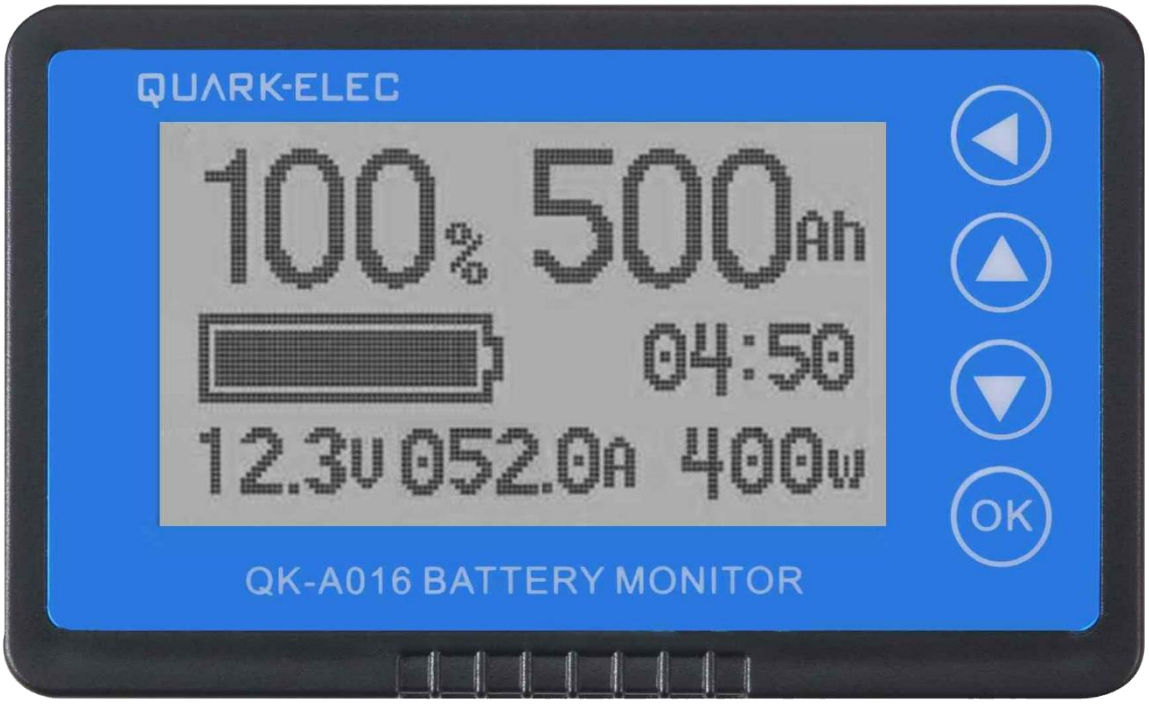
QK-A016

Battery Monitor

With NMEA 0183 message output



Designed in UK

Features

- High precision battery monitor, measure voltage, current and capacity
- Display the remaining time at the current rate of discharge and charge status
- NMEA 0183 format messages output
- Wide input voltage range: 8.0V - 120V
- Suitable for most types of batteries including lithium battery, lead-acid battery
- High current measurement resolution,0.01Amp, with current shunt
- Up to 500 Amp constant current (100A and 500A variations available)
- User programmable alarm function

Contents

1. Introduction

The QK-A016 is a high precision battery monitor and can be used for boats, campers, caravans and other devices using a battery. The A016 measures the voltage, current, ampere-hours consumed and the remaining time at the current rate of discharge. It provides wide range of battery information. The programmable alarm allows user to setup the capacity/voltage warning buzzer.

The A016 is compatible with most types of batteries in the market including: lithium batteries, lithium iron phosphate batteries，lead-acid batteries and nickel-metal hydride batteries.

The A016 outputs the standard NMEA 0183 format messages so the current, voltage and capacity information can be combined with the NMEA 0183 system on the boat and shown on the supported Apps.

2. Why a battery should be monitored?

Batteries can be ruined by excessive discharge. They may also be damaged by under-charging. This may result in the battery performance being less than what is expected. Operating the battery without good metering is like running a car without any gauges.

