



PowerBank User & Installation Guide

Revision A



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WARNING

Your attention is drawn to **“Caution!”** and **“Warning!”** statements throughout this manual.

“Caution!” refers to practices that may cause damage to the PowerBank or your electrical system.

“Warning!” identifies practices that may cause injury or death.

PowerBank is designed for installation by qualified and competent electrical engineers. Keep away from Children.

Qualified and competent engineers will be familiar with safe working practices, local health & safety legislation and the proper and safe use of tools and equipment. Therefore, not all obvious practices that may lead to system damage, injury or death are detailed within this manual. If you are in any way unsure about any aspect of the installation or use of PowerBank, contact your Dealer or Merlin Equipment for advice.

Precautions

Caution & Warning!

- This product is designed for use in 12 & 24 Volt DC systems only. Use in other than its designed application may result in fire, electric shock or other injury.
- USE ONLY in vehicles with a NEGATIVE GROUND. Failure to do so may result in fire, electric shock, damage or other injury.
- External fuses MUST be installed in each positive feed to the unit. Each fuse must be located as close to the battery terminal as possible (within 30cm).
- FUSES: Use the correct ampere rating when replacing fuses. Failure to do so may result in fire, injury, electric shock or damage.
- DO NOT install or operate the ECU in an explosive atmosphere.
- DO NOT install or expose the ECU to excessive temperatures or humidity.
- Install the ECU in a clean, dry environment. DO NOT install or expose the unit to wet or damp areas.
- If in any doubt consult a suitably qualified and competent engineer or the supplier.
- MAINTENANCE. If you have problems or suspect device failures DO NOT attempt to repair the unit yourself. Return it to your Dealer or Merlin for servicing.

Approvals and Conformity

Certificate of Conformity



Declaration of Conformity

Merlin Equipment Limited, Trading as Merlin Power Systems hereby declares that the product marketed as PowerBank is in compliance with the requirements of EU Electromagnetic Compatibility (EMC) Directive 2014/30/EU



PowerBank complies with RoHS (Reduction of Hazardous Substances) Directive 2011/65/EC. At the end of life, PowerBank should be disposed of as normal electrical waste.

Signed:

A handwritten signature in blue ink, appearing to read 'James Hortop'.

James Hortop
Managing Director
Merlin Equipment Ltd

Introduction

Thank you for choosing Merlin PowerBank!

PowerBank is a complete power management system designed for mobile platforms (e.g. boats or vehicles) with multiple battery banks.

PowerBank is a complete power management system designed to facilitate both split charging and flat battery protection on up to four battery banks.

PowerBank is a remote battery switching system. This allows you to mount battery master switches in convenient locations such as dashboards or helm panels without needing to run heavy duty cables throughout the vehicle/boat.

PowerBank is a flat battery protection system (PowerGuard). Using sophisticated battery monitoring techniques, PowerBank detects when batteries start to run low. When the batteries have run below a certain level for a pre-set period of time, the battery will be disconnected. Note: on the primary battery circuit, this can be inhibited from happening when the engine ignition is switched on.

PowerBank is also a highly advanced split charging system (SmartBank) designed to allow the split charging of up to four battery banks.

PowerBank is supplied with 8 configurable inputs and outputs which can be assigned to any function.

PowerBank will also operate on certain hybrid and electric vehicles and those fitted with both standard lead/acid, AGM, Gel and Lithium-Ion Batteries.

CAUTION! Please take the time to read and understand this manual before installation and use.

Contents

Precautions	3
Approvals and Conformity	4
Certificate of Conformity	4
Introduction	5
Contents	6
Identification of System Components	7
Installation.....	9
Positioning of Components	9
First Fix Installation	10
PowerBank Installation	11
Wiring Schematics.....	12
Typical System Layout	12
Control and Sense Cabling:	14
Control Switch Connections:	15
Data Cabling Connections:	15
Notes	16
Programming.....	17
PowerBank Operation.....	17
After Installation	19
Product Specifications.....	19
Product Accessories	20
Warranty	21

Identification of System Components

PowerBank comprises a number of components. PowerBank can be configured for up to 4 battery bank installations, at 12 or 24 Volt DC. A number of additional components (e.g. Contactors, Switches) may also be used in the system.

PowerBank Control Unit (ECU):

Contains main CPU, battery monitoring circuitry, diagnostic capabilities and 'MerlinNet' multiplex network connections.



PowerBank ECU

Contactors:

External contactors are used for both battery isolation (PowerGuard) and split charge between battery banks (SmartBank).



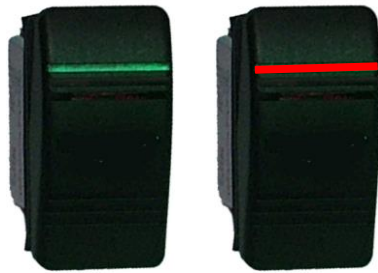
Contactor

Standard contactors are rated at 200A continuous for both 12 & 24V systems. Larger variants are available with appropriate driver relays.

Control Switches:

Illuminated rocker switches can be provided for the switched inputs into the PowerBank ECU.

For example: These can be used to control the isolation contactors and to provide emergency connection of the split charge contactor(s).



Attention: The Preview is based on a sample product, this can differ from the actual configuration supplied.

