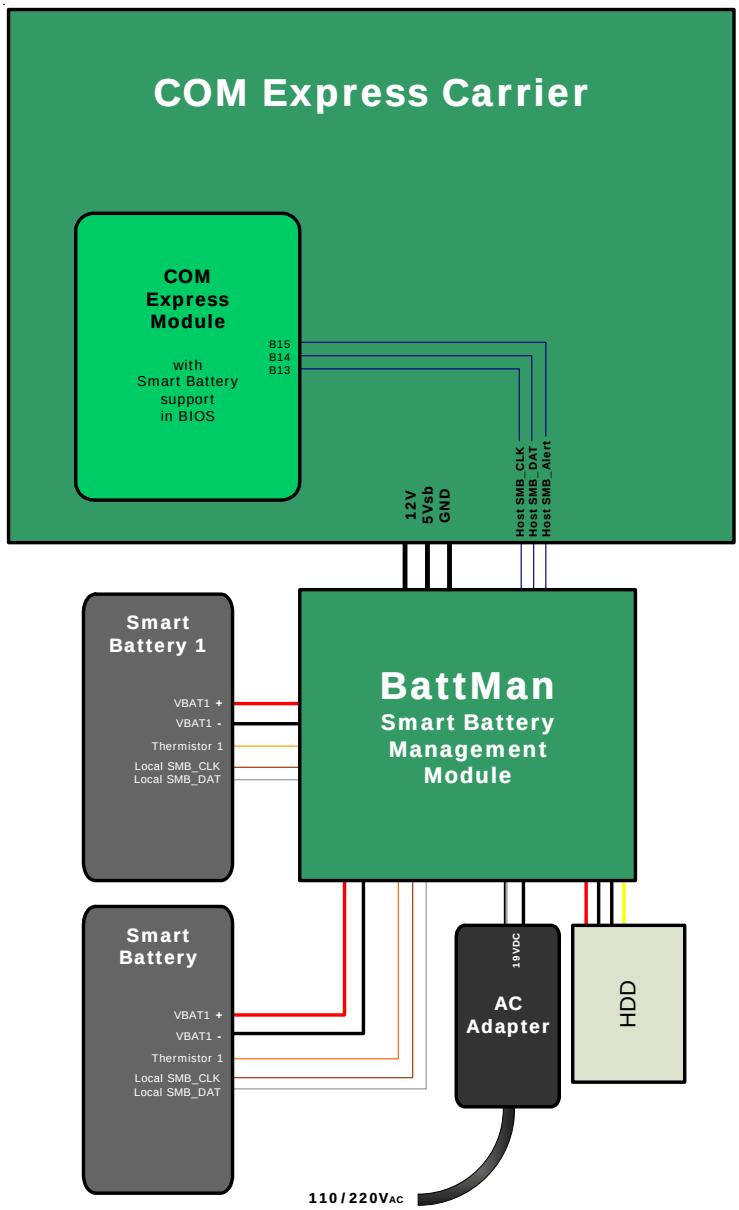
- Dual Charging - charges two Smart Batteries simultaneously to reduce charging time
- Simultaneous Discharge - simultaneous dual discharge increases battery operating time by reducing internal battery losses due to high discharge rates

