# Dual Smart Battery Management System


## Quick Hardware Reference Guide

Rev1.4 – May 2021

# DSBMS Introduction

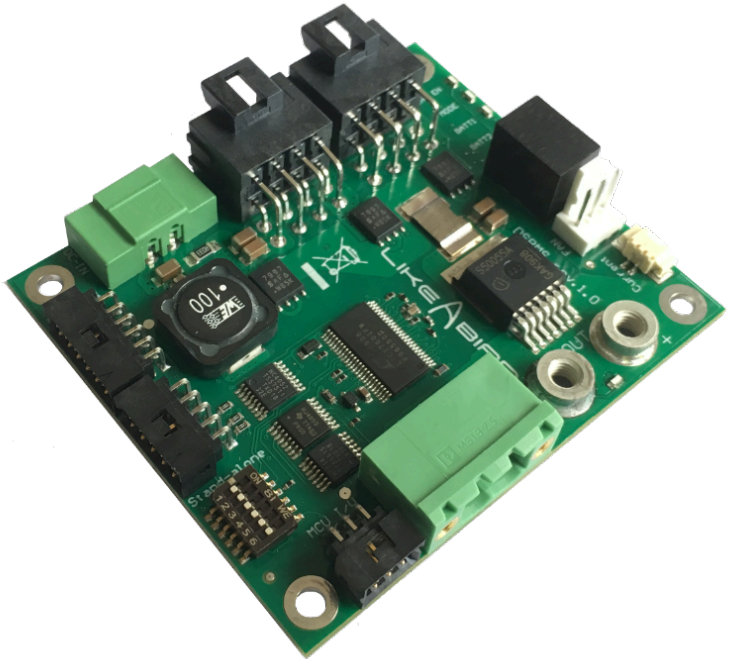
The Dual Smart Battery Management System (DSBMS) is a fully autonomous scalable Intelligent Battery and Power System (IBPS) that manages all aspects of powering a system with redundant battery power. It handles the power switching between battery power and power from an external supply along with all aspects regarding charging and discharging of the batteries. This allows you to power your system while charging your batteries at the same time.  The DSBMS are intelligent devices that allow you to attach Smart Battery packs to supply a common load. They are microprocessor controlled and monitor the safety and power information from each "Smart" battery pack attached to the controller.

A proprietary power path architecture supports simultaneous charging or discharging of both batteries. Typical battery run times are extended by up to 10%, while charging times are reduced by up to 50%. The DSBMS automatically switches between power sources in less than 10µs to prevent power interruption upon battery or wall adapter removal.

The onboard MCU I/O SMBus interfaces allow to an external Host device to monitor either battery's status. Charging accuracy is determined by the battery's internal voltage and current measurements, typically better than ±0.2%.

# DSBMS Key Features

- Manages charging of batteries using almost any external power source from power supplies to solar panels
- SMBus v1.1 Level 3 charger safety features and SBD v1.1 smart battery dataset compliant
- Allows both batteries to discharge simultaneously into single load with low loss (Ideal Diode)
- Scales from 1 to 8 batteries with 4 boards in parallel (battARRAY Cluster)
- Switches power to load between external power and battery power
- Pin headers for remote On/Off, LEDs, current sense and MCU
- Redundant battery power path with Hot Swap capability
- Can simultaneously power system and charge batteries
- PC104 and Ocean Servers adapter boards available
- Accuracy within 0.2% of value reported by battery
- Works from 2s up to 6s and 20A each battery pack
- Low loss simultaneous charging of two batteries
- Fast Autonomous Power Path Switching (<10µs)
- Fully autonomous, just hook it up and go
- Scales from 1 to 32 battARRAY Clusters
- Uses Smart Battery technology
- Integrated fan power supply
- Hardware safety features



# System Size Support:

## Power Small Systems (1-2 batteries):

- Manages power for small portable systems
- Provides redundant hot swap UPS battery backup
- Has the ability to scale battery voltages up as high as 48V using DC-DC regulators
- Max current draw of 20A per battery channel (40A in per board)

The single DSBMS forms the basis of a very flexible and efficient power supply and battery controller. This subsystem allows engineers to design a power supply with Lithium-Ion (Li-ion) battery back-up or battery power. It can be used to make instruments or electronic devices portable or 'un-interruptible' if AC power is lost.

The DSBMS module supports up to two Smart Li-ion battery packs allowing between 97 and 194 Watt-hours of battery power. The DSBMS operating model is similar to the power supply in a notebook computer. When AC is plugged in (charge voltage present) the system runs from the charge voltage and the remaining power is used to charge the battery packs. When the charge voltage is removed (loss of AC or source unplugged), the regulated DC outputs switch over seamlessly to battery power.

# System Size Support:

## Power Medium Systems (4-8 batteries – battARRAY Cluster):

- Manages power for larger portable systems
- Provides redundant hot swap UPS battery backup
- Has the ability to scale battery voltages up as high as 48V using DC-DC regulators
- Max current draw of 20A per battery channel (160A per battARRAY Cluster)
- Components can be electrically disconnected and shipped to avoid most special handling requirements of the DOT Class 9 Hazardous Goods regulations. Standard Smart Battery Packs are up to max 95 Watt Hours

The stacked DSBMS forms a cluster (battARRAY) of up to four boards and up to eight Smart Li-ion battery packs allowing between 380 and 770 Watt-hours of battery power. The DSBMS operates in a “paralleling mode” using the mounting holes as the stacking bus bar using metal standoffs. A single remote On/Off latched switch is required to enable/disable power output and only a single external MCU is required to monitor the entire battARRAY cluster.

# System Size Support:

## Power Large Systems (battARRAY Clusters in Parallel):

- Allow the ability to manage 100+ batteries to create “portable” systems with thousand of Watt-hours of power
- Has the ability to scale battery voltages up as high as 48V using DC-DC regulators

The DSBMS IBPS building blocks also allow system designers to build very large capacity Li-ion battery systems with over 10,000 watt-hours of high-density rechargeable Li-ion battery power. These systems are built out of small, safe 95 Watt-hour Li-ion smart battery packs that can be shipped via commercial freight carriers without special DOT Class 9 Hazardous Goods handling.

