

LITHIONICS BATTERY[®]

LITHIUM-ION IRON PHOSPHATE BATTERY SYSTEMS



NEVERDIE[®] BATTERY MANAGEMENT SYSTEM

2021

The World's Widest Range of Advanced Battery Systems Using NeverDie[®], miniBMS[®] & OptoLoop[®] Technology

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NEVERDIE®
LITHIUM+ELECTRONICS = LITHIONICS BATTERY

1. NEVERDIE® BATTERY MANAGEMENT SYSTEM (BMS)



Lithionics Battery's NeverDie® Battery Management System is a proprietary design featuring UL tested protective safety features, as well as state-of-health (status & fault codes), and state-of-charge monitoring. Our patent-pending BMS utilizes custom microprocessors and in-house controlled firmware that enables the customization of the BMS to perform as a Programmable Logic Controller (PLC.) The NeverDie® Battery Management System is standard on all Lithionics Battery® systems to ensure your lithium batteries are operated within their rated specifications. This increases the lifespan of your battery system and protects your valuable investment. Unlike many competitors, Lithionics Battery® uses a military grade proprietary contactor (UL508 tested to 6,000 hot-switching cycles) for BMS on/off switching. This allows for continuous current ratings of up to 400A to match the high performance of your lithium battery module.

Internal NeverDie® BMS
200A or 400A Rating



Standard NeverDie® BMS
12V to 51V 400A Rating



Advanced NeverDie® BMS
12V to 96V 400A Rating



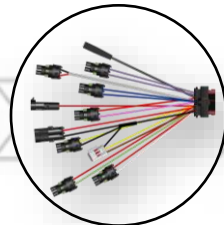
High Voltage NeverDie® BMS
102V to 512V 400A Rating



Available Features:

- ▶ Ampseal I/O Connector
- ▶ Round SOC Display*
- ▶ Bluetooth® Transmitter
- ▶ Status & Fault Code Reader

*Available on Advanced Series Only



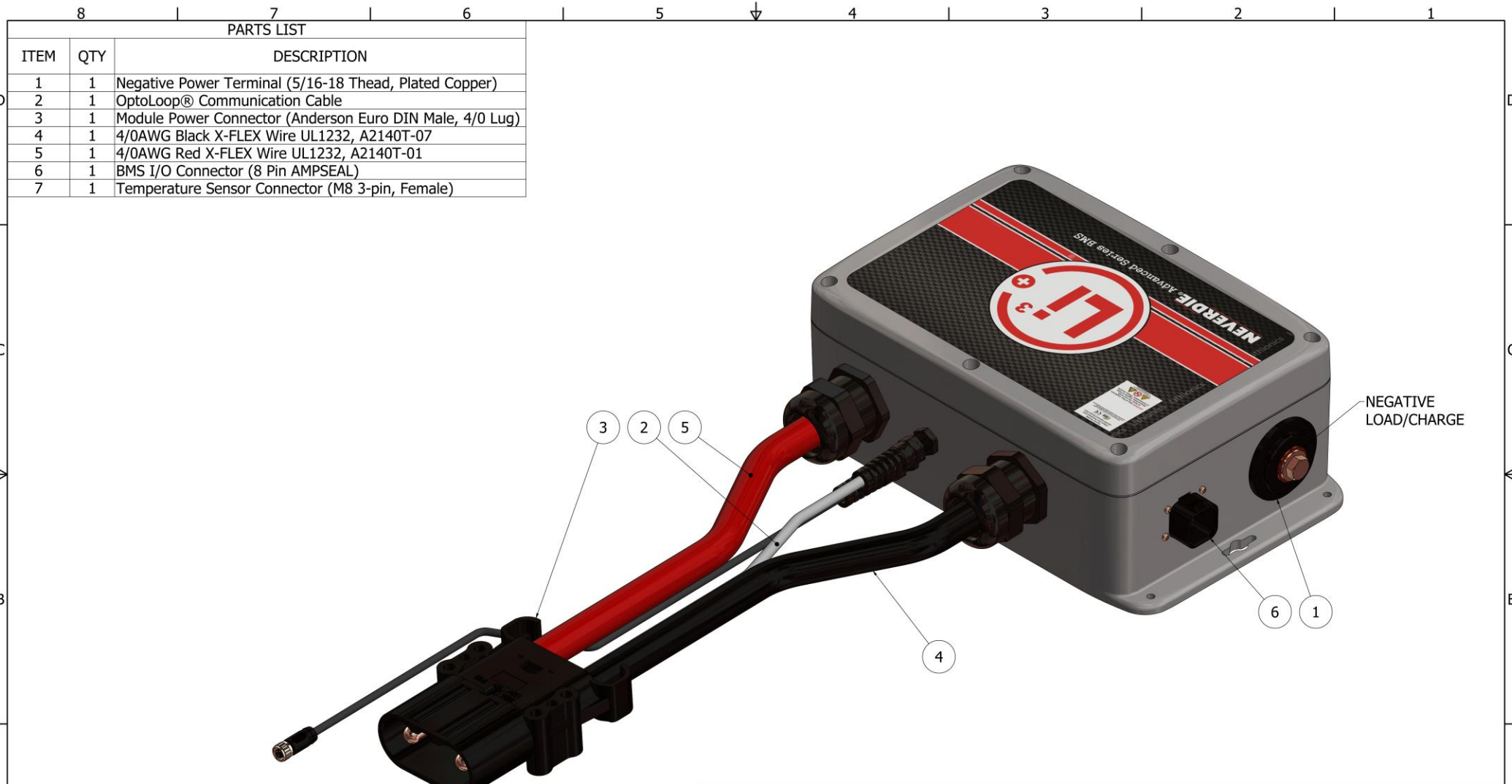
2. NEVERDIE® BMS FEATURES



[Standard and Advanced features apply to both Internal and External BMS.]