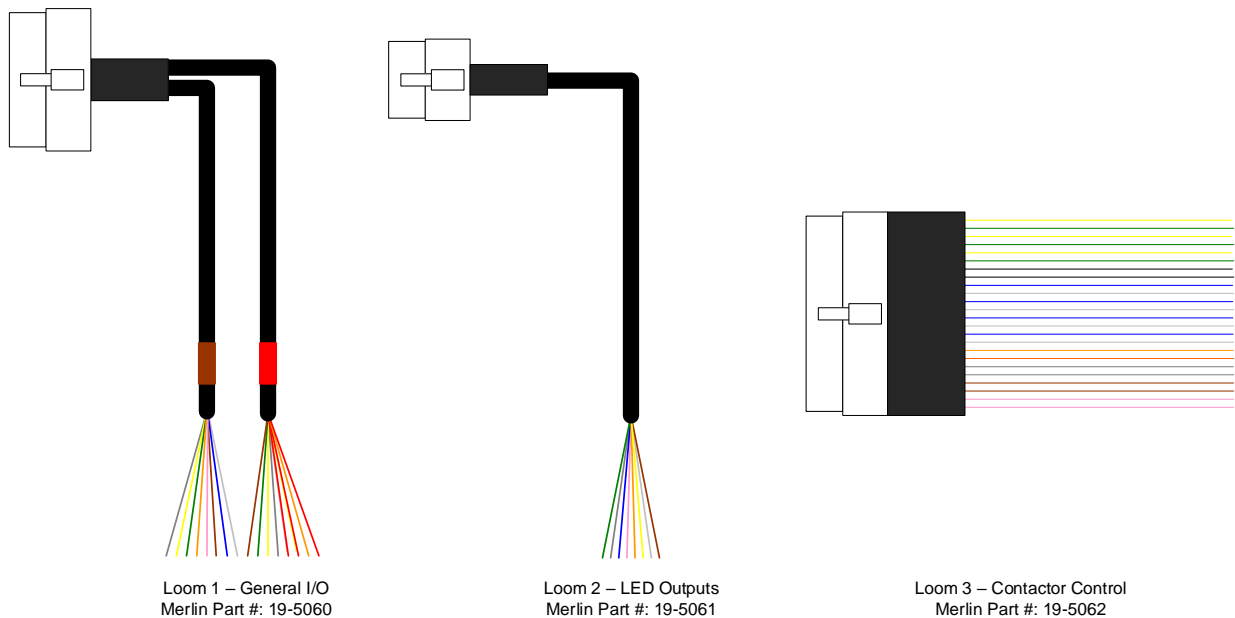
Control Switches

PowerBank control status can be communicated to the user via the LEDs contained within the switch. Alternatively, external LEDs can be used.

Up to 8 Switches can be installed per PowerBank ECU depending on configuration requirements.

System Cabling:

PowerBank will be supplied with three mating wiring looms (2 metre length) for connecting to external components.

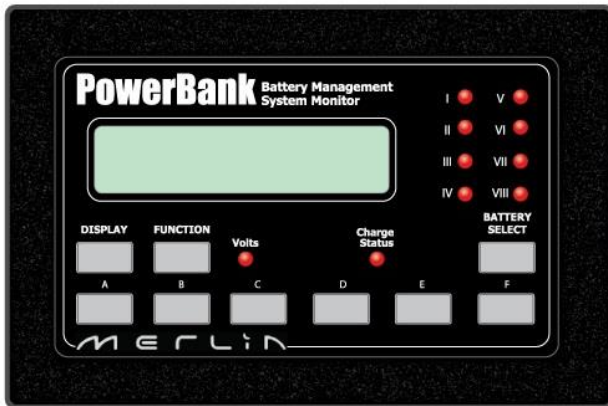


Caution! Please ensure familiarity with the wiring of cable connectors, switches etc. It is highly recommended only personnel that have undertaken correct training attempt these tasks.

Warning! Incorrectly connected cables may damage PowerBank or vehicle electrics and will invalidate the Warranty.

Control Panel:

A dedicated PowerBank Control Panel can be provided. This contains 6 configurable control buttons, LCD or LED Display and LED outputs



PowerBank Control Panel

Installation

Warning! Isolate all power supply sources before starting installation.

Positioning of Components

PowerBank main components (ECU & Contactors) do not need to be easily accessible from a user's perspective. Only the control switches or control panel need to be readily accessible to the user.

The following should be observed as parts of the PowerBank are designed for wet/dirty environments, but others are not.

PowerBank ECU:

The ECU is designed for location in a dry / clean environment. The ECU is **NOT** suitable for installation or operation in atmospheres where there is a risk of ignition or explosion. The ECU is **NOT** suitable for installation outside, under bonnet or in wet / damp cupboards.

Caution! Damage will occur if the PowerBank ECU is allowed to get wet.

Warning! Do not install the PowerBank ECU in a petrol/gas engine room environment.

Contactors:

The external isolation and split charge contactors are designed to be installed under hood, in wet engine room environments and battery compartments. The contactor is IP66 rated and will withstand hose downs. The contactor should be located as close as possible to the engine battery.

The contactors should be located as close as possible to the associated battery.

Control Switches:

The switches are designed for location in a dry environment. They should be mounted on the dashboard or within easy view/access for the vehicle operator.

Control Panel:

The control panel is designed for location in a dry environment. It should be mounted on the dashboard or within easy view/access for the vehicle operator.