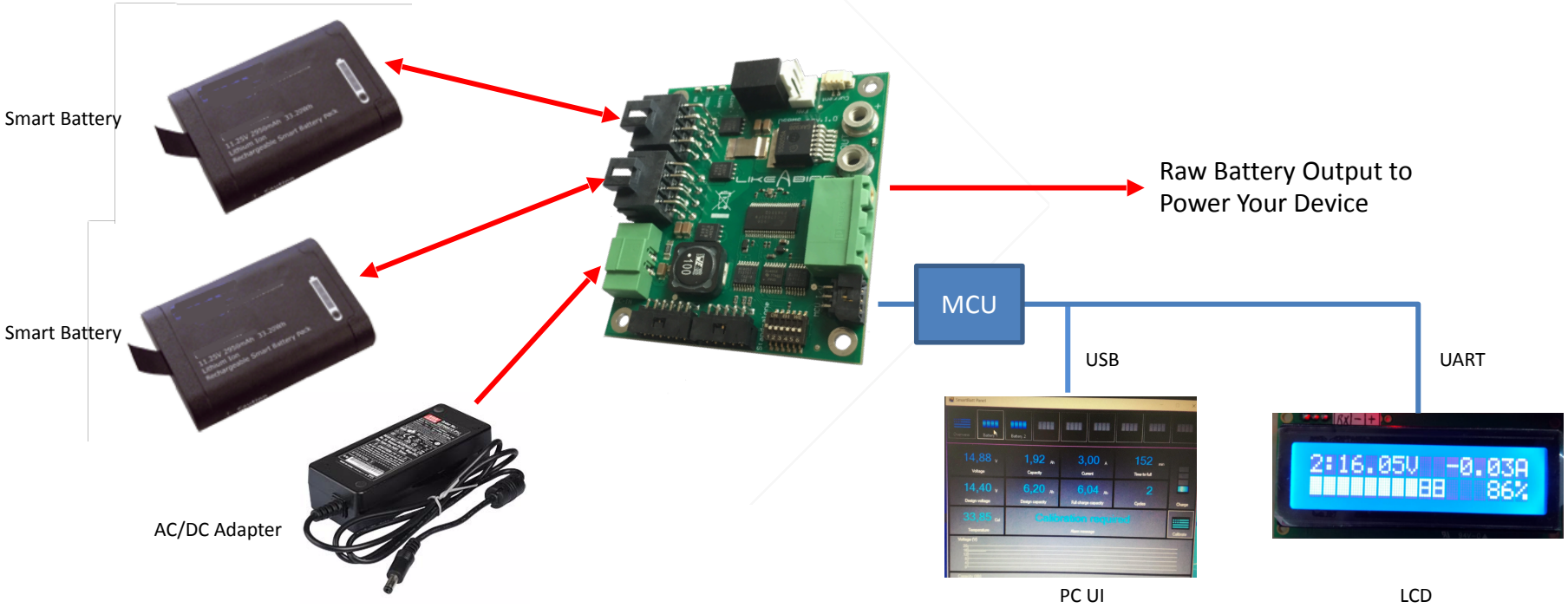
The stacked DSBMS modules support operating in a battARRAY Clusters with other battARRAY Cluster modules works in harmony, load sharing and sourcing a common load device (your system). This will allow systems with over 100 batteries and 10,000 watt-hours of power. Each battery is isolated and monitored individually during both the charge and discharge cycles. The DSBMS controllers manages the charge and discharge of all packs as well as load balancing and real-time status reporting from each battery pack.

Depending on the external MCU selection, all battARRAY Clusters can to be monitored/managed from a single host connection. CAN, LIN, RS232 or IP systems are available.

# Operation Overview

## General System

The Dual Smart Battery Management System (DSBMS) is a fully engineered subsystem for OEM and embedded applications, based on scalable ‘building blocks’. It provides battery power or acts as a battery back-up sub-system using Lithium-Ion Smart Batteries. The DSBMS scales from a small-embedded computer device requiring a few watts of power to large robotic devices needing thousands of watt-hours of battery power.



# Operation Overview

## Hot Swap and Redundant Power Source Switching

The design of the Battery Controller handles all aspects of powering a system with batteries. If external power is present, it will be used to support the load. If there is any excess power available it will automatically be used to charge the batteries (up to 70 Watts per connection). If external power is not available, power to the system will automatically be sourced from the batteries. The switching between power sources is done without having to bring down the system. The batteries and external power are all hot swappable. Switching between power sources happens in less than 10us allowing uninterrupted power to the system.

## Smart Batteries & SMBus

The DSBMS communicates to the batteries via the SMBus v1.1 to the Smart Battery Controller in the battery pack using the SBD v1.1 dataset. It uses this information during operation to maintain safe operating conditions. The status and measurements are taken right at the batteries so they are more accurate. Losses from external cables and circuits do not affect the measurements. This provides a high degree of monitoring accuracy (voltage and current to 0.2%) and high efficiency power conversion.

Current, voltage, and temperature are monitored throughout the charge and discharge cycles. If over current condition occurs, the batteries will be switched off and a POWER_NOT_GOOD condition will occur. When this condition occurs, all power to the system (all batteries and external power) must be removed to clear this condition. The voltage is monitored for maximum and minimum values to keep the batteries within safe operating conditions.  The temperature is also monitored and will disable charging and discharging if the temperature falls outside the safe operating range.

# Operation Overview

## Parallel Operation (Board Stacking)

The DSBMS is designed to support only two batteries at any given time. The DSBMS lend themselves well to sharing power resources. Each Battery Controller has a paralleling connector to form a battARRAY Cluster up to 4 boards. With input a common input current limiting, you can parallel DSBMS boards and not overload the input power source. With its onboard Ideal Diode power paths, you can parallel the outputs of each DSBMS to create a large single power source with automatic current sharing between all the batteries till end of discharge. Even the DSBMS short circuit protection features and crisis management are shared along the paralleling connector. There is technically no limits on the expansion count. However, to make the system work successfully, there are many things to set. This the reason the default limit of the DSBMS paralleling has been limited to max 4 board in a single stack. Custom modifications to support larger single stacks can be supplied on request.

Power supply between stacked boards are provided through the metal standoffs, so only one input and output connector on a single module can be used reducing wirings and the use of an external bus bar. More battARRAY Clusters should be interconnected through a high current bus bar.

# Operation Overview

## Charger BATT Status LED

In a standalone mode, the DSBMS provide four pins (J7) used to control two external LED to monitor the charge status of the batteries system when the system is charging.  If the SW6 is set to «Standalone», then the BATT LED indicates the board charging status as described in the table below. If SW6 is set to «MCU», then the SMBus is used to communicate with the external MCU board.

| LED Label | Standalone | MCU |
|---|---|---|
| BATT1 | BATTERY-1 STAUS<br>OFF = Battery is not charging (DC-IN or battery is not present)<br>ON = Battery is charging<br>BLINKING = Battery charge complete (DC-IN is present, battery is present and not charging) | SMBALERT (status) |
| BATT2 | BATTERY-2 STAUS<br>OFF = Battery is not charging (DC-In or battery is not present)<br>ON = Battery is charging<br>BLINKING = Battery charge complete (DC-IN is present, battery is present and not charging) | SDA (status) |

# Operation Overview

## External Power Signal

Pins 9 and 10 on CON7 will provide a TTL output that can be used for an external ON/OFF signal (pin 9 is the TTL output and pin 10 is ground). The output is configured to be high when the system is turned on and will go low when the external system needs to be turned off.

## External Cooling Fan

A three pin header (CON9) provide 5V for a small colling fan if the DSBMS will be operated at the higher power range and the ambient temperature is higher than 40°C. A compromise between high ambient temperature and high power must be find. LikeAbird can help you to find such parameters.