| NeverDie® BMS Features | Standard Series (12V to 51V) | Advanced Series (12V to 96V) | Dual Channel Series (12V to 51V) | High Voltage Series (102V to 512V) |
|---|------------------------------|------------------------------|----------------------------------|------------------------------------|
| OptoLoop® Cell Monitoring | ✓ | ✓ | ✓ | ✓ |
| MiniBMS® Cell Balancing | ✓ | ✓ | ✓ | ✓ |
| NeverDie Reserve (Reset/Power Switch) | ✓ | ✓ | ✓ | ✓ |
| Low-Voltage Cutoff Protection (Over-Discharge) | ✓ | ✓ | ✓ | ✓ |
| High-Voltage Cutoff Protection (Over-Charge) | ✓ | ✓ | ✓ | ✓ |
| Short Circuit Protection | ✓ | ✓ | ✓ | ✓ |
| Current Direction Based Temperature Intervention Sensor | ✓ | ✓ | ✓ | ✓ |
| UL Approved Fully Redundant Protective Safety Circuits | ✓ | ✓ | ✓ | ✓ |
| Military Grade Latching Contactor with Aux Contact Monitoring | ✓ | ✓ | ✓ | ✓ |
| Coulomb Based State-of-Charge Meter | ✓ | ✓ | ✓ | ✓ |
| Programmable NeverDie Reserve & AGSR | | ✓ | ✓ | ✓ |
| State of Health Monitoring (Status & Fault Codes) | ✓ | ✓ | ✓ | ✓ |
| BMS Data Telemetry – CANBus | ✓ | ✓ | ✓ | ✓ |
| BMS Data Telemetry – Bluetooth or Serial Port | Bluetooth Only | Order Option | Order Option | Order Option |
| BMS Data Telemetry – Ethernet TCP/IP | | Optional | Optional | Optional |
| Dual Channel (Independent Charge/Discharge Channels) | | | ✓ | |
| Redundant Coil-Driven Contactor | | Optional | | |
| Internal Pre-Charge Circuit (Programmable) | | Optional for 48V to 96V | | ✓ |
| | | | | |
| Ampseal I/O Features | Standard (8-Pin) | Advanced (23-Pin) | Advanced (23-Pin)2 | Advanced (23-Pin)3 |
| Alternator Field Control Circuit (FCC) | ✓ | ✓ | ✓ | ✓ |
| CANBus (Supports RV-C BMS Data & NCC Charger Series) | ✓ | ✓ | ✓ | ✓ |
| Remote Power Switch | ✓ | ✓ | ✓ | ✓ |
| Serial UART BMS Data Telemetry (Alternate: Serial RS232) | | ✓ | ✓ | ✓ |
| Automatic Generator Start/Restart (AGSR) | | ✓ | ✓ | ✓ |
| External Pre-Charge Circuit Control (Alternate: Heater Power) | | ✓ | ✓ | ✓ |
| BMS Auxiliary Power Input (AC Sense) | | ✓ | ✓ | ✓ |
| High Voltage Charger Interlock | | ✓ | ✓ | ✓ |
| Tri-Color LED Pod (Alternate: LED for Remote Reset Switch) | | ✓ | ✓ | ✓ |
| Alarm Circuit | | ✓ | ✓ | ✓ |
| Battery Percent (0-5V Signal) | | ✓ | ✓ | ✓ |
| Emergency Stop Input (E-Stop Circuit) | | ✓ | ✓ | ✓ |

3. EXTERNAL NEVERDIE® STANDARD BMS – PLUG & PLAY



| PARTS LIST | | |
|------------|-----|--|
| ITEM | QTY | DESCRIPTION |
| 1 | 1 | Negative Power Terminal (5/16-18 Thread, Plated Copper) |
| 2 | 1 | OptoLoop® Communication Cable |
| 3 | 1 | Module Power Connector (Anderson Euro DIN Male, 4/0 Lug) |
| 4 | 1 | 4/0AWG Black X-FLEX Wire UL1232, A2140T-07 |
| 5 | 1 | 4/0AWG Red X-FLEX Wire UL1232, A2140T-01 |
| 6 | 1 | BMS I/O Connector (8 Pin AMPSEAL) |
| 7 | 1 | Temperature Sensor Connector (M8 3-pin, Female) |

| *UL RATINGS | AVAILABLE VOLTAGES - 400A RATED |
|-------------|---------------------------------|
| UL508 | 12.8V* |
| UL991 | 25.6V* |
| UL1973 | 48.0V* |
| UL1998 | 51.2V* |

| | | | | | |
|--|---|--|--------------------|----------------------------------|--|
| <small>PROPRIETARY AND CONFIDENTIAL:</small> THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF LITHIONICS BATTERY. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF LITHIONICS BATTERY IS PROHIBITED. | <small>UNLESS OTHERWISE SPECIFIED:</small> DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL $\pm 1/32$ ANGULAR $\pm .25^\circ$ BEND $\pm .020$ TWO PLACE DECIMAL $\pm .020$ THREE PLACE DECIMAL $\pm .005$ | DRAWN: James Bowling 7/5/2018 CHECKED: T. Clock 8/9/2018 QA: C. Hakimian 8/9/2018 MFG: A. Silberhorn 8/9/2018 APPROVED: S. Tartaglia 8/9/2018 DWG NO. | LITHIONICS BATTERY | | |
| | | PART NO. AP017 SERIES | | V8 STANDARD BMS PLUG-AND-PLAY | |
| | | | | REV 0 | |
| | | | | SHEET 1 OF 4 | |
| | | | | | |