First Fix Installation

Pre-Installation Preparation:

- Disconnect the main positive and negative from each battery bank to ensure no power is on the vehicle (up to 4 battery banks)
- Remove items (e.g. seats, access panels etc) to ensure easy installation
- Survey the sites where you wish to locate components.

Mount Components:

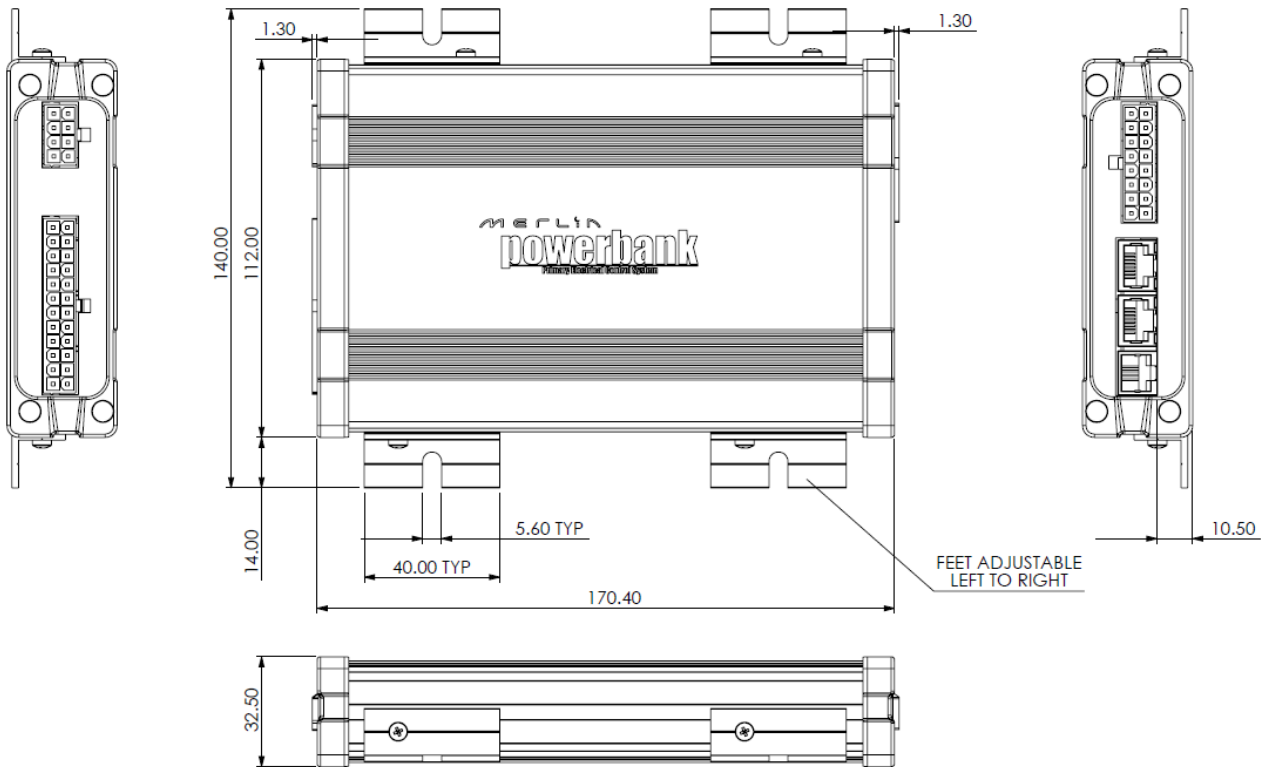
Mount the components in the agreed locations with the specifying Engineer. We recommend installing directly to bulkheads using stainless steel bolts. All nuts should be either of the Nyloc type or protected with a shake proof washer. Appropriately sized washers should be used to mount components to distribute component weight and loadings.

Plan and lay in cables:

Lay in the cables / wiring to the various components as per the system diagram supplied by the specifying / design Engineer. Ensure all cables are routed away from vehicle control devices and are suitably fixed and secured. Cables and wiring should not be installed above vehicle access points.

PowerBank Installation

The PowerBank ECU is supplied with 4 Mounting Flanges. Each flange has a mounting slot to enable fitment of M5 bolts. Ensure that the unit is securely mounted to the vehicle using suitable bolts, washers and nuts. Unit dimensions are as detailed below:



