VICTORY
ADVANCED TECHNOLOGIES
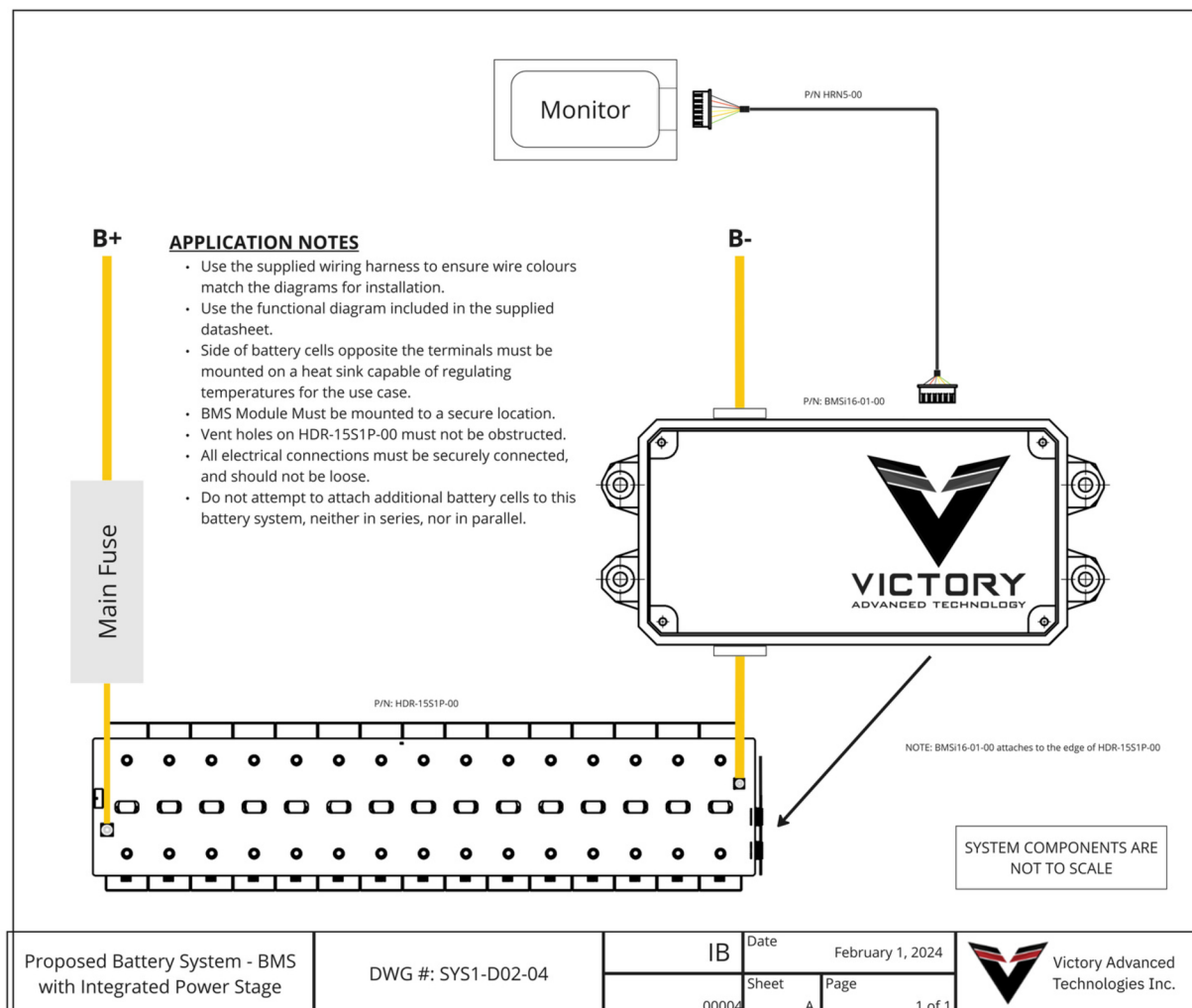
Integrated 16-Cell Battery Management System
P/N: BMSI16-00-01

- 8-16 Lithium Cells
- Temperature Sensing
- Built-in current sensing
- Internal switch-mode power supply
- Internal shunt balancers
- CANBUS connection to communicate with peripheral systems

The integrated battery management system was created to address the need for a simple, rugged, reliable battery monitoring and control for low voltage packs up to 16 cells, and a maximum of 70VDC. It can be connected to our optional monitor, or via CANBUS to monitor or configure the battery system.