PARTS LIST

| ITEM | QTY | DESCRIPTION |
|------|-----|--|
| 1 | 1 | Positive Power Terminal (5/16-18 Thread, Plated Copper) |
| 2 | 1 | Plug-n-Play Standard Enclosure with Lithionics Graphic Lid Label |
| 3 | 1 | On/Off/Reset Button, Momentary Lighted |



POSITIVE LOAD/CHARGE

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UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL $\pm .015$
ANGULAR $\pm .25^\circ$ BEND $\pm .020$
TWO PLACE DECIMAL $\pm .020$
THREE PLACE DECIMAL $\pm .005$

| | | |
|----------|---------------|----------|
| DRAWN | James Bowling | 7/5/2018 |
| CHECKED | T. Clock | 8/9/2018 |
| QA | C. Hakimian | 8/9/2018 |
| MFG | A. Silberhorn | 8/9/2018 |
| APPROVED | S. Tartaglia | 8/9/2018 |
| DWG NO. | | |

LITHIONICS BATTERY

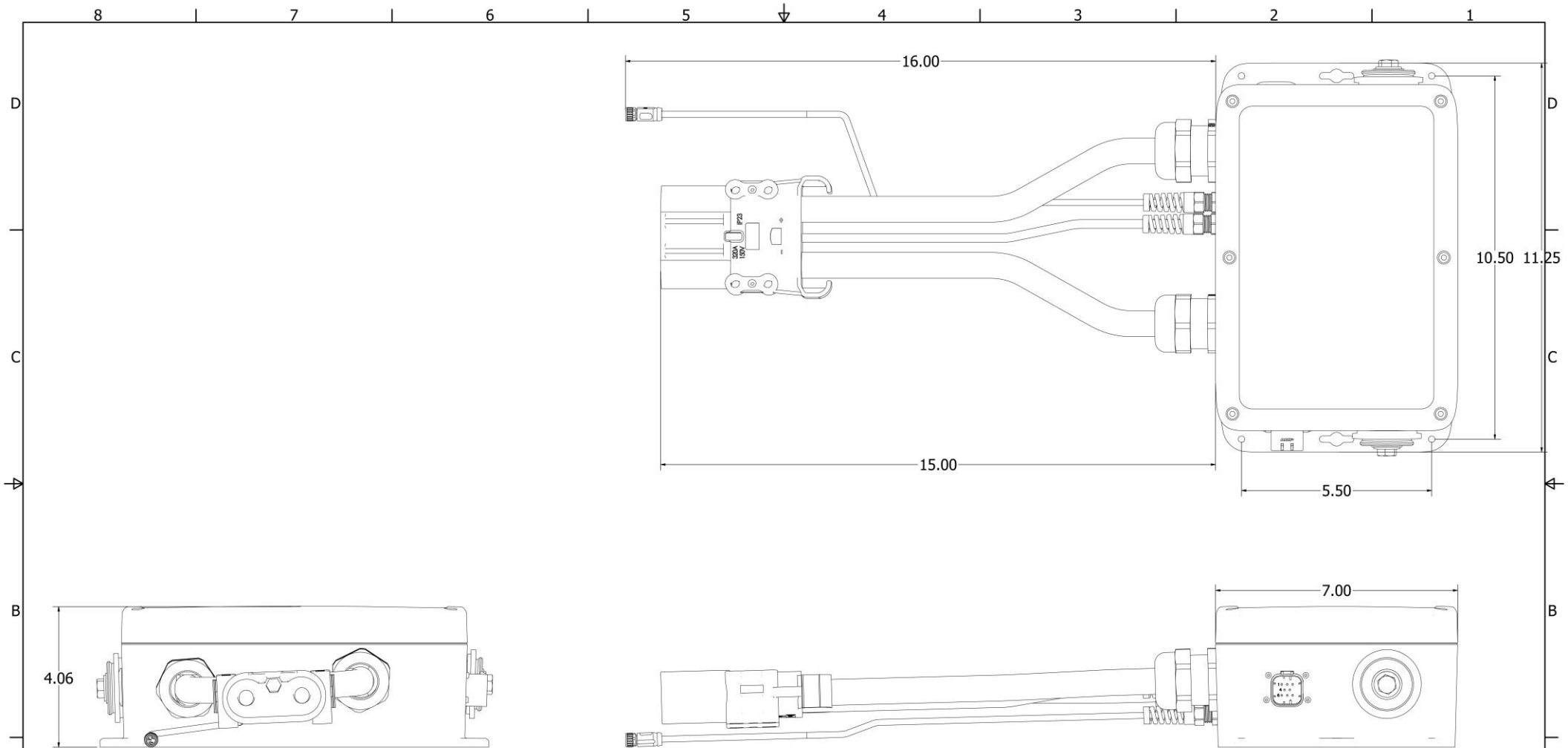
PART NO.

AP017 SERIES

V8 STANDARD BMS
PLUG-AND-PLAY

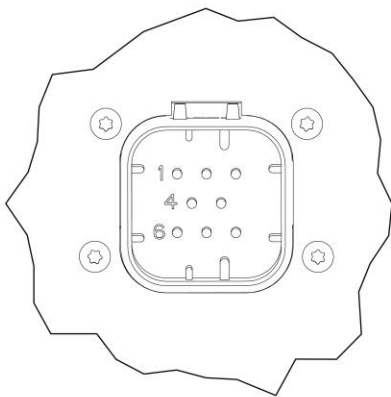
SHEET 2 OF 4

REV
0

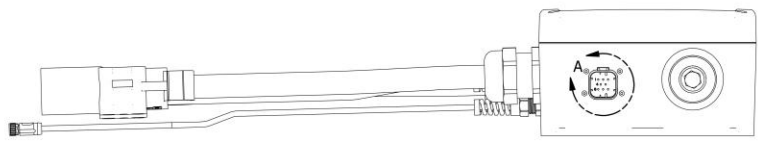


| | | | | |
|--|---|--------------------------------------|---|----------|
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| | | CHECKED T. Clock 8/9/2018 | | |
| | | QA C. Hakimian 8/9/2018 | V8 STANDARD BMS PLUG-AND-PLAY | |
| | | MFG A. Silberhorn 8/9/2018 | | |
| | | APPROVED S. Tartaglia 8/9/2018 | | |
| | | DWG NO. | | |
| | | SHEET 3 OF 4 | | REV 0 |

