SIELTEC
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VG-1
Lithium Battery Monitor User Manual

Figure 1.

User Manual

Issue 1.0

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Statement of Appreciation

Thank you for purchasing this Sieltec VG-1. We understand that with this purchase comes a responsibility for Sieltec to ensure the product is fit for purpose and provides many years of trouble free service. If you are not satisfied with this product please contact your distributor and Sieltec support will do all we can to rectify any problem relating to this product.

VG-1 VoltGo Battery Monitor
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1 Introduction

1.1 Typical application

Lithium batteries generally have Battery Management Systems (BMS) to ensure the cells stay within a safe range of operation. In some cases the BMS is internal to the battery and its operation is autonomous without much or any communications to the vessel owner.

In other cases the BMS is external and signals come from the battery to instruct the BMS on how to react. Some batteries have an internal BMS that has reporting provisions to provide very accurate and real time information regarding battery parameters. Communications can be via bluetooth, hard wired or both.

Lithium battery installations in marine environments in Australia and New Zealand are subject to an Australian and New Zealand Standard, AS/NZS3004 to ensure a safe boating environment. This Australian and New Zealand Standard calls for monitoring at the helm to provide an audio and visual alert prior to the BMS disconnecting the battery from the electrical system. This is to ensure that at times when it is vitally important that systems are operating reliably like docking and manoeuvring in tight spaces, the skipper is aware of any potential loss of power. If prior warning is given, suitable operational decisions can be made.

In many cases the implementation of this provision has been challenging. The Sieltec VG-1 provides a simple solution when used with VoltGo lithium batteries to ensure the monitoring provisions of the Australian and New Zealand Standard are met and importantly, power loss caused by a BMS disconnection is preceded by a warning. The VoltGo batteries allow access to internal BMS parameters that can flag the prospect of a disconnection event prior to that event happening so we can satisfy the provisions of AS/NZS3004.

1.2 Solution

The VG-1 provides a simple secure way to monitor and alert the skipper if battery parameters reach the point where disconnection may take place. The hardwired monitoring unit scans the various registers in each battery and provides valuable information from the internal BMS.

One of the registers within the BMS is the “Alert” register. This register provides important information if any of the battery parameters are approaching the point where disconnection may take place. If this register returns a response other than “no alerts” an “Alert” condition is set. This provides an audio and visual alarm on a small remote panel positioned near the helm. It also causes the LCD screen to provide an audio alarm and a visual alarm condition.

When an alert condition is set, a flashing alarm animation on the screen must be pressed to silence the alarm. The alarm can also be silenced by pressing the mute button on the helm mounted remote panel. Once the alarm is muted, the individual batteries can be checked by pressing the appropriate button on the screen. The battery that caused the initial alert condition is highlighted with a small red dot flashing on the battery icon located on the screen of the display.

Once the alert is muted, the mute will not reset until the alert condition has been resolved. At that time the system reverts to normal operation.

Another important register is the “Protection” register. When the internal BMS program initiates a disconnection of the battery terminals from the external environment, the Protection register provides information relating to that event. If any battery in the battery bank enters “Protection Mode” a small yellow dot appears on that battery icon on the LCD display.

A small yellow dot also appears on the battery icon display when communication is lost. If a battery has initially been detected by the system, and then for some reason the battery cannot be “seen” by the monitor, the system alarms and the disconnected battery shows a yellow dot on the battery icon display. Also, text shows on the battery bank screen and on the individual battery screen of the affected batteries.

1.3 System Components

Two main components are provided with this system.

1. A main unit with an LCD TouchScreen to provide battery information and accept the mute command. This touchscreen provides information about the entire battery bank, and individual batteries in the bank. Access to individual batteries is by pressing the individual battery symbol. The LCD screen is housed on the electronics enclosure with the connections for power, the remote helm panel, the batteries and a relay output if required.

Figure 2. Touchscreen Showing Battery Bank page

2. A small alarm panel to be mounted at or near the helm for battery monitoring. This panel has a mute button to silence the alarm and a red LED to advise an “Alert” condition has been set. Two of these screens can accommodate dual helm stations if required.

Figure 3. Remote Alarm Panel

2 Installation

2.1 Mounting the Main unit with touchscreen

The main unit for the system is a microprocessor based controller providing the communications with all other components. It should be mounted in a dry environment in a location that allows access to check initial operation.

It should be supplied with vessel 24 hr house power through a 1 amp fused connection. It has RJ45 connectors for the battery network. It also uses RJ45 connectors for the remote panels.