## External MCU Operation

The Battery Controllers can operate autonomously or can communicate to a host system via an external MCU connected to the MCU I/O connector port to report real time status. When connected to a host system and depending on the installed firmware, some advanced features can be configured to meet the specific needs of your system, including to have different ‘power on’ and ‘power off’ behavior, or to supports different types of system on-off switches. Different ‘ power down’ policies can be selected, some of which are based on battery voltage, battery capacity, battery power, and the number of batteries.

Various external MCU variants are available including USB, WiFi and/or wired Ethernet connectivity.

# Operation Overview

## External LCD Display

An external LCD display (standard 2x16 backlighted version) can be attached to the DSBMS using the LikeAbird External Basic MCU. This will allow for more detailed information to be displayed without the need of a host system. The LCD display contains two lines of information. One line is used for a bar graph displaying the amount of charge left in the battery system. The bar graph also indicates if the battery is charging or discharging.

The second line of the LCD display can show the power consumption and the current entering or leaving the battery subsystem. The second line of the display can also show the time to full charge when charging the batteries or the time to full discharge the batteries when the batteries are supplying power to the system. The LCD display supports backlighting. To conserve battery power, backlighting should not be used if the system will be put to sleep.

LCD Display content can be customized on request.

## Windows UI Application

A management program can be used to monitor the operating DSBMS modules. The LikeAbird SmartBATT-UI program, running on a Windows™ host system, will perform detailed status of the complete DSBMS system down to each battery pack. Additionally, SmartBATT-UI is a useful development tool when testing or evaluating system power consumption. The tool allows the user to monitor the operation of each controller and battery in larger configurations.

SmartBATT-UI support up to 4 controllers for a total of 8 batteries. SmartBATT-PRO supports larger battARRAY Clusters via TCP/IP. The data can also be directed to a file that can keep a full log of the status of the system.

Using the TCP/IP variant, DSBMS modules can be remotely controlled via Internet using wired or LTE based access systems. A Cloud application is in development.

# DSBMS SMBus Interface

The SMBus interface allows the DSBMS to communicate with two batteries and the external SMBus Host (MCU). The SMBus Interface supports true dual port operation by allowing the SMBus Host to be connected to the SMBus of either battery. The DSBMS is able to operate as an SMBus Master or Slave device.

References:

- Smart Battery System Manager Specification: Revision 1.1
- Smart Battery Data Specification: Revision 1.1
- Smart Battery Charger Specification: Revision 1.1
- System Management Bus Specification: Revision 1.1
- I2C-Bus and How to Use it: V1.0, Philips Semiconductor

# Battery Operation & Power Conditioning

The DSBMS Controller supports up to two 2s to 6s Smart Li-ion Battery Packs allowing between 90 and 180 Watt-hours of battery power. The DSBMS operating model is similar to the power supply in a notebook computer. When AC is plugged in (charge voltage present) the system runs from the charge voltage and the remaining power is used to charge the battery packs. When the charge voltage is removed (loss of AC or source unplugged), the regulated DC outputs switch over seamlessly to battery power. A standalone DSBMS module outputs raw battery voltage that ranges from (4s) 11 - 16.8 Volts as the battery packs discharge.

When a charge voltage is applied, the charge voltage will supply the power to the embedded system and charge the batteries if required.  When wall power is removed, the system will run on battery power. When the batteries have reached the end of the discharge cycle the regulated power will be shutdown. This is the same power mode used in Laptop computers.

All batteries are allowed to discharge at the same time. The simultaneous discharge allows for increased battery time due to a decrease in power loss from the switch circuit and internal battery losses. The maximum rate of discharge for a DSBMS is 20 Amp per battery with a total current of 40 Amp per board.

The DC-OUT provides various features:

Overload protection, Current limitation, Short circuit protection, Fast deenergizing of inductive loads, Diagnostic feedback with load current sense, Open load detection via current sense, Electrostatic discharge (ESD) protection.

# Battery Operation & Power Conditioning

## DC-DC Power Conditioning Boards

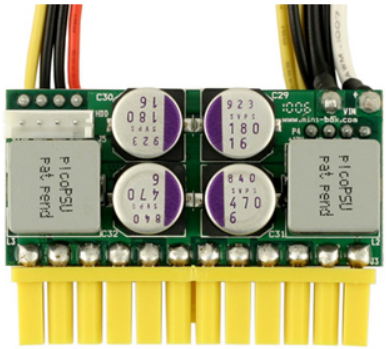
If a regulated voltage output is required, easily connect our Smart Power Conditioning Module (SPCM) to the DSBMS power outputs. The SPCM gives you a selectable regulated voltage between 3.3V to 16.5V at a continuous current of up to 8 Amp.

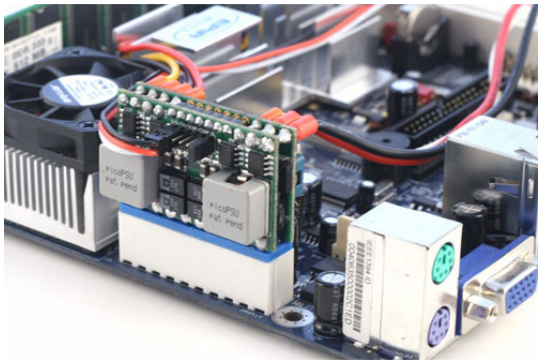
https://likeabird.eu/index.php/product/dc-dc-converter-module/

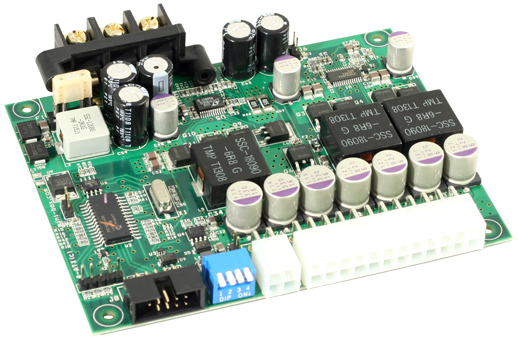
## ATX DC-DC Power Supply Modules

If you need to power supply a wide range of ITX motherboards as well as regular boards, we recommend the use of the picoPSU, M2, M3 or M4  upconverter.

http://www.mini-box.com/DC-DC





# DSBMS Operational Requirements

The following table provides the facilities requirements that must be met for the DSBMS.