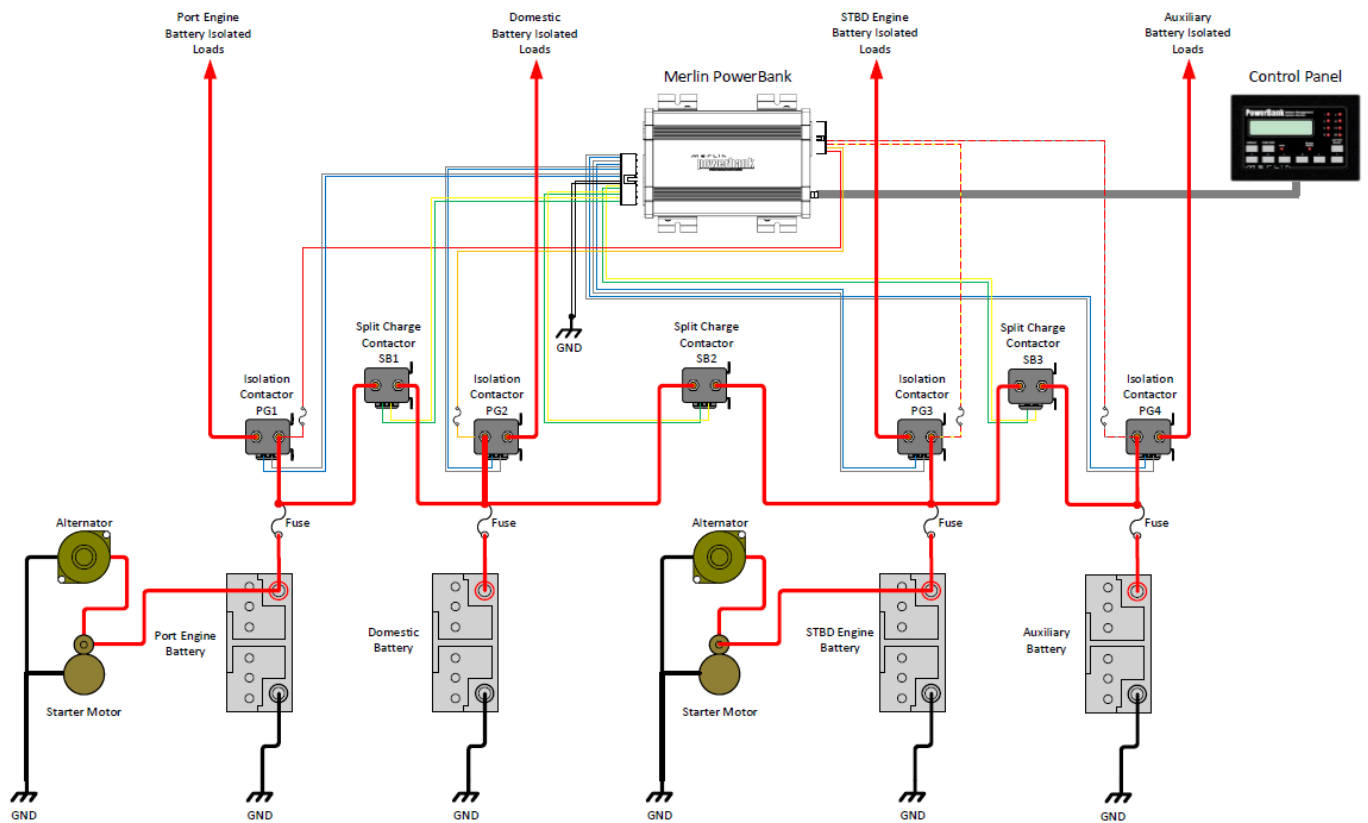
The PowerBank wiring connections are as detailed within the Interface Control Document.