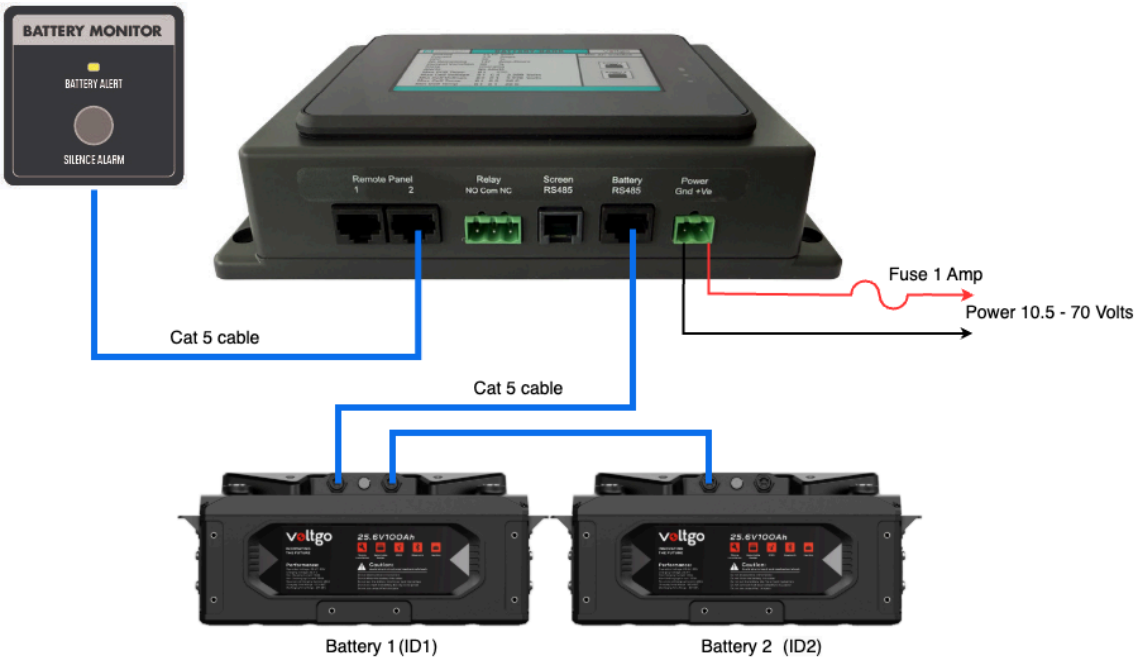

Figure 4. Basic cabling configuration

2.2 Mounting the Remote Panel

The remote alert panel is a 50mm x 50mm panel to be mounted in close proximity to the helm. This small panel allows the skipper to mute the alarm if a battery alert takes place. It is mounted with its connector passing through the underlying panel.

Figure 5. Remote panel mounting adhesive

It is supplied with strong adhesive for fixing to the backing material. This material can be used as a cutout template for cutting the hole if required. Although this adhesive is very strong, if for some reason it is not sufficient the panel can be mounted using small screws in each corner. The remote panel can be connected to the main unit with a standard pin to pin RJ45 network cable. Provision for two remote panels has been made for vessels with two helm stations.

2.3 Alternative mounting of the Touch Screen

The touchscreen is mounted on the electronics enclosure. In rare cases, if the touchscreen needs to be mounted at another location it can be removed from the enclosure and mounted elsewhere. It allows easy access to all relevant battery parameters so if for some reason the mounting of the electronics enclosure and the screen need to be separated they can be.

The remotely mounted touchscreen has power and data supplied by an RJ12 connector on the main unit. This connector is only used for the rare occasion when the Touch Screen is mounted remotely from the main unit and uses a standard pin to pin cable.

Figure 6. Remote touch-screen and external relay connections

2.4 Relay Connection

Access to a relay providing Normally Open (NO) or Normally Closed (NC) dry contacts is available. This relay activates when an alert condition is set and allows a custom alert system to be connected if required. It can also be used to interface to third party systems (like Victron) for more advanced remote monitoring if that is required. In the case of a Victron CerboGX it can be connected directly to one of the digital inputs and the alert condition can be logged using the Victron Remote Monitoring (VRM) system.