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3 Functional Block Diagram

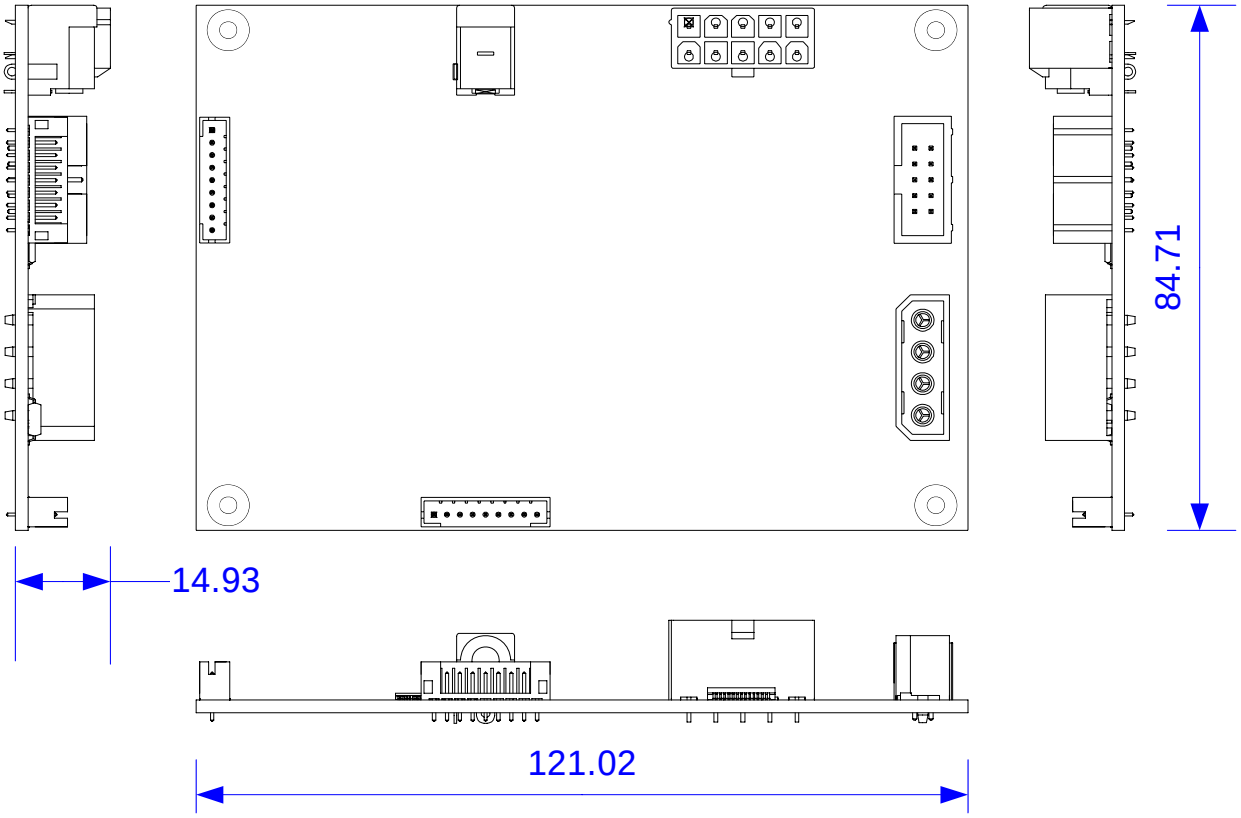
The BattMan module provides 12V and 5Vsb to the COM Express Carrier Board and 12V and 5V to the Auxiliary Power connector to support a storage device.

The BattMan module communicates with the COM Express host system via the Host SMBus interface. The BattMan module acts as a slave and the COM Express module sends commands to the BattMan module to get information. The three SMBus signals SMB_CLK, SMB_DAT and SMB_ALERT# correspond to pins B13, B14 and B15 on the AB connector of the COM Express module. A Local SMBus is used for communciations between the BattMan module and Smart Batteries.