| BMS I/O Connector Functions | |
|-----------------------------|--|
| # | FUNCTION |
| 1 | On/Off/Reset Button |
| 2 | Contact State LED Indicator |
| 3 | CANbus |
| 4 | Alternator Field Control Circuit (FCC) |



DETAIL A
SCALE 3 : 1



| BMS I/O Connector Function's Pinouts | | |
|--------------------------------------|-----------------|---|
| PIN | FUNCTION | PIN DEFINITION |
| 1 | Reset Button | Reset Button wire 1 |
| 2 | Remote LED + | Contact State LED Signal |
| 3 | Can Low | Isolated CANbus Low signal |
| 4 | Remote LED Neg. | LED return, tied to battery negative |
| 5 | Can High | Isolated CANbus High signal |
| 6 | Reset Button | Reset Button wire 2 |
| 7 | FCC 1 | Alternator Field Control Circuit wire 1 |
| 8 | FCC 2 | Alternator Field Control Circuit wire 2 |

| | | | | | |
|--|--|---|---------------------------|--|----------|
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| | | PART NO. | | V8 STANDARD BMS PLUG-AND-PLAY | |
| | | AP017 SERIES | | | |
| | | SHEET 4 OF 4 | | | REV 0 |

4. EXTERNAL NEVERDIE® ADVANCED BMS – PLUG & PLAY

PARTS LIST

| ITEM | QTY | DESCRIPTION |
|------|-----|--|
| 1 | 1 | BMS I/O Connector (23 Pin AMPSEAL) |
| 2 | 1 | LCD Pod Connector (M12 8-pin, Female) |
| 3 | 1 | Module Power Connector (Anderson Euro DIN Male, 4/0 Lug) |
| 4 | 1 | Negative Power Terminal (5/16-18 Thread, Plated Copper) |
| 5 | 1 | 4/0AWG Black X-FLEX Wire (UL1232, A2140T-07) |
| 6 | 1 | 4/0AWG Red X-FLEX Wire (UL1232, A2140T-01) |
| 7 | 1 | OptoLoop® Communication Cable |
| 8 | 1 | Temperature Sensor Connector (M8 3-pin, Female) |



| *UL RATINGS | AVAILABLE VOLTAGES - 400A RATED | |
|-------------|---------------------------------|--|
| UL508 | 12.8V* | |
| UL991 | 25.6V* | |
| UL1973 | 48.0V* | |
| UL1998 | 51.2V* | |
| | 60-96V | |

| REVISION HISTORY | | | | |
|------------------|-----|---------------------------------|-----------|---------------|
| ZONE | REV | DESCRIPTION | DATE | APPROVED |
| | 1 | Voltage update | 10/5/2018 | James Bowling |
| | 2 | Add Bluetooth BLE output Option | 1/2/2019 | James Bowling |

| | | | | |
|--|--|---|--|---|
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|--|--|---|--|---|

| | |
|---------------------------|--|
| LITHIONICS BATTERY | |
| AP037 SERIES | V8 ADVANCED BMS PLUG-AND-PLAY |
| SHEET 1 OF 4 | REV 2 |