Apart from offering an accurate state of charge indication, the battery monitor can also help users how to get the best service life out of the battery. The service life of battery could be negatively affected by excessive deep discharging, under- or overcharging, excessive charge- or discharge currents and/or high temperatures. Users can detect such abuse easily through the display monitor of the A016. Ultimately the longevity of the battery can be extended which will result in long term savings.

3. Connections and Installation

Before starting the installation, ensure that no metal tool can cause a short circuit. Removing all jewellery such as rings or necklaces prior to any electrical work is considered best practice. If you believe you may not be sufficiently skilled to undertake this installation safely, please seek the assistance of an installers/electricians who is aware of regulations for working with batteries.

Please strictly follow the orders of connections given below.

Use a fuse of the correct value as shown in the following diagram.

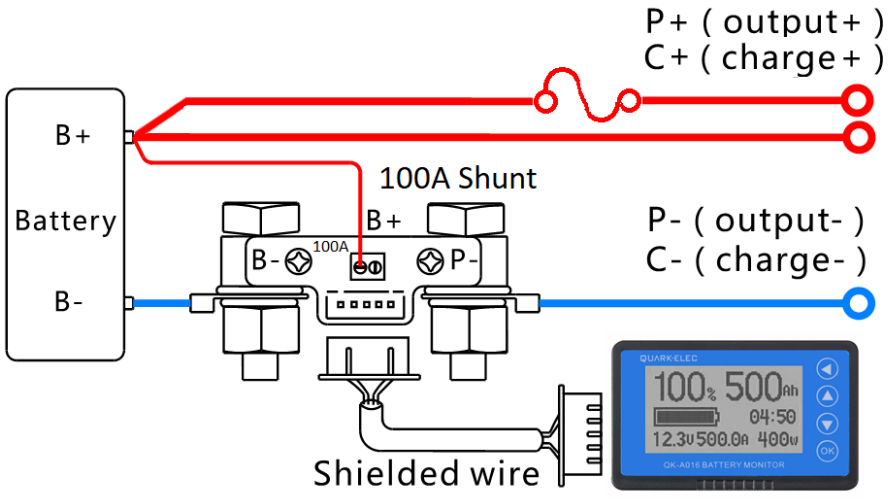


Figure 1 A016-100 wiring diagram

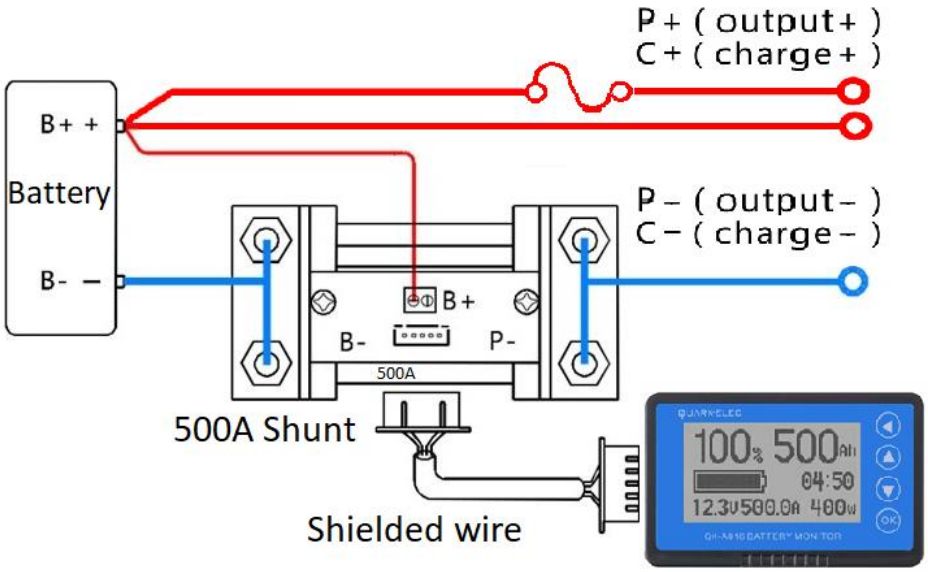
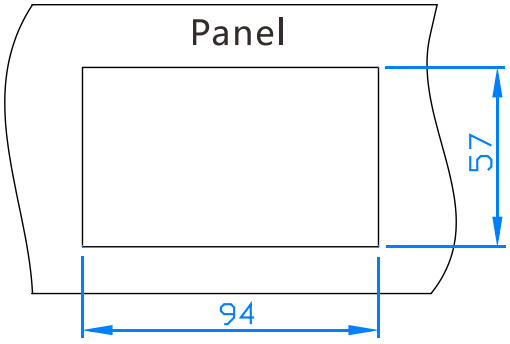