Parameter	Value	Unit
Number of Cells	8-16	
Battery Types	LiFePO4, LiCo, LiMn, NMC, etc	
Accuracy	<0.002	VDC
Battery Capacity	5-1200	Ah
Current Measurement	0-500 (Shunt) 0-1200 (Hall-Effect)	A
CANBUS Capacity	290	Bit
CANBUS Rate	250	kb/s
Power Consumption	>30	mA

Integration

APPLICATION NOTES

- Use the supplied wiring harness to ensure wire colours match the diagrams for installation.
- Use the functional diagram included in the supplied datasheet.
- Side of battery cells opposite the terminals must be mounted on a heat sink capable of regulating temperatures for the use case.
- BMS Module Must be mounted to a secure location.
- Vent holes on HDR-15S1P-00 must not be obstructed.
- All electrical connections must be securely connected, and should not be loose.
- Do not attempt to attach additional battery cells to this battery system, neither in series, nor in parallel.

B+

Main Fuse

B-

P/N HRN5-00

Monitor

P/N: BMSi16-01-00

P/N: HDR-15S1P-00

NOTE: BMSi16-01-00 attaches to the edge of HDR-15S1P-00

SYSTEM COMPONENTS ARE NOT TO SCALE

Proposed Battery System - BMS with Integrated Power Stage	DWG #: SYS1-D02-04	IB	Date	February 1, 2024	Victory Advanced Technologies Inc.
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Accessories

Part	Description
HRN5-00	A 6-pin connector for communication.
HMI-00-00 (optional)	A monitor that allows programming and monitoring of the BMS
HDR-15S1P-00	A Battery cell header for prismatic cells. Allows direct mounting of the BMS unit, entirely removing the need for a cell tap harness.
Main Fuse	Fuse with a voltage rating of greater than the maximum battery voltage, an amperage rating of no more than the battery's rated current.

Communications

The BMS uses a single 6-pin JST XH connector for all of its communications. Five of those pins are for the CANBUS and one pin is for sleep mode.

Pinouts (Colours based on P/N: HRN5-00)		
Pin	Name	Wire Colour
1	GND	Black
2	12 VDC	Red
3	CANH	White
4	CANL	Yellow
5	Shield	Orange
6	Sleep	Green

LED Status Indicator

The BMS has a bicolour LED Indicator (Red and Green) which displays the operating status. The table below summarizes the meanings behind the possible colour combinations.

Status	Colour
Running (No Errors)	Green
Sleeping	Blinking Green
Under-Voltage Trip	Flashing Red
Over-Voltage Trip	Red
Thermal Trip	Flashing Red/Green

Sleep Mode

The BMS has a sleep pin on the communication that can be used to put the device into "sleep-mode. Sleep mode does three things:

1. Puts the BMS into a low-power mode;
2. shut off power outputs, disabling the battery
3. Turns off the CANBUS, so that the BMS cannot be used.

This is used in mobile applications when the vehicle is neither being driven, nor charged. In stationary applications this function can be a party of the anti-theft, as it disables the battery and makes the BMS unresponsive to CANBUS commands. It will continue to monitor the the cell voltage and shunt current, and to preserve safety, will turn itself off completely if any cells fall below the minimum threshold voltage.

In order to enter sleep mode, ground the pin to the GND reference. When not in sleep mode, the pin should be allowed to float, or be pulled high (to the 12VDC.

CANBUS Commands

This section of the document is intended to provide assistance in the integration of the BMS with an external device for the purpose of monitoring and/or configuration. The BMS uses CAN 2.0B with 29 bit IDs. All Packets are the Data frame type, though some require no actual data.

For consistence and intercompatibility across product lines, this BMS uses the same CAN protocol as the other Victory Advanced Technologies BMS devices. Some data is not applicable/available to this BMS, and those bytes are marked as "Reserved" in the tables on the following pages.

All IDs are given in decimal format.

Status Broadcast (Tx)

The BMS broadcasts this packet at 4Hz, containing its current status and operating information.

ID30: Broadcast Status (Tx)								
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Error Code					Status High		
Byte 1	Battery Amp-hours remaining, 0.1Ah resolution, high byte							
Byte 2	Battery Amp-hours remaining, 0.1Ah resolution, low byte							
Byte 3	Battery Voltage, 0.1V Resolution, high byte							
Byte 4	Battery Voltage, 0.1V resolution, low byte							
Byte 5	Reserved							
Byte 6	Reserved							
Byte 7	Temperature (C+40)							

Status High	
Value	Name
0	Idle
1	Reserved
2	Running
3	Reserved
4	Stopped
5	Reserved

Error Code		
Value	Name	Information
0	No Error	
1	Corrupt Settings	Invalid settings value detected in memory
2	Overcurrent Warning	Current has exceeded the warning threshold
3	Overcurrent Shutdown	Current has exceeded fault threshold (drive shutdown)
4	Low Cell Warning	One or more cells below minimum voltage threshold
5	BMS Shutdown	Vehicle shutdown due to undervoltage cell for 10+ seconds
6	High Cell Warning	One or more cells above maximum voltage threshold
7	BMS Ended Charge	Charger has been stopped due to overvoltage cell for >1 sec
8	BMS Over-temp	The themperature has exceeded upper limit
9	BMS Under-Temp	The temperature is below lower limit
10	Low SoC Warning	Battery state of charge has passed the low warning level
11	Reserved	
12	Reserved	
13	Reserved	
14	Reserved	
15	Reserved	
16	CAN Error	A CAN communications error was detected

Receive Configuration Data (Rx)

These 8 byte packets contain the new configuration parameters sent to the BMS. Note that settings will not be saved to memory until all four config packets are received, and values will automatically be limited to their allowable range.