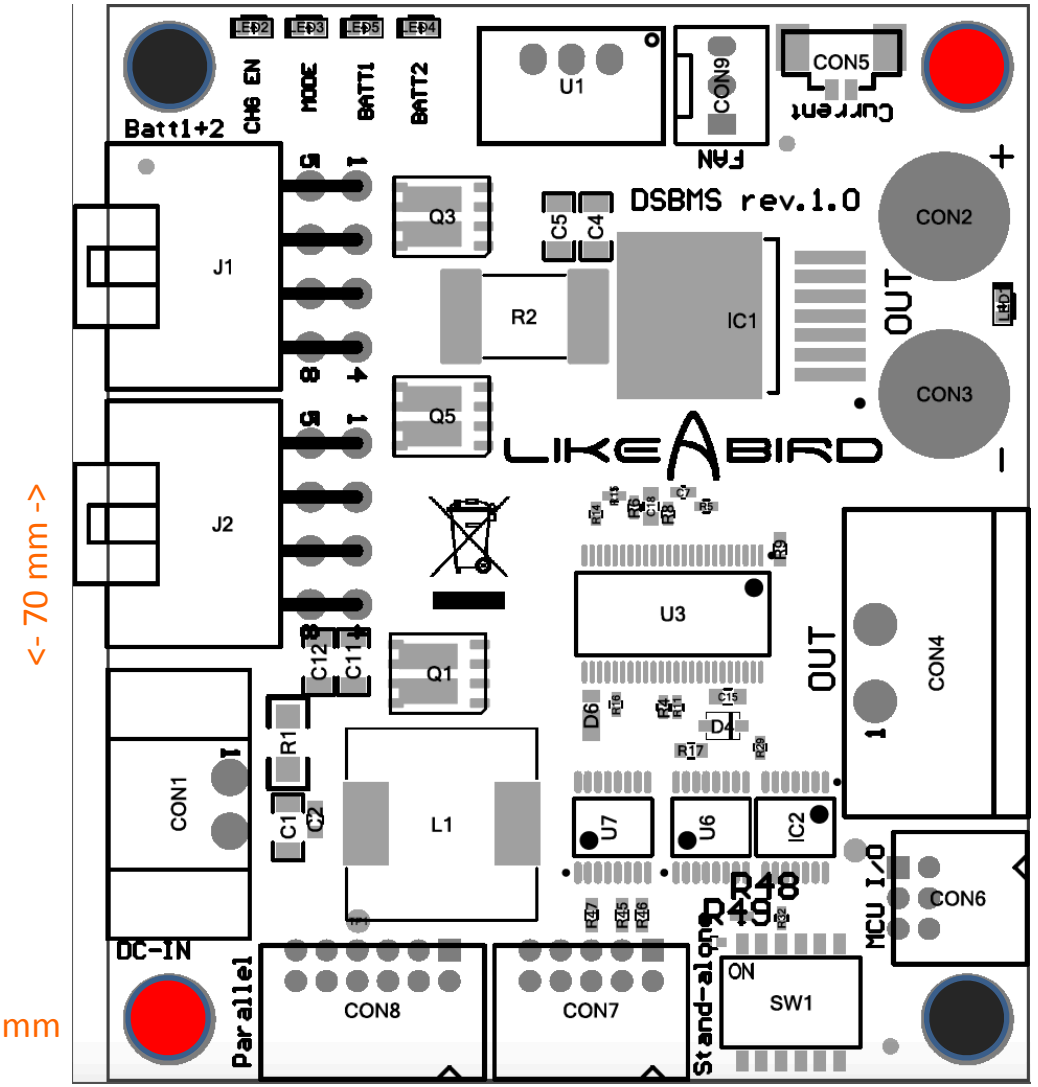
| Type | Requirements |
|---|---|
| Electrical | • Primary DC input: 18-20 VDC, 90W (for charging or direct system power)<br>• Battery inputs: 2s to 6s SMBus and SBS rev 1.1 compliant smart batteries<br><br>*Refer to DSBMS Technical Specifications for complete wall adapter power supply specifications.* |
| Thermal | • Fan air flow should be provided if operated under heavy load<br>• Ambient air temperature not exceeding 40 ° C (104 ° F) while the DSBMS is operating |
| Installation | • Can be strapdown installed using 4 M3 screws. **NOTE: Mounting holes are also used for Power-Stacking! Positive (V+) related mounting hole SHALL NOT BE GROUNDED!**<br>• Can be installed in vertical or horizontal position<br>• Do not mount upside down |

# DSBMS Board Mechanical Specs

The top view of the DSBMS shows all available connectors and pin header available on the board. There are no hidden connectors or pin headers on the bottom side of the board.

Power Stack: Negative Voltage
NOTE: CAN BE GROUNDED

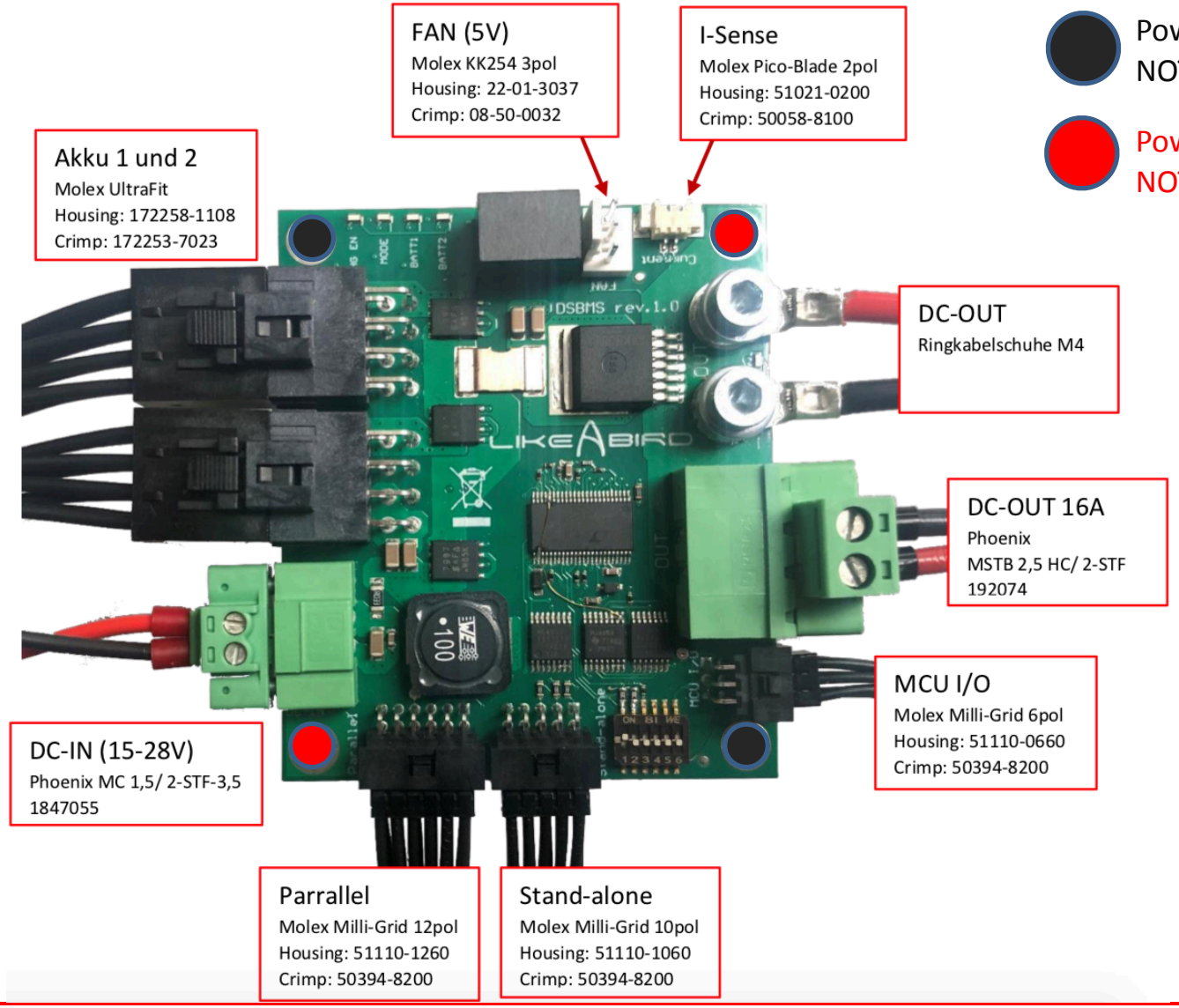
Power Stack: Positive Voltage
NOTE: DO NOT GROUND!