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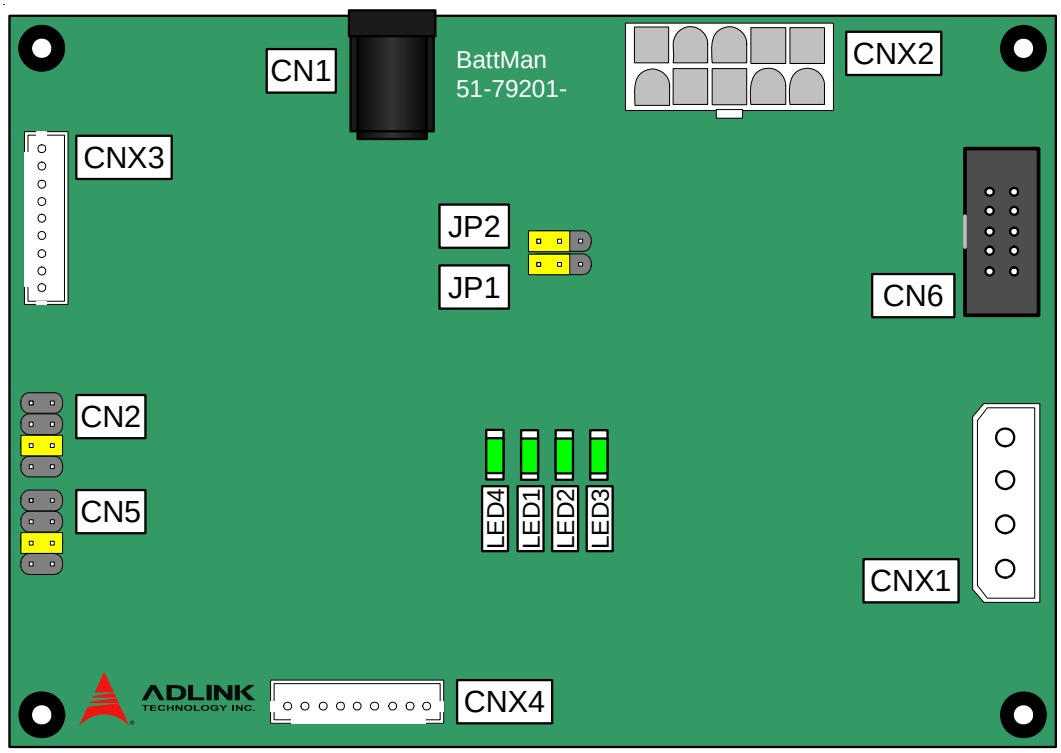
4 Mechanical Dimensions



dimensions in mm

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5 Component Locations



Connector	Function
CN1	19V AC/DC Power Adapter Input
CN2	Low Battery Voltage Trip Threshold Jumper
CN5	Maximum Charge Voltage Jumper
CN6	Host Control/Monitor Connector
CNX1	Auxiliary Output Power Connector
CNX2	ATX Output Power to Host System Connector
CNX3	Battery 1 Connector
CNX4	Battery 2 Connector
JP1	Operating Mode Jumper
JP2	Charger Enable/Disable Jumper

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6 Module Configuration

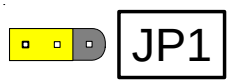
6.1 Operating Mode

The BattMan module supports two operating modes that are configurable by jumper setting:

- Battery Management Mode - connects with the COM Express host system via the Host SMBus interface to function as a Smart Battery Management System
- Stand-alone Charger Mode - acts as a stand-alone charger for two Smart Batteries

The operating mode is set using jumper JP1.

JP1	Mode
1-2	Battery Management Mode (default)
2-3	Stand-alone Charger Mode

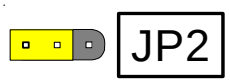


6.2 Charger Enable/Disable

The BattMan module charger function can be enabled or disabled by jumper setting. When the charger is enabled and the 19V AC/DC power adapter is connected, Smart Batteries connected to the module will be charged automatically according to the battery status. When the charger is disabled, Smart Batteries connected to the module will not be charged.

The charger function is set using jumper JP2.

JP2	Mode	
1-2	Enabled (automatic charging)	(default)
2-3	Disabled (charger OFF)	



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6.3 Indicator LEDs

There are four LEDs to indicate the Operating Mode and Charger Status of the BattMan module. The functions of LED1~4 are dependent on the settings of JP1 and JP2.