Figure 2 A016-500 wiring diagram

1. Determine a mounting location and mount the shunt. The shunt should be installed in a dry and clean place.
2. Remove all loads and charging sources from the battery before any other steps are taken. This is often accomplished by turning off a battery switch. If there are loads or chargers directly attached to the battery, they should be disconnected as well.
3. Serial connect the shunt and the negative terminal of the battery (the blue wires shown on the wiring drawing).
4. Connect B+ of the shunt to the positive terminal of the battery with a AGW22/18 wire (0.3 to 0.8mm^2).
5. Connect the positive load to the positive terminal of the battery (using a fuse is highly recommended).
6. Connect the positive charger terminal to the positive terminal of the battery.
7. Connect the display to the shunt with the shielded wire.
8. Double check all the connections with the above diagram before turning on the battery switch.

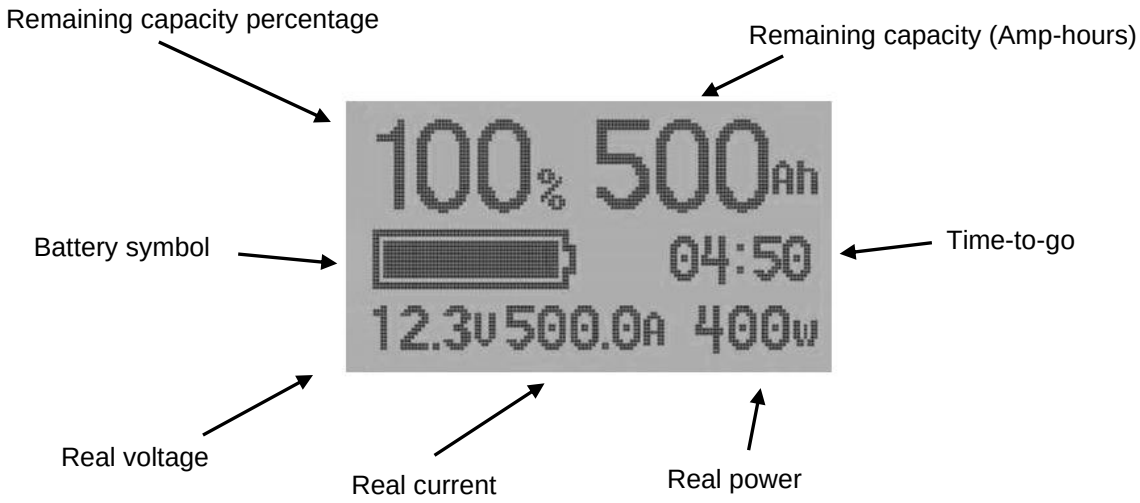
At this point the display will power up, and be operational in a few seconds.

The A016's display comes with a buckled enclosure. A 57*94mm's rectangular slot need to be cut for fitting



4. Display and Control panel

The display shows the state-of-charge on the screen. The following image provides what the displayed values indicate:



Remaining capacity percentage: This shows the percentage of the actual full-charge capacity of the battery. 0% indicates empty while 100% means full.

Remaining capacity in Amp-hours: The remaining capacity of the battery is indicated in Amp-hours.

Real voltage: Displays of the real voltage level of the battery. Voltage helps assess approximate state-of-charge and to check for proper charging.

Real current: The current display informs of the current load or charge of the battery. The display shows the instantaneously measured current rate flowing out of the battery. If the current flows into the battery, the display will show a positive current value. If the current flows out of the battery, it is negative, and the value will be shown with a preceding negative symbol (i.e -4.0).