# DSBMS Connectors and Jumpers

| Type | Function |
|---|---|
| Power | CON1: VDC-In<br>CON2: VBAT-Out (High Power - Positive)<br>CON3: VBAT-Out (High Power - Negative)<br>CON4: VBAT-Out (Low Power) |
| System | CON5: Analog Current Sense<br>CON6: MCU I/O<br>CON7: Stand Alone I/O<br>CON8: Paralleling I/O<br>CON9: Fan |
| Batteries | J1: Smart Battery Pack 1<br>J2: Smart Battery Pack 2 |
| Dip Switches | SW1: Board Configuration |

# DSBMS Connectors




Power Stack: Negative Voltage
NOTE: CAN BE GROUNDED

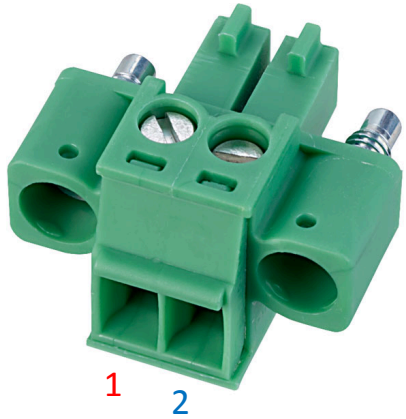
Power Stack: Positive Voltage
NOTE: DO NOT GROUND!

# CON 1: Power Wall DC Power Input Connector

| Pin | Signal | Function |
|---|---|---|
| 1 | VDC_IN | VDC positive power input |
| 2 | VDC_GND | VDC negative power input |

Mating Connector

- Manufacturer: Phoenix Contact
- Part Name: MC 1,5/ 2-STF-3,5
- Mfg. Part Number: 1847055



# CON 2-3: 40A System High-Power Output Connector

| Pin | Signal | Function |
|---|---|---|
| 2 | BAT_OUT | System Power positive power output |
| 3 | BAT_GND | System Power negative power output |

CON2-3

Mating Connector

- Manufacturer: JST (Japan Solderless Terminals)
- Part Name: GS4-6 – Ring Tongue Terminal, M4, 10 AWG
- Mfg. Part Number: GS4-6

# CON 4: 16A System Power Output Connector

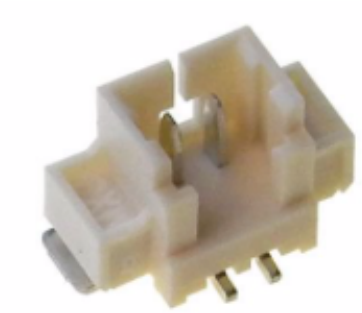
| Pin | Signal | Function |
|---|---|---|
| 1 | BAT_OUT | System Power positive power output |
| 2 | BAT_GND | System Power negative power output |

Mating Connector

- Manufacturer: Phoenix Contact
- Part Name: MSTB 2,5 HC/2-STF
- Mfg. Part Number: 1912074

# CON 5: Analog Current Sensor Header

| Pin | Signal | Function |
|---|---|---|
| 1 | Current Sense | SSR Analog Current Sensor |
| 2 | GND | Ground |



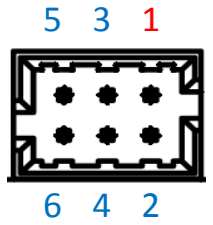
Mating Connector

- Manufacturer: Molex
- Part Name: Picoblade, 2 Circuits
- Mfg. Part Number: 510210200 Crimp Housing

# CON 6: MCU I/O Header

| Pin | Signal | Function |
|---|---|---|
| 1 | +5V | 5V Power Supply for MCU Board |
| 2 | INTB | Interupt Signal (SMBus Alert) |
| 3 | SCL OUT | SMBus SCL Signal |
| 4 | SDA OUT | SMBus SDA Signal |
| 5 | GND | Ground |
| 6 | GND | Ground |

CON6



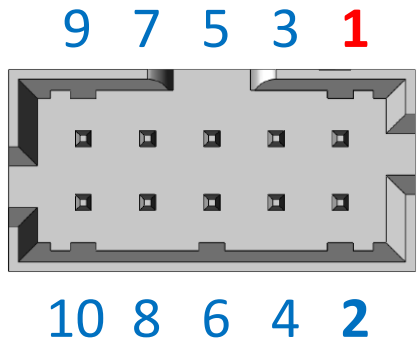

Mating Connector

- Manufacturer: Molex
- Part Name: Milli-Grid, 6 Circuits
- Mfg. Part Number: 51110-0656 Crimp Housing
- Alternative Part Number: 51110-0660

# CON 7: Stand Alone I/O Header

| Pin | Signal | Function |
|---|---|---|
| 1 | LED BATT-1 | Status LED for Battery 1 |
| 2 | GND | Ground |
| 3 | LED BATT-2 | Status LED for Battery 2 |
| 4 | GND | Ground |
| 5 | LED SSR_ON/OFF | On/Off signal LED |
| 6 | GND | Ground |
| 7 | SSR_ON/OFF | BAT output On/Off switch |
| 8 | GND | Ground |
| 9 | TTL_OUT | External trigger signal out |
| 10 | GND | Ground |