2.5 RS485 Cabling

The cable from the main unit to the battery is an RJ45 cable with pins 1 and 2 connected. It can simply be a standard pin to pin network cable. The VG-1 system uses different pins to the VoltGo CANBus interface so both systems can work simultaneously. The Sieltec VG-1 system needs the batteries to be “daisy chained” together. If another system such as the Victron VE.Can is used, the Victron VE.Can can connect to Battery 1, batteries can be daisy chained with network cables and the VG-1 system can connect to the last battery in the battery bank.

No termination is required on this RS485 system.

2.6 Setting Battery ID Numbers

It is important that each battery is given a sequential unique ID number using the VoltGo bluetooth app. The batteries should be numbered sequentially starting at ID1. This numbering must be done by use of the bluetooth app.

Figure 7. VoltGo battery app to change battery ID number.

When the ID number has been selected the battery must be switched off and then switched back on using the press button switch on the battery for that ID number to become active. Each battery must be given a sequential number starting at Battery ID1. When the VG-1 system starts, it looks for the batteries in sequence to determine how many are in the battery bank. The assignment of the correct battery ID to each battery allows the VG-1 to determine how many batteries are in the battery bank and allows each battery to be individually addressed to obtain status information for that battery.

3 System Operation

3.1 Overview

When power is applied the startup screen is displayed. The startup screen remains until a battery or batteries are found on the Battery RS485 network. The VG-1 auto-detects what type of batteries and how many batteries are in the Battery Bank. The system can detect up to a maximum of 15 batteries in the battery bank.

If the system is started with no batteries connected the startup screen will remain until the batteries are connected. When they are connected, after a short delay, the system will reboot and start up to detect what type and number of batteries are in the battery bank.

After about 6 minutes the screen will darken. The screen backlight will illuminate if the touchscreen is touched or if the system detects an “Alert” condition.

The central unit uses RS485 to communicate with the batteries one at a time. Each register in each battery is separately addressed and reports back to the central unit with the various parameters of the battery.

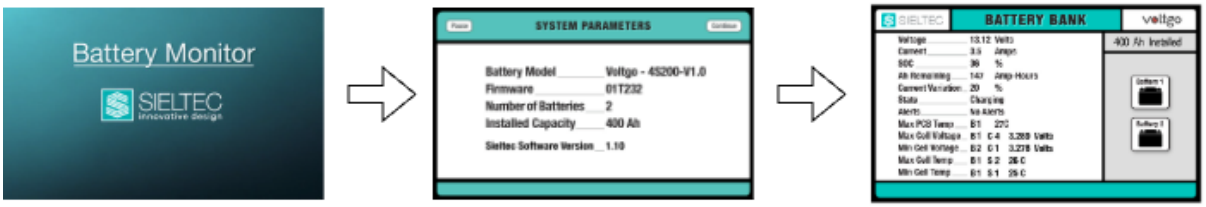

Figure 8. Startup sequence

When batteries are detected, after a short period, the screen transitions to the System Parameters page for 5 seconds. The System Parameters page provides the type of batteries found, the firmware revision level of the batteries, the number of batteries found, the installed capacity and the Sieltec VG-1 firmware level.

The System Parameters page can be paused if required by pressing the “Pause” button. Pressing the “Continue” button will transition to the Battery Bank Page.

For engineering use the System Parameters page can be paused. To progress to the Battery ID, Serial Number, Firmware level and State of Health (SOH) of each battery in the battery bank, swipe right.. Swipe left or press the “Home” button to resume the System Parameters page. The “Continue” button transitions to the Battery Bank page.

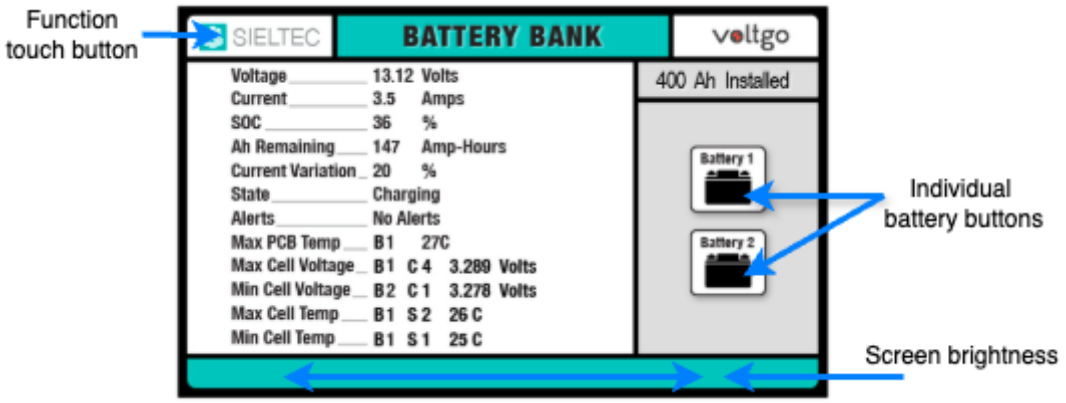

Figure 9. Battery Bank touchscreen regions

The Battery Bank page provides important information relating to the battery bank. All parameters on that page relate to the battery bank apart from Status which advises the status of Battery ID1.