Wiring Schematics

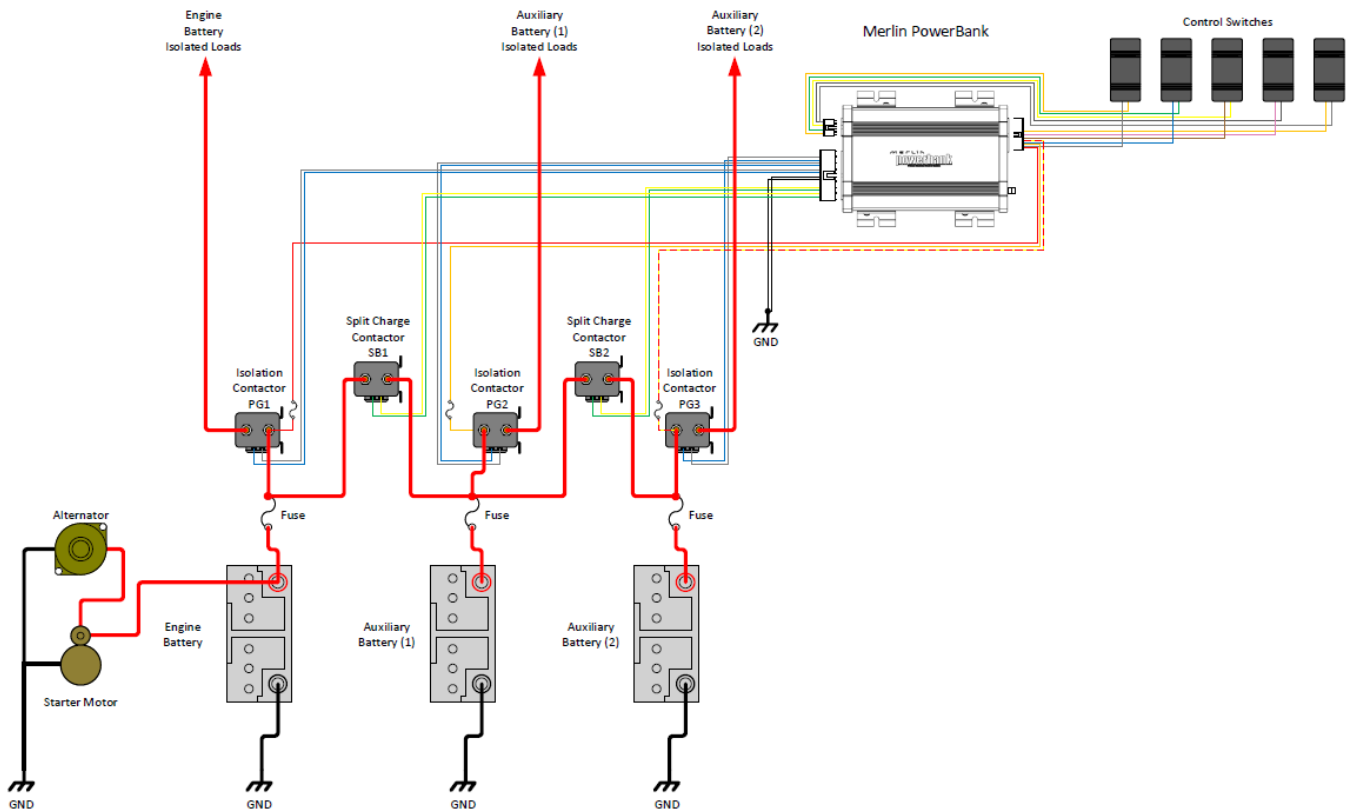
Typical System Layout

This section is for information only. Please check with the specifying / design engineer. However, these diagrams show typical layouts which will give you an understanding of how the systems install and the component parts required.

The following diagram shows a typical 4 Battery Bank example installed on a twin-engine boat using a PowerBank control panel:

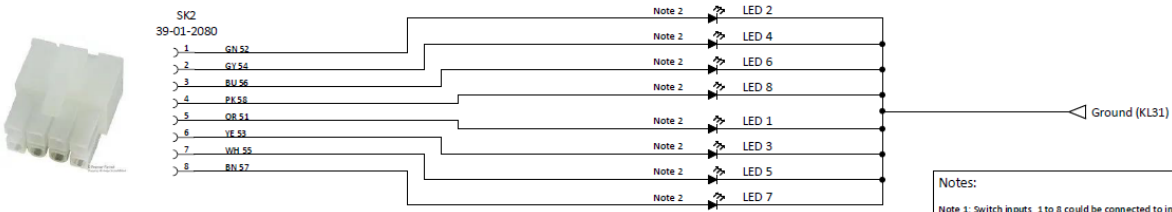
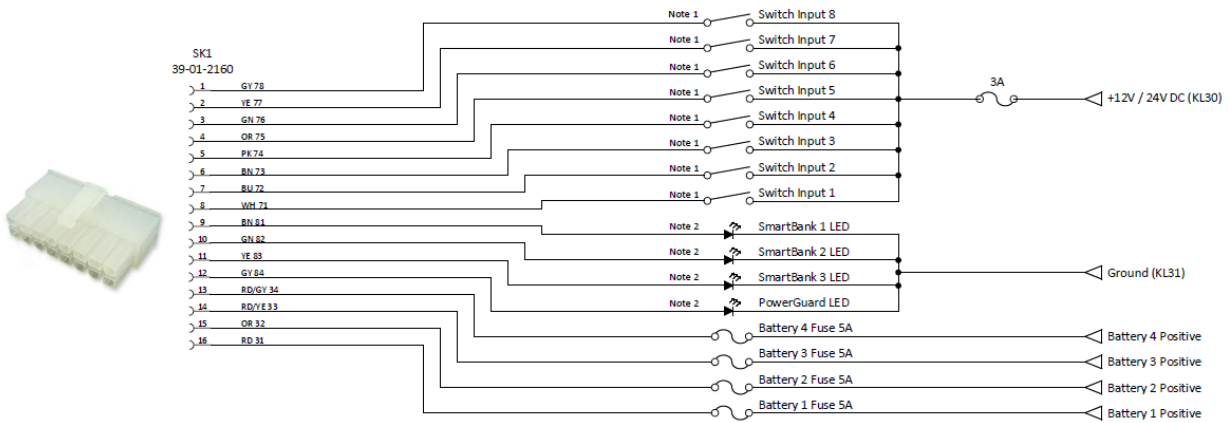


The following diagram shows a typical 3 Battery Bank example installed on a vehicle using control switches with internal LEDs for status indication:



- **Caution!** Ensure always that the correct polarity is observed on the PowerBank wiring. Serious damage to the PowerBank ECU will occur if wires are shorted or connected the wrong way around.
- **Caution & Warning!** We recommend that appropriately rated fuses or circuit breakers are inserted between batteries and PowerBank Contactors to protect against short circuits. These should be rated based upon maximum vehicle alternator output (Amps) or a maximum current rating of 200A.
- **Caution & Warning!** Failure to connect an ignition inhibit wire to the engine battery may cause damage to the engine alternator and all electronics on the vehicle. Furthermore, critical loads like electric power steering may cease to operate.
- Fuses should be located as close as possible to the battery positive terminal of each battery bank
- High current cables must have a current rating higher than that of the associated fuse.

Control and Sense Cabling:



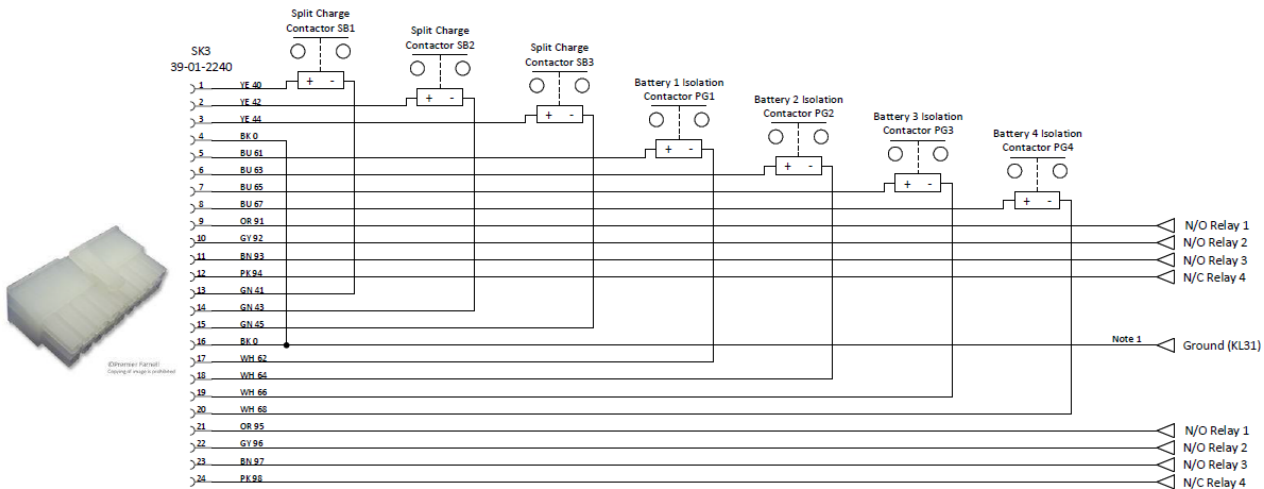
Notes:

Note 1: Switch inputs 1 to 8 could be connected to inhibit functions (such as vehicle ignition or starter feed) depending on PowerBank programming. Functional switches should be momentary (On) Off.

Note 2: LED Supply 5 Volt DC source with a 1K series limiting resistor

Note 3: Wire / cable wiring must comply with IPC/WHMA-A-620A

Note 4: All switch inputs / LED outputs are configurable



Notes:

Note 1: Both ground wires (Terminals 4 & 16) MUST be connected

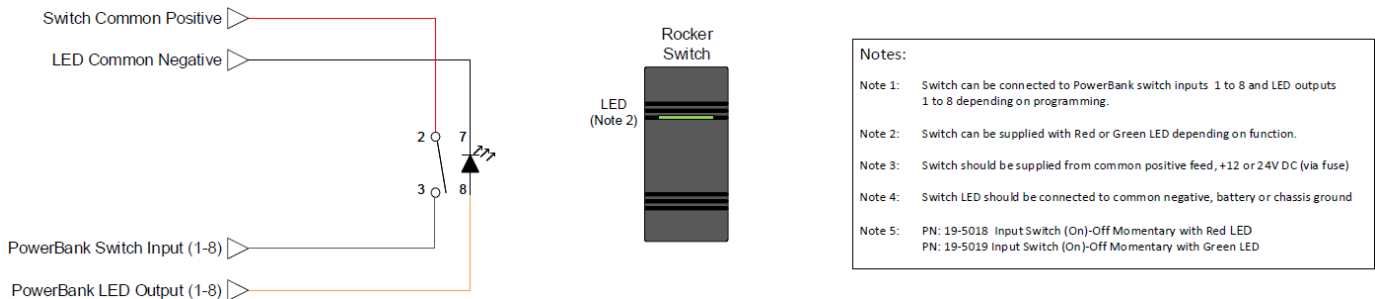
Note 2: Wire / cable wiring must comply with IPC/WHMA-A-620A

- **Caution & Warning! PowerBank battery sense and switch supply wiring requires protection with a small inline fuse, generally as detailed on the above drawing**

Control Switch Connections:

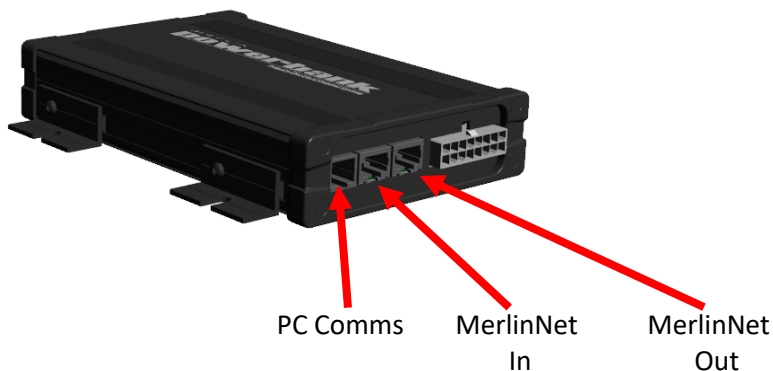
PowerBank can be configured for control either by the PowerBank Control Panel or via Merlin supplied momentary rocker switches. These can be supplied with either red or green LEDs depending on function.

The switch connections are as follows:



Data Cabling Connections:

The PowerBank ECU is supplied with the following data cable connections:

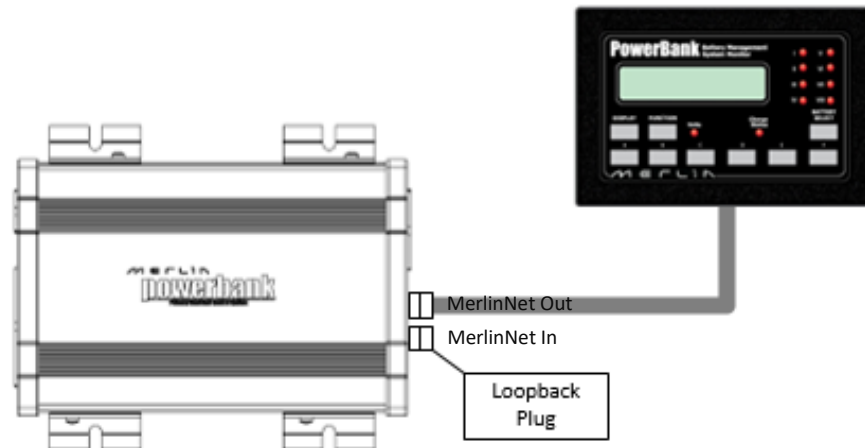


The PC comms connection is used to connect to the PowerBank ECU for configuration and diagnostic purposes.