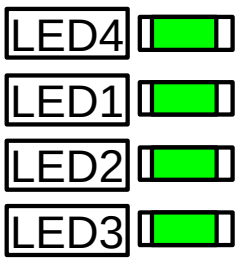
When in Battery Management Mode (JP1 pins 1-2 shorted), LED1/LED2 are connected to the Host SMBus clock and data signals and are ON to indicate that the BattMan module is actively communicating with the Host System. LED3 is connected to the SMB_ALERT signal and will light briefly during system power up but will remain OFF during normal operation.

When in Stand-alone Charger Mode (JP1 pins 2-3 shorted), LED1 is OFF and LED2/LED3 indicate the charging status of Battery2/Battery1 respectively (ON if charging).

LED	JP1 (1-2) Battery Management Mode	JP1 (2-3) Stand-alone Charger Mode
1	(ON) SMB_CLK Active	OFF
2	(ON) SMB_DAT Active	ON if Battery2 charging
3	SMB_ALERT Active	ON if Battery1 charging

When the charger is enabled (JP2 pins 1-2 shorted) and the 19V AC/DC power adapter is connected, LED4 is ON. When the charger is disabled (JP2 pins 2-3 shorted) or the 19V AC/DC power adapter is not connected, LED4 is OFF.

LED	JP2 (1-2) Charger Enabled	JP2 (2-3) Charger Disabled
4	ON (charger enabled & 19VDC present)	OFF (charger disabled or no 19VDC)



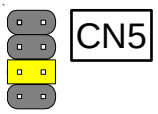
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6.4 Battery Settings

The BattMan module has been designed to provide power to COM Express systems using battery packs having 2, 3, 4 or 5 Li-ion cells in series. There are two jumper settings that must be set according to the number of cells in series in the battery pack:

- Maximum Charge Voltage - protects the Smart Battery from charging with excessive voltage
- Low Battery Voltage Trip Threshold - protects the battery from excessive power drain

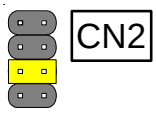
Maximum Charge Voltage (CN5)



The Maximum Charge Voltage setting is a hardware limitation on the charging voltage supplied to the Smart Battery. The CN5 jumper setting determines one of four voltage limits that are applied to the charger voltage output value. These limits provide a measure of safety with a hardware restriction on charging voltage, which cannot be overridden by software. This voltage sets the limit that will be applied to the battery as reported by battery. Since the battery internal voltage monitor point is the actual cell voltage, you may see higher voltages (up to 512mV higher) at the external charger terminals due to the voltage servo loop action.

CN5	Max Charge Voltage	Li-ion Cells per Battery
1-2	8.2 V	2
3-4	12.6 V	3
5-6	16.8 V (default)	4
7-8	21 V	5

Low Battery Voltage Trip Threshold (CN2)



This jumper provides a user selectable voltage trip threshold to protect a Smart Battery from over discharging and effectively damaging the battery. The voltage trip threshold setting depends on the Smart Battery output voltage which in turn depends on the number of cells in series in the battery pack.

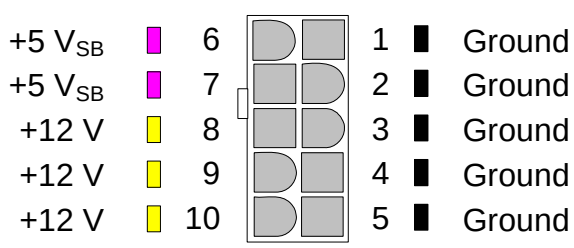
CN2	Max Charge Voltage	Li-ion Cells per Battery
1-2	5.3 V	2
3-4	7.9 V	3
5-6	11.4 V (default)	4
7-8	14.5 V	5

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7 Connector Pin Assignments

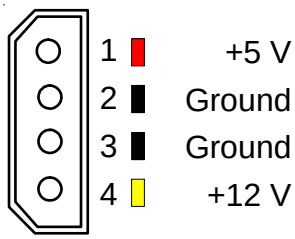
7.1 ATX Output Power to Host System Connector (CNX2)