The user can switch to the Individual Battery page by pressing the battery icon on the Battery Bank Page. The Battery Bank page can be resumed by pressing the “Home” button on the top right of the Individual Battery page.

If the screen is too bright, a slow swipe left on the lowest portion of the Battery Bank page will darken the screen. The screen will go to full brightness in the event of an “Alert” or “Communications Lost” occurring.

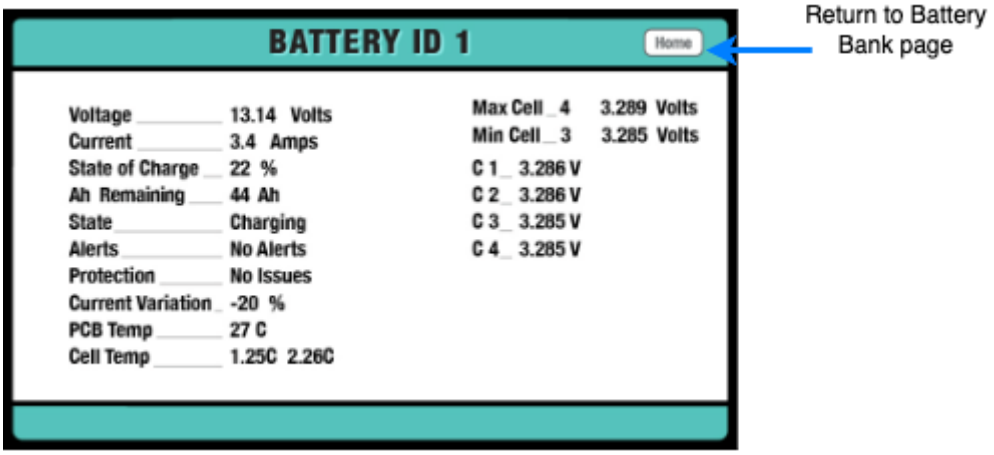

Figure 10. Individual battery page

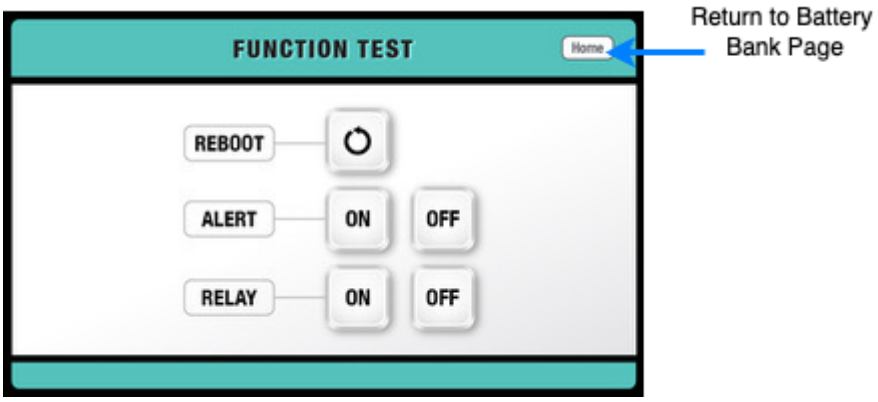

Figure 11. Function test page

For maintenance purposes, a test function screen is available by pressing the Sieltec logo in the top left corner of the Battery Bank page. This has three functions

1. Reboot the system. By pressing “Reboot” the monitoring board is restarted and the screen is rebooted. This is needed if more batteries are added to the existing bank or if a communications cabling problem is resolved and the system needs to re-establish the number and type of batteries used. The same result can be achieved by removing and re-establishing power.
2. Alert: By pressing “Alert” the battery Bank alert animation and the audio alarm can be tested on the Touch Screen and the red LED and the audio buzzer can be checked on the remote panel. The Mute function can also be tested.
3. Relay: by pressing this function the relay contacts can be tested.