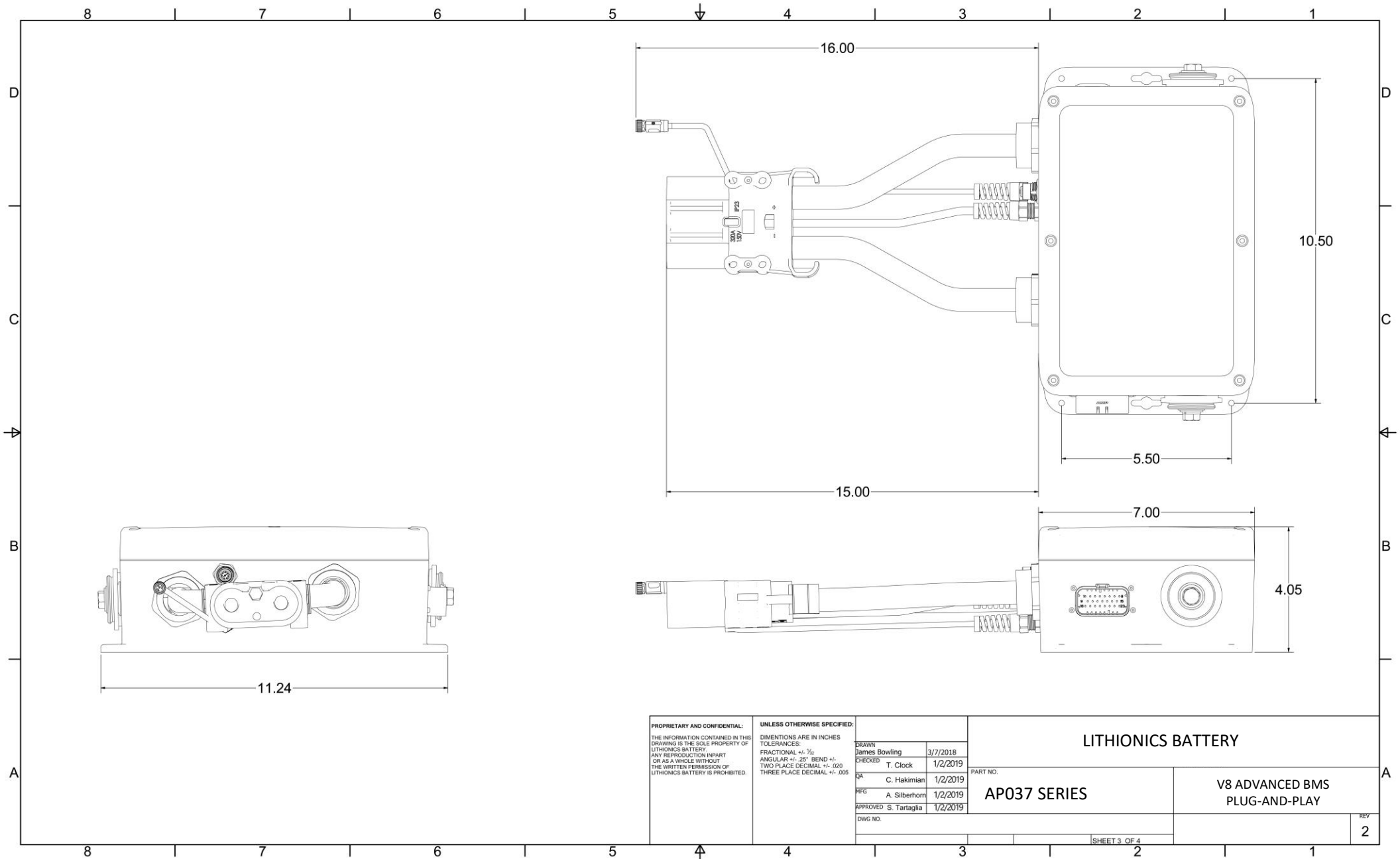
PARTS LIST

| ITEM | QTY | DESCRIPTION |
|------|-----|--|
| 1 | 1 | Plug-n-Play Advanced Enclosure with Lithionics Graphic Lid Label |
| 2 | 1 | Positive Power Terminal (5/16-18 Thread, Plated Copper) |
| 3 | 1 | IDEC CW4LM1E10Q3S Momentary Lighted Switch |



POSITIVE LOAD/CHARGE

| | | | | |
|--|--|---|---|---|
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| | | <p>CHECKED T. Clock 1/2/2019</p> | | |
| <p>QA C. Hakimian 1/2/2019</p> | <p>MFG A. Silberhorn 1/2/2019</p> | <p>APPROVED S. Tartaglia 1/2/2019</p> | <p>PART NO. AP037 SERIES</p> | <p>V8 ADVANCED BMS PLUG-AND-PLAY</p> |
| <p>DWG NO.</p> | | | <p>SHEET 2 OF 4</p> | <p>REV 2</p> |



| | | | | |
|--|---|--------------------------------------|---------------------------------|---|
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| | | CHECKED T. Clock 1/2/2019 | | |
| | | QA C. Hakimian 1/2/2019 | PART NO. AP037 SERIES | V8 ADVANCED BMS PLUG-AND-PLAY |
| | | MFG A. Silberhorn 1/2/2019 | | |
| | | APPROVED S. Tartaglia 1/2/2019 | | |
| | | DWG NO. | | |
| | | SHEET 3 OF 4 | | REV 2 |

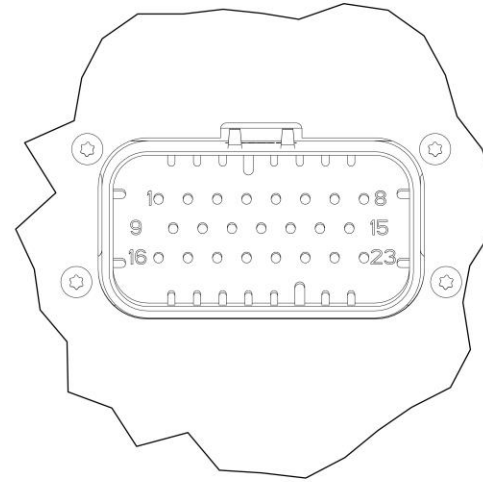
BMS I/O Connector Functions

| # | DEFAULT FUNCTION | ALTERNATE FUNCTION* |
|----|---|--------------------------------------|
| 1 | Alternator Field Control Circuit (FCC) | |
| 2 | Automatic Generator Start/Restart (AGSR) | |
| 3 | Precharge Control | Heater Power Supply |
| 4 | External Power Input | |
| 5 | CANbus | |
| 6 | Serial UART | Serial RS232 or Bluetooth BLE output |
| 7 | Contact State LED Indicator | TRI-Color LED Pod |
| 8 | Battery Low LED Indicator | TRI-Color LED Pod |
| 9 | On/Off/Reset Button | |
| 10 | High Voltage Cutoff/Charger Interlock (HVC) | |
| 11 | Alarm | |
| 12 | Battery Percent 0-5V (Fuel) | |

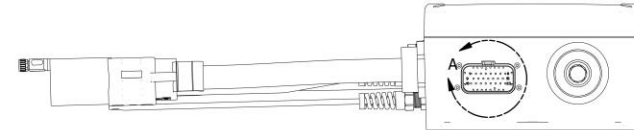
*Alternate functions must be specified at time of ordering.
*Alternate functions replace default functions.