12V and 5Vsb supply to COM Express host system



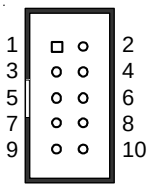
7.2 Auxiliary Output Power Connector (CNX1)

Power supply to peripheral devices such as harddisks



7.3 Host Control / Monitor Connector (CN6)

All signals to and from the host system to control and monitor the BattMan module



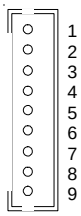
Pin	Signal	Pin	Signal
1	Host SMB_CLK	2	Host SMB_DAT
3	PWRBTN	4	BATLOW
5	PS_ON	6	+3.3V
7	+12V	8	+5V
9	SMB_ALERT	10	NC

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7.4 Battery 1 Connector (CNX3)

Interface between Battman and Smart Battery 1

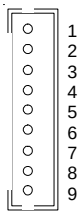
Pin	Description
1	Battery Power I/O
2	Battery Power I/O
3	Battery Power I/O
4	Local SMB_CLK
5	Local SMB_DAT
6	Thermistor Force/Sense Connection
7	Ground
8	Ground
9	Ground



7.5 Battery 2 Connector (CNX4)

Interface between Battman and Smart Battery 2

Pin	Description
1	Battery Power I/O
2	Battery Power I/O
3	Battery Power I/O
4	Local SMB_CLK
5	Local SMB_DAT
6	Thermistor Force/Sense Connection
7	Ground
8	Ground
9	Ground



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8 Getting Started

This chapter describes how to connect the BattMan Smart Battery Reference System to power a COM Express system and access the battery power subsystem information under Windows OS.

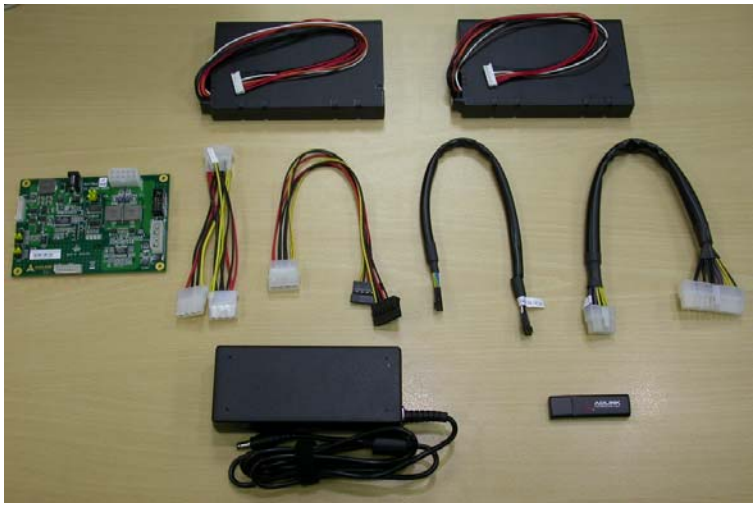
8.1 Unpacking the Contents

The BattMan Smart Battery Reference System contains the following:

- BattMan module
- Two Smart Batteries
- AC adapter
- Cables
- USB drive with manual and schematics