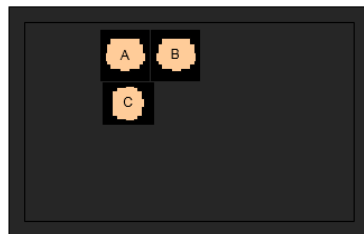
PowerBank can be connected to other devices using 'MerlinNet'. This is a proprietary low power multiplex network developed by Merlin Equipment.

Where the PowerBank is has been ordered or supplied with a control panel, connection to the PowerBank will be via the 'MerlinNet Out' connection. Connection is via an 8-way flat data cable and mating RJ45 connectors.

A 'Loopback' plug will need to be fitted to the 'MerlinNet In' connection, generally as per the diagram below:



Connections to the rear of the control panel are as follows:



MerlinNet Socket A: Loopback Plug
MerlinNet Socket B: Merlin PowerBank
Socket C: Not Used

Again a 'Loopback' plug will need to be fitted in socket A to ensure correct data comms operation.

It should be noted that other devices can also be connected onto the MerlinNet multiplex network. These include the DataCell Battery Monitor and Expansion Modules. These devices can be connected to provide accurate battery monitoring and remote switching accordingly.

Notes

Final Checks:

Once cabling is complete. We highly recommend following the checklist below before reconnecting the main battery cables

- **CAUTION! Incorrect and reverse polarity may damage the system.**
- **WARNING! Reverse polarity connections to batteries may cause them to explode. Check all cabling before powering up the system.**

Pre-Powerup Checks:

- Check security of each component
- Check main battery cables against system diagrams
- Check main battery cables are correctly sized based upon rated loads
- Check tightness of all connections
- Ensure all live terminals are covered with rubber insulating boots
- Check all negative connections are secure

Digital Signal Processing:

PowerBank senses and processes voltages using a Digital Signal Processing (DSP) which filters out transient spikes and electrical noise preventing contactors connecting and disconnecting erroneously.

The DSP operation means that the PowerBank will take time to respond to sudden changes in voltage, so it may appear that there is a time-lag between the voltage reaching a certain level and the PowerBank reacting to it. This is normal operation.

Battery Connection:

Connect the batteries.

You will hear various clicks and clunks as the PowerBank determines the position of contactors.

Depending on unit status the control panel or switch LEDs will light.

Programming

In most cases, PowerBank will be pre-configured for your installation. You should only need to access the programming software to adjust voltage thresholds and timers. It is not recommended that you change high level configuration functions without consultation with Merlin Equipment.

Due to the complexity of the PowerBank configuration, the programming instructions are available within a separate programming guide.

Please ensure all programming requirements and parameters and any customer training needs are addressed by your specifying engineer before taking delivery of the unit.

PowerBank Operation

PowerBank has been developed as a total battery management product for up to 4 battery banks.

During normal operation the PowerBank will monitor the voltages of the batteries. Depending on the voltages it will carry out the following tasks:

1. Flat battery isolation (PowerGuard)

Should a battery discharge to below a programmed pre-set voltage threshold, a timer will activate. If the voltage remains below this threshold for the timer period, the relevant battery contactor will isolate.

Re-connection of the battery can be configured within the programming to activate via the Control Panel buttons, control switches or a voltage alarm as battery voltage increases (e.g. via a charger).

2. Split Charge (SmartBank)

Should a battery voltage increase to above a programmed pre-set voltage threshold, a timer will activate. If the voltage remains above this threshold for the timer period a split charge contactor will connect and parallel the battery banks enabling split charging between the pair.

Further split charge contactors may then connect depending on unit configuration and programming.

One the battery pair voltage discharges to below another pre-set voltage threshold, a timer will activate. If the voltage remains below this threshold for the timer period, the contactor will open separating the battery banks.

3. Battery Isolators

PowerBank can be configured within programming to provide user control (via the Control Panel or switches) of the battery isolators. This facility negates the need for additional battery isolation devices within the system.

The LED outputs can be used to provide user feedback as to whether the battery is manually connected or disconnected.

4. Emergency Parallel

PowerBank has the ability to parallel battery banks together to provide an emergency 'jump start' facility in the event of a flat engine start battery.

Again, this can be configured within programming to activate via the Control Panel or switches.

5. Control Inputs / Outputs

PowerBank has 8 configurable switch inputs and 8 configurable LED outputs.

The inputs can be connected to external switches to control PowerBank functions such as battery isolation, emergency split charge etc. They may also be connected to various vehicle signals e.g. Ignition or Starter feeds to control PowerBank inhibit functions. The control inputs can also be activated via the PowerBank Control Panel.

Each switch input can be configured for any function. Each function has a wide variety of modes. Multiplied up, there are thousands of combinations available.