BMS I/O Connector Function's Pinouts

| PIN | PIN DEFINITION | ALTERNATE PIN DEFINITION* |
|-----|---|------------------------------------|
| 1 | FCC wire 1 | |
| 2 | AGSR wire 2 | |
| 3 | AGSR wire 1 | |
| 4 | Precharge/Alarm output +12V supply positive | |
| 5 | Precharge output negative wire | Heater Power Supply Positive input |
| 6 | Alarm output negative wire | |
| 7 | External Power Input positive 12-24V | |
| 8 | Common Ground for all non-isolated circuits | |
| 9 | FCC wire 2 | |
| 10 | Isolated CANBus High Signal | |
| 11 | Isolated Serial UART TX Signal | Isolated Serial RS232 TX signal |
| 12 | Analog 0-5V Fuel Output Signal | |
| 13 | Contact State LED Signal | Tri-Color LED Pod-Green signal |
| 14 | Charger relay wire 2 | |
| 15 | Reset Button return wire | |
| 16 | Isolated CANBus/Serial 5V Power | Isolated CANbus/Serial 5V power |
| 17 | Isolated CANBus low Signal | |
| 18 | Isolated Serial UART RX Signal | Isolated Serial RS232 RX signal |
| 19 | Isolated CANBus/Serial ground | Isolated CANbus/Serial ground |
| 20 | Battery Low LED Signal | Tri-Color LED Pod - Red Signal |
| 21 | Aux1 input Signal | |
| 22 | Charger relay wire 1 | |
| 23 | Reset Button out wire | |



DETAIL A
SCALE 3 : 1



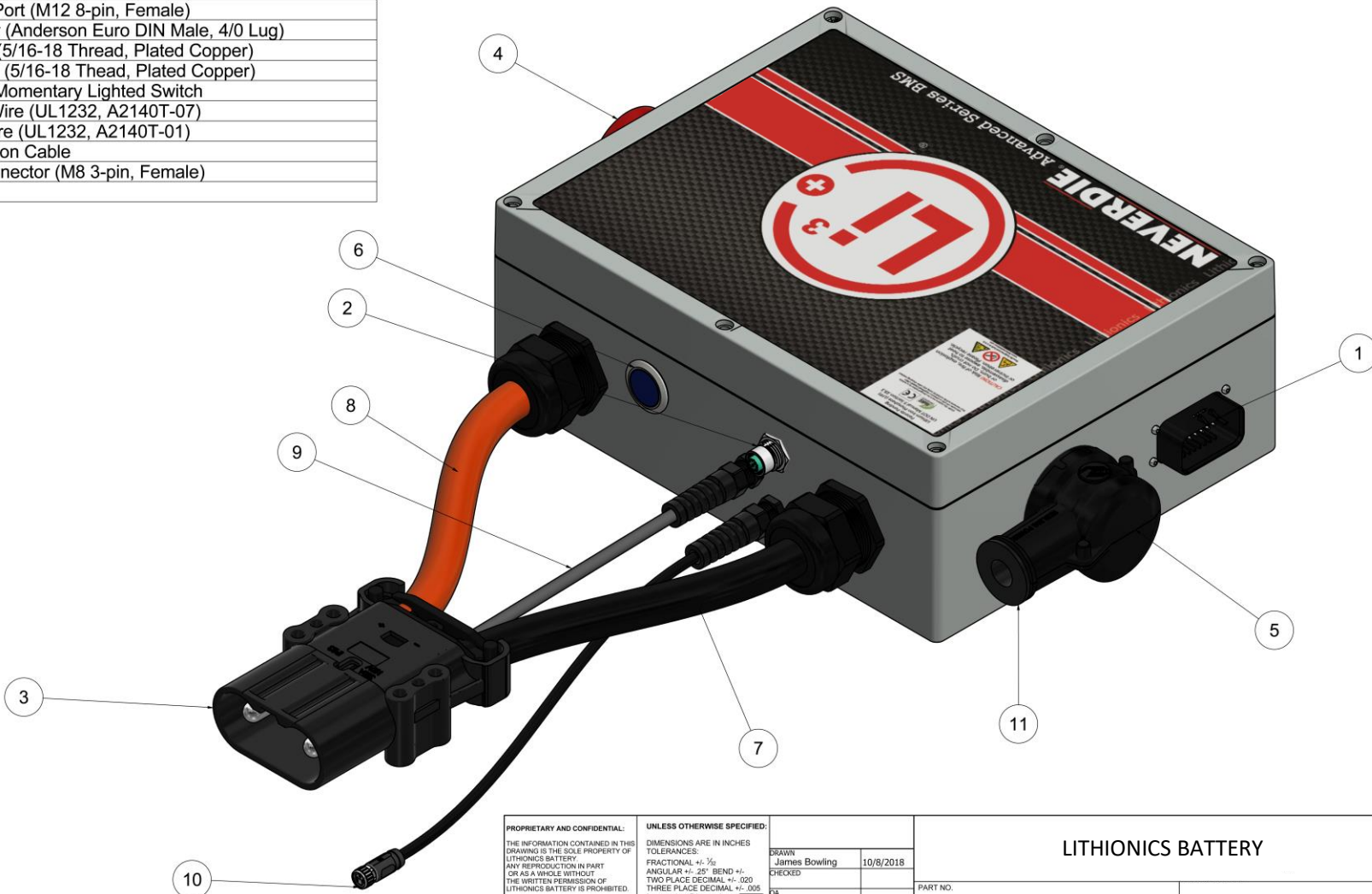
| REVISION HISTORY | | | | |
|------------------|-----|---------------------------------|-----------|---------------|
| ZONE | REV | DESCRIPTION | DATE | APPROVED |
| | 1 | Voltage update | 10/5/2018 | James Bowling |
| | 2 | Add Bluetooth BLE output Option | 1/2/2019 | James Bowling |

| | | | | |
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| | | PART NO. AP037 SERIES | V8 ADVANCED BMS PLUG-AND-PLAY | |