Real power: The power rate been consumed whilst discharging or supplied whilst charging.

Time-to-go: Shows an estimate of how long the battery will sustain a load. Indicates the time remaining until battery is completely discharged when the battery is discharging. The remaining time will be calculated from the residual capacity and the real current.

Battery symbol: When the battery is being charged it will cycle to show it is filling. When the battery is full the symbol will be shaded.

5. Setting up

5.1. Setup battery monitor parameters

The first time you use your A016, you will need to set the battery to its starting point at either empty or full capacity to start the monitoring process.

Quark-elec recommend starting at full (after the battery has been fully charged) unless you are unsure of the capacity of the battery. In this case the capacity (CAP) and High voltage (HIGH V) need to be

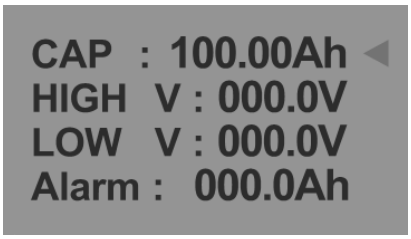
setup. The capacity can be found on the specifications of the battery, this should normally be listed on the battery. The high voltage can be read from the screen after fully charged.

If you are unsure of the battery capacity, then you can start with the battery fully depleted (empty). Check the voltage shown on the screen and set this as the low voltage (LOW V). Then set the monitor to its highest capacity (e.g. 999Ah). Afterwards please charge the battery fully and record the capacity when charging is complete. Enter the Ah reading for capacity (CAP).

You can also setup the alarm level to receive audible alerts. When the state-of-charge capacity has fallen below the set value, the percentage and battery symbol will flash, and the buzzer will be begin beeping every 10 seconds.

5.2. Setup process

1. Press and hold the OK key on the faceplate until the set-up screen appears. This will show the four parameters needed to be entered.



2. Press the up(▲) or down(▼) keys to move the cursor to the setting you would like to change.
3. Press the OK key to select the parameters for setting.
4. Press the up or down arrow keys again to select the proper value applied.
5. Press the OK key to save your settings and then press left(◄) key to exit the current settings.
6. Press the left(◄) key again, the display will exit the set-up screen and back to the normal working screen.

- Setup HIGH V or LOW V only, don't set the both value unless you clearly know the voltage characteristics of the battery.

5.3. Backlight

The backlight can be switched OFF or ON to save energy. When the display works in the normal screen mode (not setting-up), press and hold left (◄) key will switch the backlight between ON and OFF.

The backlight will flash during charge mode and light solid on during discharge mode.

5.4. Sleep mode in low power

When the battery current is less than the backlight turn-on current(50mA), the A016 will enter a sleep mode. Pressing any key can wake up A016 and turn on the display showing for 10 seconds.

The A016 will go back to the normal work mode once the battery current is higher than the backlight turn-on current.

6. NMEA 0183 output

The A016 outputs the real time voltage, current, and capacity (in percent) via the NMEA 0183 output. This raw data can be monitored using any serial port monitor software or apps on mobile devices. Alternatively, apps such as OceanCross can be used to view the end user information.

The output sentence format is shown below:

```
   1   2  3  4   5   6
   |   |  |  |   |   |
$IIXDR,a,x.x,b,c--c,*hh<CR><LF>
1: Prefixer(Talker ID), fixed as IIXDR.
2: Measurement type. Where U is for voltage, I is for current, G is for capacity;
3: Measurement data.
4: Units of measurement.
5: Name of device, fixed as A016.
6: Checksum.
Example:
$IIXDR,U,12.10,V,A016,*CS   ----the current voltage is 12.1V
$IIXDR,I,2.1,A,A016,*CS     ----the present current is 2.1Amp
$IIXDR,G,64.0,%,A016,*CS    ----the current capacity(remain) is 64.0%
```

The voltage, current and capacity information can be shown via Apps on a mobile phone (Android),e,g, OceanCross:

The latest OceanCross can be download from: https://www.quark-elec.com/downloads/apps/