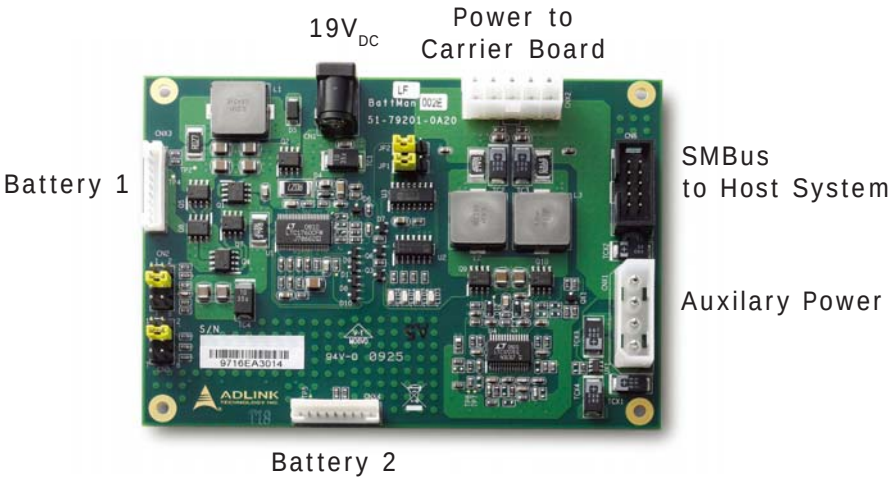




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8.2 Cable Connections

The BattMan module connectors are shown in the diagram below.

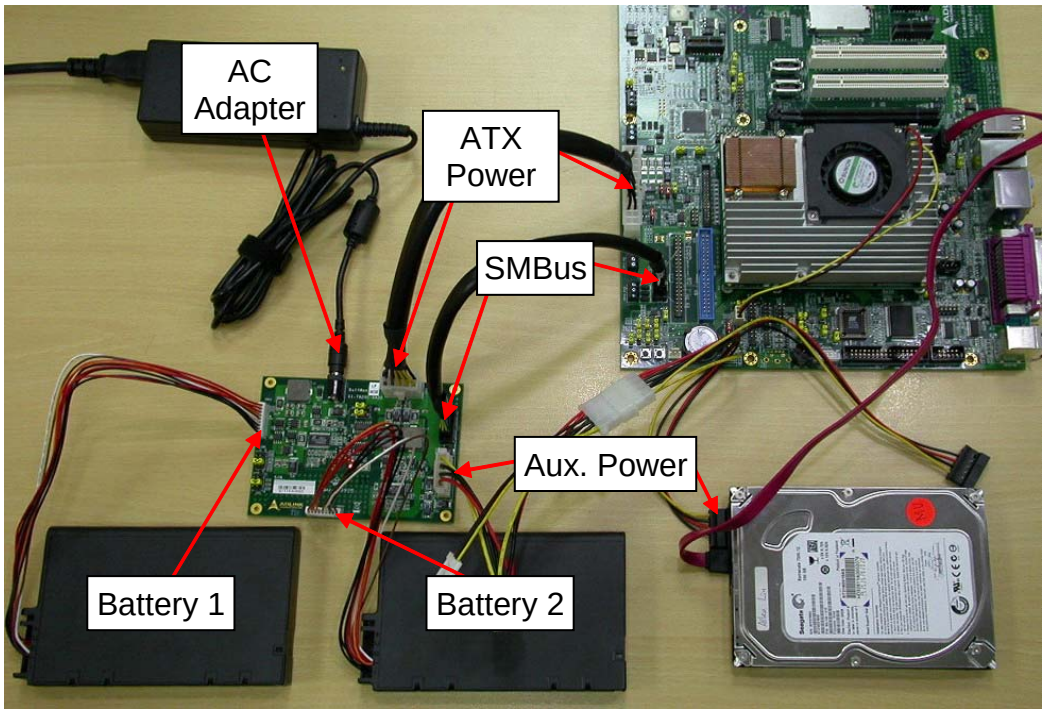


NOTE: Be sure to set JP1 and JP2 to the correct settings for your battery packs before connecting the AC adapter to the BattMan module. See Section 6.4 Battery Settings.

1. Connect the ATX Power output of the BattMan module (CNX2) to the ATX power input of the COM carrier board using the 10-pin to 24-pin ATX cable provided.
2. Connect the SMBus header of the BattMan module (CN6) to the Smart Battery Management connector on the carrier board.
3. If required, connect the Auxiliary Power output of the BattMan module (CNX1) to the storage device using the 4-pin Molex and SATA power adapter cables provided.
4. Connect the Smart Batteries to the BattMan module.
5. Connect the DC output of the AC adapter to the BattMan module and the AC input to a wall power outlet.