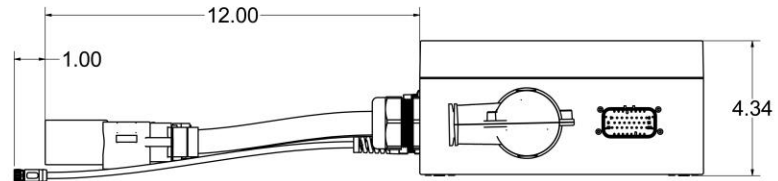
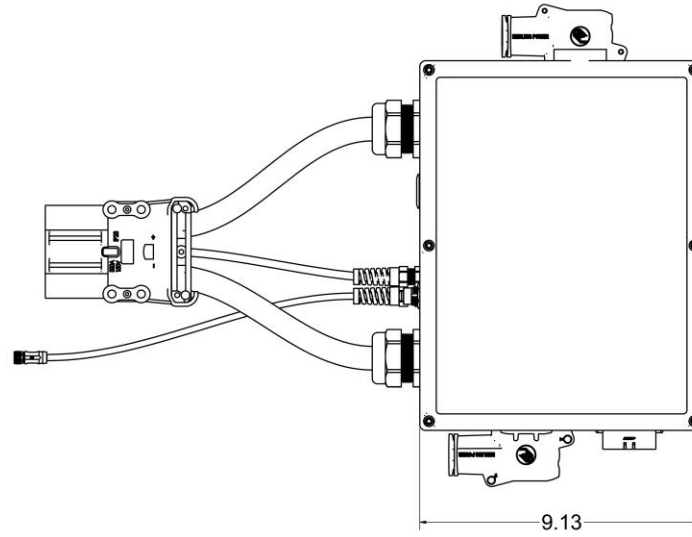
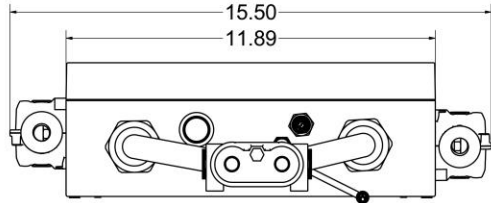
5. EXTERNAL NEVERDIE® ADVANCED BMS – HIGH VOLTAGE

PARTS LIST

| ITEM | QTY | DESCRIPTION |
|------|-----|--|
| 1 | 1 | BMS I/O Connector (23 Pin AMPSEAL) |
| 2 | 1 | State of Charge Display Port (M12 8-pin, Female) |
| 3 | 1 | Module Power Connector (Anderson Euro DIN Male, 4/0 Lug) |
| 4 | 1 | Positive Power Terminal (5/16-18 Thread, Plated Copper) |
| 5 | 1 | Negative Power Terminal (5/16-18 Thread, Plated Copper) |
| 6 | 1 | IDEC CW4LM1E10Q3S Momentary Lighted Switch |
| 7 | 1 | 4/0AWG Black X-FLEX Wire (UL1232, A2140T-07) |
| 8 | 1 | 4/0AWG Red X-FLEX Wire (UL1232, A2140T-01) |
| 9 | 1 | OptoLoop® Communication Cable |
| 10 | 1 | Temperature Sensor Connector (M8 3-pin, Female) |
| 11 | 1 | Rebling Terminal Boot |



| | | | | |
|--|--|---|---|--|
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| | | CHECKED QA RFG APPROVED DWG NO. | | |
| | | | HIGH VOLTAGE BMS 102-512 VOLTS | |
| | | | SHEET 1 OF 3 | |
| | | | REV 1 | |



| | | | | |
|--|--|---|---------------------------------|---|
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| | | QA: _____ MFG: _____ APPROVED: _____ DWG NO. _____ | PART NO. AP036 SERIES | HIGH VOLTAGE BMS 102-512 VOLTS |
| | | | SHEET 2 OF 3 | REV 1 |

BMS I/O Connector Functions

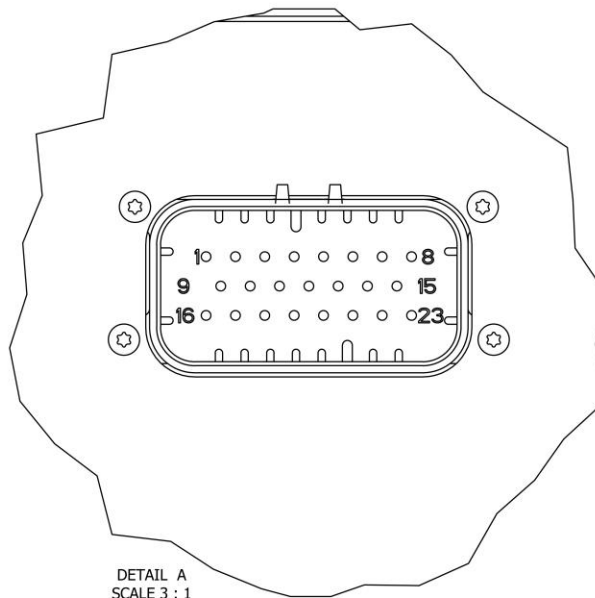
| # | DEFAULT FUNCTION | ALTERNATE FUNCTION* |
|----|---|---------------------|
| 1 | Alternator Field Control Circuit (FCC) | |
| 2 | Automatic Generator Start/Restart (AGSR) | |
| 3 | Precharge Control | Heater Power Supply |
| 4 | External Power Input | |
| 5 | CANbus | |
| 6 | Serial UART | Serial RS232 |
| 7 | Contact State LED Indicator | TRI-Color LED Pod |
| 8 | Battery Low LED Indicator | TRI-Color LED Pod |
| 9 | On/Off/Reset Button | |
| 10 | High Voltage Cutoff/Charger Interlock (HVC) | |
| 11 | Alarm | |
| 12 | Battery Percent 0-5V (Fuel) | |
| 13 | E-Stop Function | |

*Alternate functions must be specified at time of ordering.