7. Specifications

Item	Specification
Power source voltage range	8.0V to 120V
Current	0.1 to 100A(A016-100) or 0.1 to 500A(A016-500)
Operating power consumption (Backlight on / off)	12-22mA / 42-52mA
Standby power consumption	6-10mA
Voltage Sampling Accuracy	±1%
Current Sampling Accuracy	±1%
Display backlight ON current draw	<50mA
Working Temperature	-10°C to 50°C
Battery Capacity Setting Value	0.1-999Ah
Display cable length	3 meters,10 meters as an option
NMEA 0183 output cable length	1 meter
Operating temperature	-10°C to +55°C
Storage temperature	-25°C to +85°C

Dimensions(in mm)	100×61×17

For more information

For technical support and other enquiries, please go to the Quark-elec forum at https://www.quark-elec.com/forum/ or email info@quark-elec.com

8. Limited Warranty and Disclaimer

Quark-elec warrants this product to be free from defects in materials and manufacture for two years from the date of purchase. Quark-elec will, at its sole discretion, repair or replace any components that fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts and labour. The customer is, however, responsible for any transportation costs incurred in returning the unit to Quark-Elec. This warranty does not cover failures due to abuse, misuse, accident or unauthorized alteration or repairs. A returns number must be given before any unit is sent back for repair.
The above does not affect the statutory rights of the consumer.

This product is designed to aid navigation and should be used to augment normal navigational procedures and practices. It is the user's responsibility to use this product prudently. Neither Quark-, nor their distributors or dealers accept responsibility or liability either to the products user or their estate for any accident, loss, injury or damage whatsoever arising out of the use or of liability to use this product. Quark- products may be upgraded from time to time and future versions may therefore not correspond exactly with this manual. The manufacturer of this product disclaims any liability for consequences arising from omissions or inaccuracies in this manual and any other documentation provided with this product.

Document history

Issue	Date	Changes / Comments
1.0	22-04-2021	Initial release
1.1	18-11-2022	A016-500 available

Quark-elec (UK)
Unit 7, the Quadrant
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Royston, UK
SG8 5HL

Some helpful information:

Rating of Commonly used 12V DC Appliances (directly battery powered, typical value)	
Appliance	**Current**
Autopilot	2.0A
Bilge Pump	4.0-5.0 A
Blender	7-9 A
Chart Plotter	1.0-3.0 A
CD/DVD Player	3-4 A

Coffee Maker	10-12 A
LED Light	0.1-0.2 A
Standard Light	0.5-1.8 A
Hair Dryer	12-14 A
Heated Blanket	4.2-6.7 A
Laptop Computer	3.0-4.0 A
Microwave- 450W	40A
Radar Antenna	3.0 A
Radio	3.0-5.0 A
Vent Fan	1.0-5.5 A
TV	3.0-6.0 A
TV Antenna Booster	0.8-1.2 A
Toaster Oven	7-10 A
LP Furnace Blower	10-12 A
LP Refrigerator	1.0-2.0 A
Water Pump 2 gal/m	5-6 A
VHF Radio(transmit/standby)	5.5/0.1 A
Vacuum	9-13 A

Rating of Commonly used 230V AC Appliances (inverted power from 12VDC battery, typical value)	
Appliance	**Current**
Microwave	70-90A
TV	7-10A
Kettle	70-90A
Laptop Computer	5-6A
Toaster	70-90A

Typical value of Flooded, AGM, SLA and GEL Battery SOC table	
Voltage	**Battery State of Charge (SoC)**
12.80V - 13.00V	100%
12.70V - 12.80V	90%
12.40V - 12.50V	80%
12.20V - 12.30V	70%
12.10V - 12.15V	60%
12.00V - 12.05V	50%
11.90V - 11.95V	40%
11.80V - 11.85V	30%
11.65V - 11.70V	20%
11.50V - 11.55V	10%
10.50V - 11.00V	0%

When the SOC falls below 30% the risk of damaging the battery is increased. Therefore, we advise to always keep the SOC above 50% to optimize the life cycles of the battery.