The outputs can be used to provide user interface via LEDs. These LEDs can be switch mounted or stand alone. Again, each LED Output can be configured for any function. Each function has a wide variety of modes. Multiplied up, there are thousands of combinations available.

The PowerBank will normally be supplied pre-configured for your installation. However further information is available on configuration within the PowerBank Programming Guide.

Warning! Please note that changing the configuration settings may result in incorrect operation of your device.

After Installation

If you are unsure about any aspect please consult a suitably qualified engineer, your Dealer or Merlin Equipment Ltd before commissioning the unit.

Product Specifications

PowerBank	
Part Number(s)	19-5005
ECU Maximum Dimensions excluding cabling (W x L x H)	170.4 x 140 x 32.5mm
ECU Weight excluding cabling	0.45 Kg
Voltage Rating	12 or 24V DC
Operational Input Voltage Range	6.5 to 36V DC
Operation Temperature Range (°C)	-25 to + 105°
Maximum Contactor Current	200A Continuous, 350A Peak
Current Consumption	15mA* *At 12V DC with ECU in idle state with no contactors or LEDs powered and no additional items connected to the MerlinNet multiplex.
Maximum number of Battery Banks	4
Voltage Reading Range	0 to 19.3V or 38.6V (Dependant on 12 / 24V Setting)
Voltage Reading Accuracy	+/- 0.1V DC on 12V setting +/- 0.2V DC on 24V setting
LED Output	5V DC Source with 1K series limiting resistor
PC Communications	RJ11 – RS232 Communications

Product Accessories

Merlin Part Number	Description
19-5004	DataCell/PowerBank/PowerBank Combi Programming Kit
19-5010	Flat Battery / Isolator Contactor 12V (200A)
19-5011	Flat Battery / Isolator Contactor 24V (200A)
19-5014	Split Charge Contactor 12V (200A)
19-5015	Split Charge Contactor 24V (200A)
19-5012	Flat Battery / Isolator Contactor 12V (350A)
19-5013	Flat Battery / Isolator Contactor 24V (350A)
19-5016	Split Charge Contactor 12V (350A)
19-5017	Split Charge Contactor 24V (350A)
19-5018	Input Switch (On)-Off Momentary with Red LED
19-5019	Input Switch (On)-Off Momentary with Green LED
19-5030	PowerBank LED Remote Panel
19-5031	PowerBank LCD Remote Panel
19-5032	Expansion Module (EM06)
19-5052	MerlinNet Cable 3.2m
19-5053	MerlinNet Cable 7.5m
19-5054	MerlinNet Cable 10m
19-5057	Merlin Net Loop Back Plug
U3/WIP/PBANK/RELAY-FIX12	PowerBank Relay Driver 12 Volt (350A Latching Contactors)
U3/WIP/PBANK/RELAY-FIX24	PowerBank Relay Driver 24 Volt (350A Latching Contactors)
10-4012	Cable Cap Insulation Boot 2 – 2/0 AWG Red
10-4013	Cable Cap Insulation Boot 2 – 2/0 AWG Black
HWC/FHMG/1	Mega Fuse Holder
HWC/FME/200	200A Mega Fuse
HWC/ATOF/KIT	ATO Single Blade Fuse Holder
HWC/BF3	3 Amp Blade Fuse
HWC/BF5	5 Amp Blade Fuse

Warranty

PowerBank is warranted to be free of defects caused during manufacture for a period of 2 years from purchase. The warranty may be invalidated if the device has been altered, misused, installed incorrectly or operated in adverse conditions described in the “Precautions” section of this document.

What does this warranty cover and how long does it last? This Limited Warranty is provided by Merlin Equipment Limited. (“Merlin”) and covers defects in workmanship and materials in your PowerBank. This warranty period lasts for 24 months from the date of purchase at the point of sale to you, the original end user customer, unless otherwise agreed in writing (the “Warranty Period”). You will be required to demonstrate proof of purchase to make warranty claims.

This Limited Warranty is transferable to subsequent owners but only for the unexpired portion of the Warranty Period. Subsequent owners also require original proof of purchase as described in “What proof of purchase is required?”

What will Merlin do? During the Warranty Period Merlin will, at its option, repair the product (if economically feasible) or replace the defective product free of charge, provided that you notify Merlin of the product defect within the Warranty Period, and provided that Merlin through inspection establishes the existence of such a defect and that it is covered by this Limited Warranty.

Merlin will, at its option, use new and/or reconditioned parts in performing warranty repair and building replacement products. Merlin reserves the right to use parts or products of original or improved design in the repair or replacement. If Merlin repairs or replaces a product, its warranty continues for the remaining portion of the original Warranty.

Period or 90 days from the date of the return shipment to the customer, whichever is greater. All replaced products and all parts removed from repaired products become the property of Merlin.

Merlin covers both parts and labour necessary to repair the product and return shipment to the customer via a Merlin-selected non-expedited surface freight within the contiguous United States and Canada. Alaska, Hawaii and outside of the United States and Canada are excluded. In Europe, this is the EMEA. Contact Merlin Customer Service for details on freight policy for return shipments from excluded areas.

How do you get service? If your product requires troubleshooting or warranty service, contact your merchant. If you are unable to contact your merchant, or the merchant is unable to provide service, contact Merlin directly at: Merlin Equipment Ltd, Clyst Court, Hill Barton Industrial Estate, Exeter, Devon, EX5 1SA, United Kingdom. Tel: +44 (0) 1202 697979.