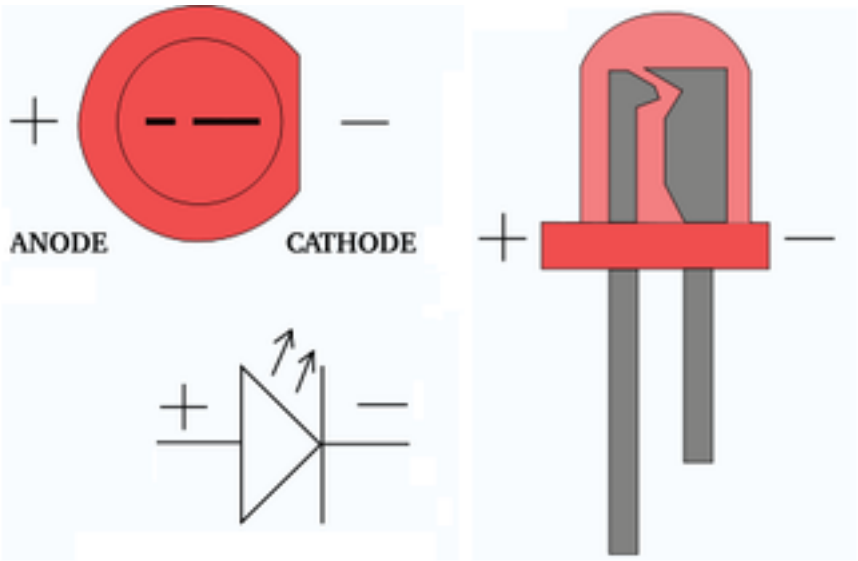
CON7

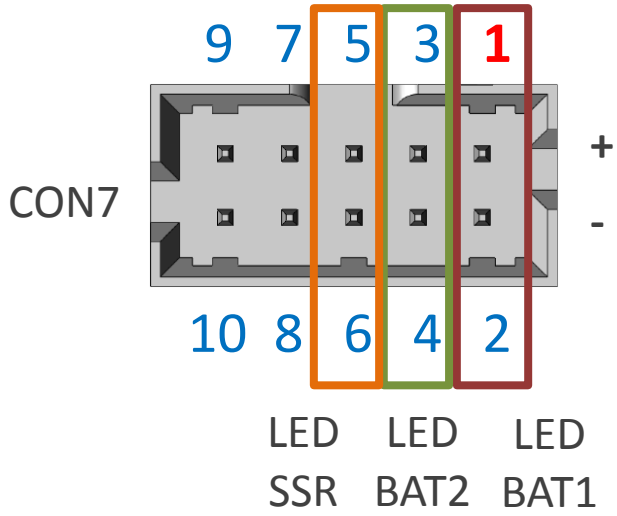



Mating Connector

- Manufacturer: Molex
- Part Name: Milli-Grid, 10 Circuits
- Mfg. Part Number: 51110-1056 Crimp Housing
- Alternative Part Number: 51110-1060

# CON 7: LED Connection



# CON 8: Paralleling I/O Header

INTERNAL USE ONLY

# CON 9: FAN Header

| Pin | Signal | Function |
|---|---|---|
| 1 | N/C | Not Connected |
| 2 | +5V | FAN Power Supply |
| 3 | GND | Ground |

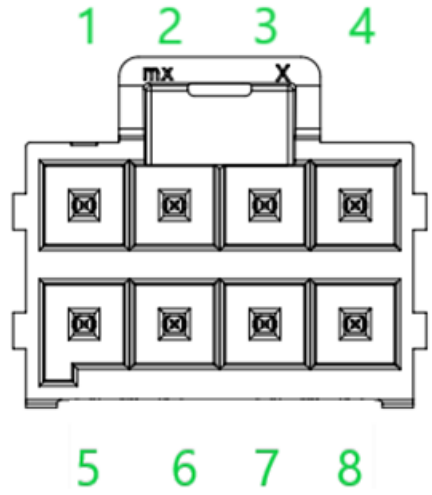
Mating Connector

- Manufacturer: Molex
- Part Name: KK 254, 3 Circuits
- Mfg. Part Number: 2695 Crimp Terminal Housing

# J1-J2: Smart Battery Connector

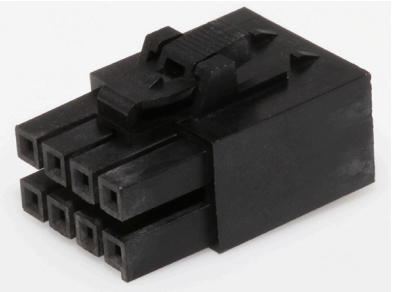
| Pin | Signal | Function |
|---|---|---|
| 1 | BAT_Positive | Positive side of battery |
| 2 | I2C_SCL | SMBus Clock |
| 3 | TEMP/Sense | Battery temperature sensor |
| 4 | BAT_Negative | Negative side of battery |
| 5 | BAT_Positive | Positive side of battery |
| 6 | I2C_SDA | SMBus Data |
| 7 | I2C_GND | SMBus Ground (Battery Negative) |
| 8 | BAT_Negative | Negative side of battery |

J1-J2
Board Connector




Mating Connector

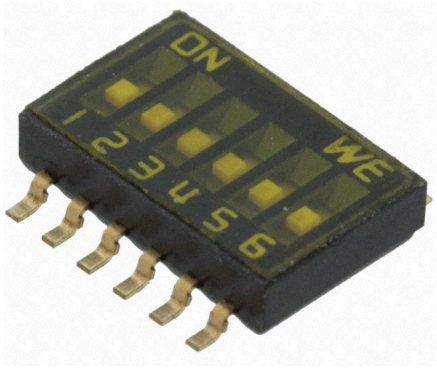
- Manufacturer: Molex
- Part Name: Ultra-Fit, 8 Circuits
- Mfg. Part Number: 172258-1108 Crimp Housing



Mating Cable Connector

# SW1: Board Configuration Switches

| SW | Signal | Function |
|---|---|---|
| 1 | DIP Cells 1 | Cell Count Selector |
| 2 | DIP Cells 2 | Cell Count Selector |
| 3 | ILM Charger Limit | OFF = 4A; ON = 3A |
| 4 | SMBus Addr 1 | SMBus Address |
| 5 | SMBus Addr 2 | SMBus Address |
| 6 | Board Mode | ON = MCU; OFF = Stand-Alone |




## Battery Cell Count Selection

| SW1 | SW2 | Function |
|---|---|---|
| ON | ON | 2S |
| OFF | ON | 3S |
| ON | OFF | 4S |
| OFF | OFF | Optional |

## SMBus Address Selection

| SW4 | SW5 | Add. 7-Bit | Add. 8-Bit |
|---|---|---|---|
| OFF | OFF | 0x04 | 0x08 |
| ON | OFF | 0x06 | 0x0C |
| OFF | ON | 0x08 | 0x10 |
| ON | ON | 0x0A | 0x14 |

# Charge LED: On-Board LED Functions

The user-selectable dip switch SW6 controls the Host SMBus operating mode. If the SW6 is set to «Standalone», then the onboard LED indicates the board charging status as described in the table below. If SW6 is set to «MCU», then the SMBus is used to communicate with the external MCU board.

| LED Label | Standalone | MCU |
|---|---|---|
| CHG EN | OFF | SCL (status) |
| MODE | OFF | ON |
| BATT1 | BATTERY-1 STAUS<br>OFF = Battery is not charging (DC-IN or battery is not present)<br>ON = Battery is charging<br>BLINKING = Battery charge complete (DC-IN is present, battery is present and not charging) | SMBALERT (status) |
| BATT2 | BATTERY-2 STAUS<br>OFF = Battery is not charging (DC-In or battery is not present)<br>ON = Battery is charging<br>BLINKING = Battery charge complete (DC-IN is present, battery is present and not charging) | SDA (status) |