The Battery has three important reporting functions; Status, Alert and Protection.

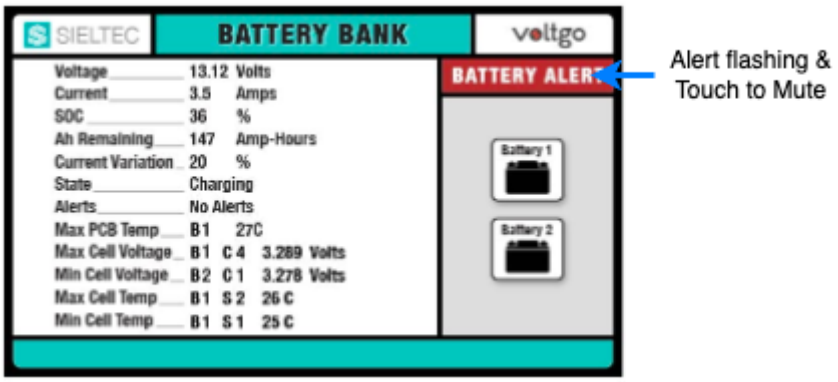

Figure 12. Battery Alert animation

The status information advises the current status of the battery. This will advise if the battery is idling in standby, being charged or being discharged. It can also advise if the battery has entered protection mode.

The alert function provides information relating to the final stages of the battery condition before disconnection. This provides warning in plenty of time that parameters are approaching, but have not yet reached a level where the battery BMS may disconnect from the rest of the system to protect itself from harmful conditions.

The third is protection advice. This function advises the reason that a battery has entered protection mode.

When the alert register provides information relating to the battery condition that is out of normal range, an alert is set. When an alert is set, the buzzer in the touchscreen and the buzzer in the small remote panel sound. The LED on the remote panel illuminates and a small alert animation presents on the touchscreen. The sound can be muted by pressing the mute button on the remote panel or pressing the alert animation on the touchscreen.

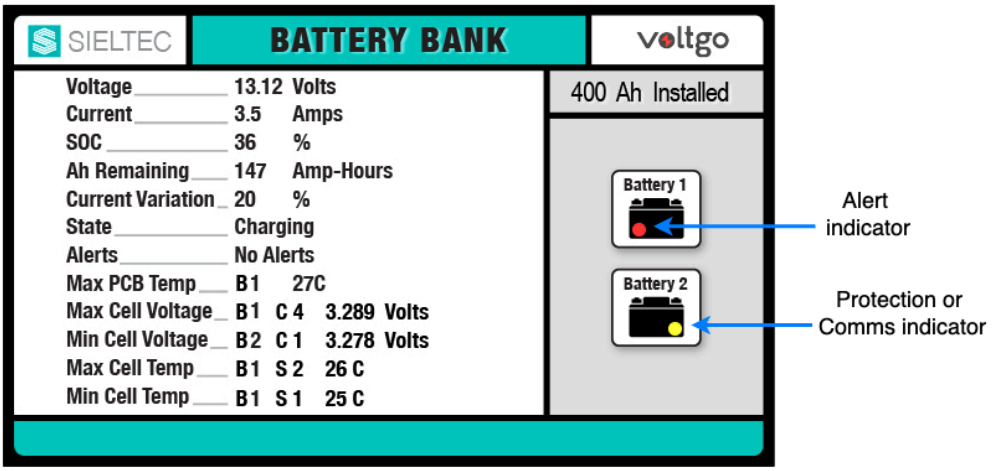

Figure 13. Alert and Protection or Comms indicators

While the alert condition is set and the mute function has not been activated, the screen will always be on the Battery Bank screen. When the alert status has been acknowledged by muting the sound, the individual battery screens can be accessed for further analysis.

When the audio alarm is silenced by the mute function, the red LED is still illuminated on the remote panel to advise the alert is still active. When the reason for the alert is resolved, the red led on the remote panel is extinguished and the mute function is reset ready for the next alert.

When the alert is active, all battery functions on all batteries are still monitored.

Each battery in an “alert” state has a red flashing dot on the battery icon on the battery bank screen.

If a battery enters a protection mode or communications with that battery is lost, a small yellow flashing dot will appear on that battery icon.

3.2 Timing

Each read of each register takes a finite time to make the request and for the answer to return. The information can be seen updating on the screens. Sometimes it is possible for some readings to not make sense if the readings are taken at times that are slightly different and the current drawn from the battery bank is varying considerably.