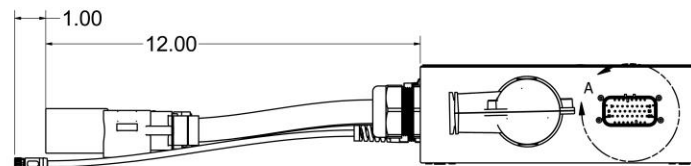
*Alternate functions replace default functions.

BMS I/O Connector Function's Pinouts

| PIN | PIN DEFINITION | ALTERNATE PIN DEFINITION* |
|-----|---|------------------------------------|
| 1 | FCC wire 1 | |
| 2 | AGSR wire 2 | |
| 3 | AGSR wire 1 | |
| 4 | Precharge/Alarm output +12V supply positive | |
| 5 | Precharge output negative wire | Heater Power Supply Positive input |
| 6 | Alarm output negative wire | |
| 7 | External Power Input positive 12-24V | |
| 8 | Common Ground for all non-isolated circuits | |
| 9 | FCC wire 2 | |
| 10 | Isolated CANBus High Signal | |
| 11 | Isolated Serial UART TX Signal | Isolated Serial RS232 TX signal |
| 12 | Analog 0-5V Fuel Output Signal | |
| 13 | Contact State LED Signal | Tri-Color LED Pod-Green signal |
| 14 | Charger relay wire 2 | |
| 15 | Reset Button return wire | |
| 16 | Isolated CANBus/Serial 5V Power | Isolated CANbus/Serial 5V power |
| 17 | Isolated CANBus low Signal | |
| 18 | Isolated Serial UART RX Signal | Isolated Serial RS232 RX signal |
| 19 | Isolated CANBus/Serial ground | Isolated CANbus/Serial ground |
| 20 | Battery Low LED Signal | Tri-Color LED Pod - Red Signal |
| 21 | E-Stop, Switched N.C. | |
| 22 | Charger relay wire 1 | |
| 23 | Reset Button out wire | |



DETAIL A
SCALE 3 : 1



| | | | | | |
|--|--|--|---|--|-----------------------|
| <p>PROPRIETARY AND CONFIDENTIAL: THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF LITHIONICS BATTERY. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF LITHIONICS BATTERY IS PROHIBITED.</p> | <p>UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL: $\pm 1/32$ ANGULAR: $\pm .25^\circ$ BEND $\pm .1$ TWO PLACE DECIMAL $\pm .020$ THREE PLACE DECIMAL $\pm .005$ Inspection Dimension: </p> | DRAWN: James Bowling CHECKED: 10/8/2018 | LITHIONICS BATTERY AP036 SERIES HIGH VOLTAGE BMS 102-512 VOLTS | | PART NO. REV 1 |
| | | PRT NO. DWG NO. | | | |

6. INTERNAL NEVERDIE® COMPACT SERIES BMS

Compact Series using our Economy-Version 100 Amp Rated BMS (CS100) & 200 Amp Rated BMS (CS200)



Internal NeverDie® Compact Series Features

- miniBMS® Cell/Module Sensors and Microprocessors with Automatic Cell Balancing
- 100A or 200A Continuous Discharge Current Rating
- Over-Charge, Over-Discharge and Short-Circuit Protection (LVC, HVC, SCC)
- Pushbutton Storage Operation
- NeverDie® Power Reserve (Spare Fuel) for Hotel Loads and Worry-Free Power for Engine Cranking
- Optional Bluetooth®: Monitor Battery Voltage, State-of-Charge, Temperature, Current & Status Code from your mobile device

Optional Bluetooth® Features

- Live Telemetry Data Feed (voltage, current, temperature)
- Accurate State of Charge Reporting
- State of Health Monitoring (Status & Fault Codes)
- Free App Available for Download on Google Play & Apple App Store



▶ State of Charge Monitoring

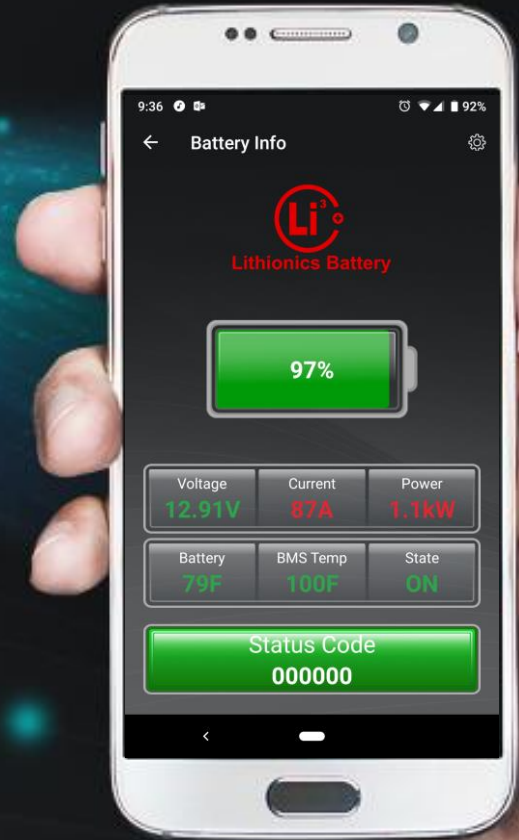


▶ Status & Fault Code Reader

with **NEVERDIE** Technology



7. LITHIONICS BATTERY® NOW WITH BLUETOOTH® TELEMETRY



Lithionics Battery® Monitor