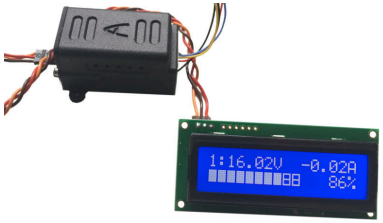
# Qualified Add-Ons

| Manufacturer | Mfr Part Number | Description |
|---|---|---|
| APEM | IPR1SAD2LOG | Off-On Miniature Push Button Switch, IP67, Panel Mount Green LED |
| APEM | Q6F1BXX”RGYB”02E | Flush Indicator Panel Mount, 6mm Mounting Hole Size, LED, Solder Lug/Fastons Termination, 3 mm Lamp Size, 1.8 to 3.8VDC 20mA max |
| Mean Well | GS90A19-P1M | Desktop AC Adapters 90W 19V 4.74A |
| LikeAbird | LAB-NHD-LCD1602-USB | Serial LCD Display, 16x2 Characters, Backlight including MCU USB Controller Box |
| LikeAbird | LAB-DSBMS-BATT-AMP | Battery Cable with AMP Connector, 30cm |
| LikeAbird | LAB-DSBMS-BATT-OE | Battery Cable with open end, 30cm |

Push Button

LED Indicator

AC Adapter

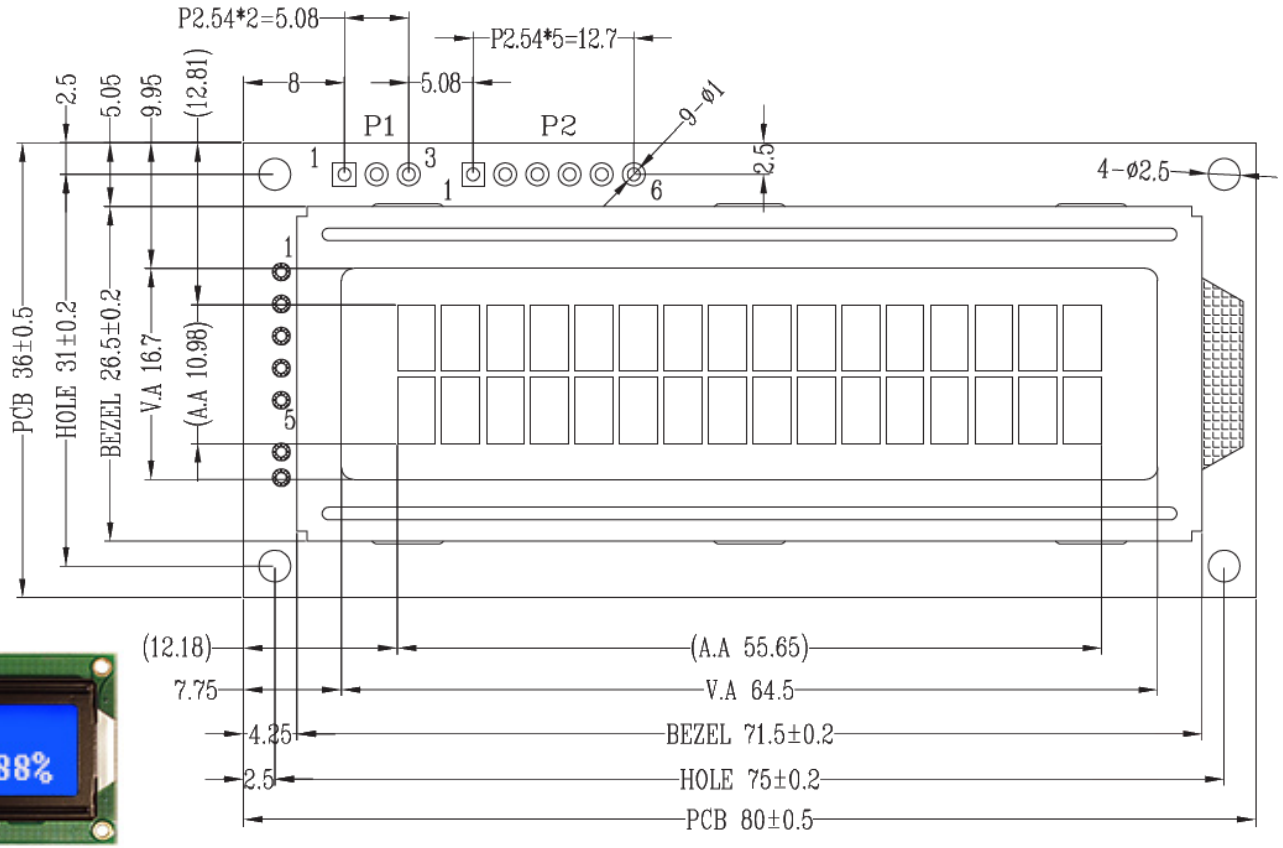


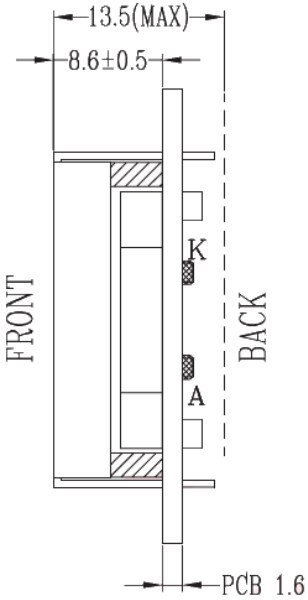

LCD Display +
USB Controller

Battery Cable

# Qualified Add-Ons – LCD Display

| Manufacturer | Mfr Part Number | Description |
|---|---|---|
| LikeAbird | LAB-NHD-LCD1602-USB | Serial LCD Display, 16x2 Characters, Backlight including MCU USB Controller Box |


Note: dimensions in mm

# SMBus v1.1 and SBData v1.1 Compliant Smart Batteries

accutronics professional battery solutions

RRC power solutions

Inspired Energy Solutions for Portable Power

Epsilor

MPL MIL POWER LTD Delivering Battery Performance

Bren-Tronics, Inc. Intelligent Military Batteries & Charging Systems™

DENCHI POWER

ULTRALIFE®

PATCO™

inVENTUS POWER

saft a company of TOTAL

CENTURY DYNAMICS


RRC/Inspired Energy Packs

VR420A Pack

Cylindrical Energy Source (CES)