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The figure below shows a BattMan Smart Battery Reference System connected to an Express-BASE carrier board with COM Express module and SATA hard drive.



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8.3 Windows OS Interface

Device Presence

ADLINK's system BIOS fully supports the BattMan Smart Battery Reference System and reports the presence of a Smart Battery device to the OS. In Windows, the battery power subsystem information is listed in the Device Manager under the "Batteries" category. The system BIOS will check the current system configuration and then report back to the OS. There are three possibilities for the battery report information.

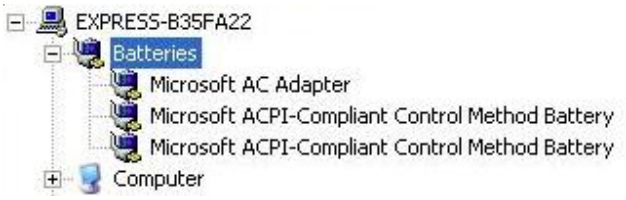
No battery power subsystem present

The system BIOS checks for the presence of a charger, selector or system manager. If there is no device attached, it will only report the presence of an AC adapter to the OS.



BattMan module present

If the BattMan module is present in the system, the system BIOS will report an AC adapter and two battery devices to the OS.



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Battery State Notification

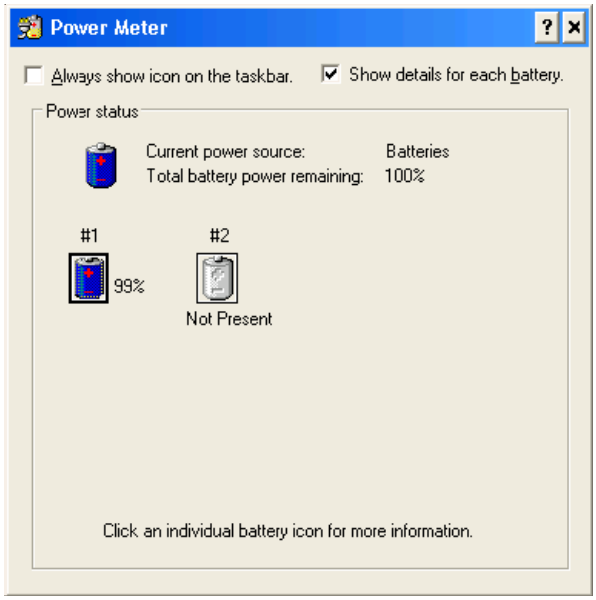
The system BIOS is notified of the state of the battery power subsystem (AC power or battery mode) when it receives an SMBALERT# as a SCI event. An alert may be sent to update the charging state, remaining battery capacity, or presence of an AC adapter. The OS can also query the system BIOS to update the battery power information. Placing the cursor over the battery state icon will cause the OS to update the battery power information.

When an AC adapter is inserted or removed, the battery state icon in the taskbar will change to indicate the current state. To display the battery state icon in the taskbar, enable the option "Always show icon on the taskbar" from the "Advanced" tab of "Power Options Properties".



Battery Information

To view detailed battery status information, double-click on the battery or AC adapter icon.



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9 References

Following specifications are used for reference to develop the smart battery management support for ADLINK Computer-on-Module (COM) products.

- Advanced Configuration and Power Interface Specification, Revision 3.0.
- Smart Battery Charger Specification, Revision 1.1.
- Smart Battery Data Specification, Revision 1.1
- Smart Battery Selector Specification, Revision 1.1.
- Smart Battery System Manager Specification, Revision 1.0 Release Candidate b.
- System Management Bus Specification: Revision 1.1, SBS Implementers Forum
- I2C-Bus and How to Use it: V1.0, Philips Semiconductor.

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