ID32: Receive Configuration Data 1 (Rx)					
	Description	Units	Minimum	Maximum	Note
Byte 0	Pack Capacity	Ah x5	1	250	
Byte 1	SoC Warning	%	0	99	
Byte 2	Full Voltage	V x2	5	251	
Byte 3	Warn Current	A x10	1	121	
Byte 4	Trip Current	A x10	1	121	
Byte 5	Reserved				
Byte 6	Number of Cells		8	16	
Byte 7	Current shunt type	Enum	0	3	0 = No shunt, 1 = 100A shunt, 2 = 200A shunt, 3 = 500A shunt, all 75mV shunts

ID33: Receive Configuration Data 2 (Rx)					
	Description	Units	Minimum	Maximum	Note
Byte 0	Reserved				
Byte 1	Reserved				
Byte 2	Reserved				
Byte 3	Reserved				
Byte 4	Reserved				
Byte 5	BMS Min Voltage	1.50 + 0.01nV	0	250	
Byte 6	BMS Max Voltage	2.00 + 0.01nV	0	250	
Byte 7	Balance Voltage	2.00 + 0.01nV	0	252	Static thresholds of 2.00–4.50 are achieved with values of 0-250. For dynamic threshold, use value 251. To disable balancing, set value to 252

Receive Configuration Data (Rx)

ID34: Receive Configuration Data 3 (Rx)					
	Description	Units	Minimum	Maximum	Note
Byte 0	BMS Hysteresis	x0.01 V	0	50	
Byte 1	BMS Min Temp	n-40C	0	141	
Byte 2	BMS Max Temp	n-40C	0	141	
Byte 3	Max Charge Voltage	V	0	255	
Byte 4	Max Charge Current	A	0	127	
Byte 5	Reserved				
Byte 6	Reserved				
Byte 7	Reserved				

ID35: Receive Configuration Data 4 (Rx)					
	Description	Units	Minimum	Maximum	Note
Byte 0	Reserved				
Byte 1	Reserved				
Byte 2	Reserved				
Byte 3	Reserved				
Byte 4	Reserved				
Byte 5	Stationary Mode		0	1	
Byte 6	Reserved				
Byte 7	Reserved				

Rx Commands

ID37: Acknowledge Error (Rx)

This byte is the ID of the error being acknowledged

ID38: Reset State of Charge (Rx)

You can reset the BMS SoC by sending a packed to ID38. Any data in this packed is ignored

ID40: Battery Current

If ID32, byte 7 is 1,2 or 3, this ID will send the instantaneous current at 4Hz as a single 24 bit (big endian format) in milliamps. The value is unsigned with a 8388608 offset, so this number from the value to get a signed value for current in milliamps. If ID32 byte 7 is set to 0, the BMS will not send this message.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Battery Current, High Byte							
Byte 1	Battery Current, Middle Byte							
Byte 2	Battery Current, Low Byte							

Cell Voltages

ID301: Cell Voltage 1-4 (Tx)								
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Voltage 1, High Byte							
Byte 1	Voltage 1, Low Byte							
Byte 2	Voltage 2, High Byte							
Byte 3	Voltage 2, Low Byte							
Byte 4	Voltage 3, High Byte							
Byte 5	Voltage 3, Low Byte							
Byte 6	Voltage 4, High Byte							
Byte 7	Voltage 4, Low Byte							

ID302: Cell Voltages 5-8 (Tx)								
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Voltage 5, High Byte							
Byte 1	Voltage 5, Low Byte							
Byte 2	Voltage 6, High Byte							
Byte 3	Voltage 6, Low Byte							
Byte 4	Voltage 7, High Byte							
Byte 5	Voltage 7, Low Byte							
Byte 6	Voltage 8, High Byte							
Byte 7	Voltage 8, Low Byte							

ID311: Cell Voltages 9-12 (Tx)								
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Voltage 9, High Byte							
Byte 1	Voltage 9, Low Byte							
Byte 2	Voltage 10, High Byte							
Byte 3	Voltage 10, Low Byte							
Byte 4	Voltage 11, High Byte							
Byte 5	Voltage 11, Low Byte							
Byte 6	Voltage 12, High Byte							
Byte 7	Voltage 12, Low Byte							