BB-2590

BB-2557


LI-80

LI-145

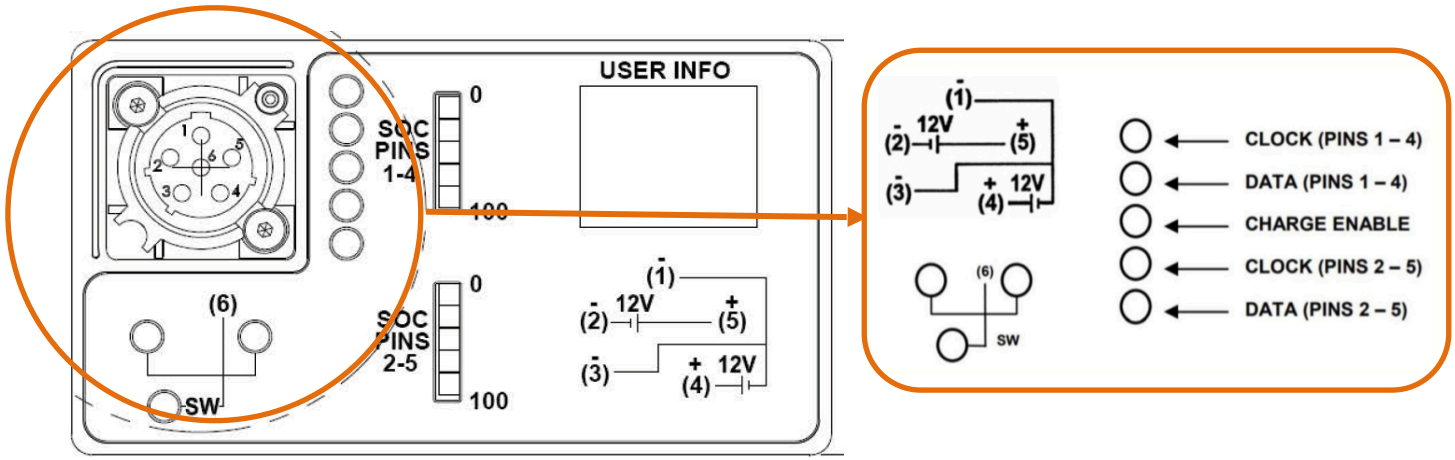
# NOTE ABOUT 2590 BATTERIES

Each 2590 battery consists of two individual 14.4V battery sections which can be externally connected in either series or parallel, depending on user requirements. Selected 2590 batteries are fully compliant with System Management Bus (SMBus) and Smart Battery System (SBS) specifications, which means they are easily integrated into compatible host systems or smart chargers.

To allow charging of the 2590, pin 3 (TEMP/Sense) on the DSBMS J1 and J2 connectors must be shorted to ground!

**CHARGE EACH SECTION (PIN 1-4 and PIN 2-5) INDIPENDENTLY!**

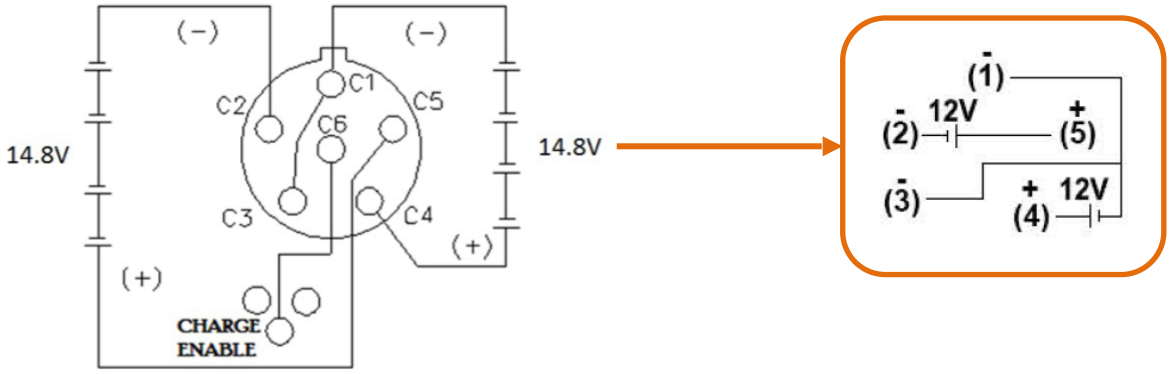
2590 Series

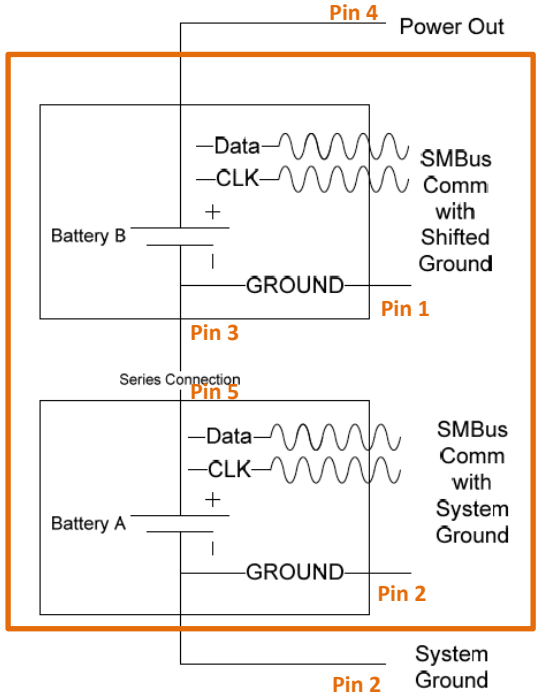


# NOTE ABOUT 2590 BATTERIES

Another overlooked 2590 design consideration is communicating with a battery that is used in a series application such as shown below. This is an issue because data and clock for SMBus are relative to the ground point of the circuit, and batteries utilized in series applications shift the ground of the higher-voltage section. That is, the actual ground point is equal to the voltage of the lower-battery section (10-16.8V DC on a 2590) and continually shifts throughout the battery discharge. This requires the use of an isolated input for proper communication or a shorting path will exist to system ground. Several companies make optical and inductive isolators for I2C and SMBus, including NXP Semiconductors and Analog Devices, Inc. It is good practice to add some ESD protection and filtering to the battery communication interface.

**DO NOT CONNECT PIN 2 AND PIN 4 TO THE DSBMS J1 or J2!**
**This will damage the DSBMS!**



# Typical Applications

- Robotics / UGVs / UAVs / UUVs / AUVs
- Communication Devices
- Ground Control Stations
- SATCOM Devices
- Rugged, Portable Electronics
- Detection Devices
- Autonomous Remote Sensors and Surveillance
- Portable Power Systems

# DSBMS Evaluation Kits

Kit Includes:

- DSBMS Controller module
- Two High-Power Smart Batteries
- Power Conditioning Board
- Power button
- Power adapter and cabling

The DSBMS Smart Battery Management Evaluation System is a proof-of-concept battery power subsystem and supports two High-Power Smart Batteries providing unregulated raw battery along with stabilized 12V, 9V and 5V, or optionally ATX power outs for mobile embedded systems. The DSBMS system allows developers to easily and quick implement battery power in own applications requiring high mobility in the following ways:

- Emulates the battery power subsystem functionality of a prototype system during the design phase
- Functions as a ready-made battery power subsystem for a customized system
- Provides a reference design to integrate a battery power subsystem into a custom-designed carrier

www.likeabird.eu