For instance, the current variation feature provides a measure of the variation a battery is contributing to the total discharge, or percentage of the charging current compared to what the average should be across all batteries. If the current is very dynamic, and the readings are taken at times when the readings are not steady state, the current variation parameter can be wildly different from the steady state reading.

3.3 Parameters explained.

3.3.1 Battery Bank page.

The battery bank page automatically adjusts for the number of batteries in the battery bank. When the system starts, the number of batteries is detected and the appropriate battery bank page is selected.

Voltage: The average voltage of all voltages of all batteries in the battery bank
Current: The total current being discharged or being charged by the battery bank
SOC: The State of charge of the battery bank
Capacity Remaining: The capacity in ampere hours remaining in the battery bank.
Maximum PCB Cell Temperature: The maximum PCB temperature of any PCB temperature sensor in the battery bank.
State: The current state of the battery bank as defined by Battery 1.
Alerts: The current state of alert for any battery in the battery bank that is in an alert state
Current variation: The maximum variation from the theoretical balanced state for charging or discharging current.
Minimum Cell Voltage: This is the battery number and cell number for the lowest voltage cell in the Battery bank.
Maximum Cell Voltage: This is the battery number and cell number for the highest voltage cell in the Battery bank.
Minimum Cell Temperature: This is the battery and battery sensor number for the minimum cell temperature in the battery bank.
Maximum Cell Temperature: This is the battery and battery sensor number for the maximum cell temperature in the battery bank.

3.3.2 Individual Battery Page

Voltage: The voltage of the battery
Current: The total current being discharged or being charged by that battery
SOC: The State of Charge of that battery
Capacity Remaining: The capacity in ampere hours remaining in that battery
PCB Cell Temperature: The PCB temperature of that battery.

State: The current state of the battery.
Alerts: the current state of alert for that battery
Current variation: The variation for that battery from the theoretical balanced state for charging or discharging current
Cell Voltage maximum: The cell and voltage of the maximum voltage cell
Cell Voltage minimum: The cell and voltage of the minimum voltage cell
Cell Voltages: All cell voltages for that battery

3.3.3 Current variation explained:

If we have two batteries and the battery bank current is 60 amps, we expect each battery to be discharging 30 amps. If one battery is discharging 0 amps and the other is discharging 60 amps we have a 100% current variation. If each battery is discharging 30 amps we have a 0% current variation.

This feature allows us to identify a battery that is not behaving as it should or a connection to a battery that may be higher than usual resistance. We can see the contribution of each battery in the battery bank.

It is evaluated by the formula

Current Variation = ((Average current - Battery current) / Average current) x 100

3.4 Cable Pin Assignments

3.4.1 Battery Connection Cable

Pin	Identifier	Meaning
1	RS485 B	RS485 9600 baud serial
2	RS485 A	RS485 9600 baud serial
3		
4		
5		
6		
7		
8		

Table 1. Battery Data Connection

3.4.2 Remote Panel Cable

Pin	Identifier	Meaning
1	+5 Volt	Power to the remote panel
2	Buzzer	Buzzer return active low
3	Not used	
4	LED	LED return active low
5	Not used	
6	Not used	
7	Mute	Mute return Active high
8	Not used	

Table 2. Remote Panel Connection

3.4.3 Remote Touch-screen Cable

Pin	Identifier	Meaning
1	RS485 B	RS485 9600 baud serial
2	RS485 A	RS485 9600 baud serial
3	Not used	
4	Not used	
5	Ground	LCD Touchscreen Ground
6	+10 Volts	LCD Touchscreen Power

Table 3. Remote Touch-screen Connection

4 Technical Specifications

Power Supply	
Supply Voltage	10.5 - 70 Volts DC
Supply Protection	Continuous reverse polarity protection
Supply current	90mA @ 24V Screen Dark: 50mA @ 24V
Fuse recommended	1 amp
Power Connector	2 Pin 5.08mm pitch, Screw terminal
Maximum Battery Bank	15 batteries
Battery type	12, 24, 48 volt batteries
Relay connector	3 pin 5.08mm pitch, Screw terminal
Maximum Relay Current	0.8 Amps, 30V normally open and normally closed contacts
Remote Alarm connector	RJ45 Cat 5 Straight through cable
Remote Screen connector	RJ12
Battery Connector	RJ45 Cat 5 Straight through cable
Battery Serial Connection	RS485, Galvanically isolated, 9600 baud

Table 4. Specifications

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