

BATMAN **Battery** *Monitoring*

The ideal device for the Outdoor Enthusiast and the Enthusiastic Camper!!



BATMAN - BATTERY MONITOR INSTALLATION GUIDE
www.perfectpower.com

Manufactured & Supplied by:
Digital Data Systems Pty Ltd
Tel: +2711 7915947
Email: info@perfectpower.com

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Caring for the environment!

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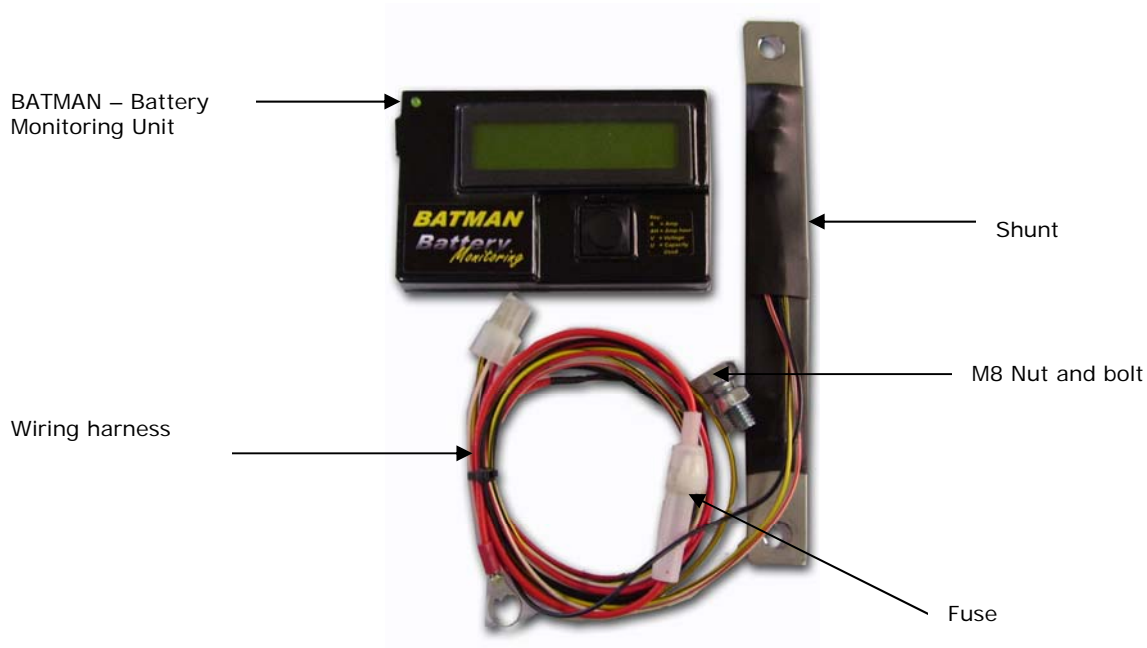
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1. INTRODUCTION

The BATMAN Battery Monitor is a unique device that measures the charge that has been used from your batteries. At a touch of a button, the used capacity is displayed in AH (Ampere Hour). The BATMAN Battery Monitor allows you to instantly see the state of your batteries, how much current drawn and how much your charger has put back in. The BATMAN Battery Monitor is an essential device for those dual battery campers who need to know how much longer their batteries will last or how much an appliance draws, such as fridges, lights, compressors, water pumps, etc. The BATMAN Battery Monitor will be able to tell you the impact that your solar panel, your alternator and your mains charger have and how much AH you have remaining as well as the amount it still needs to charge. The BATMAN Battery Monitor takes the guesswork out of dual battery camping and gives you the facts.

FIGURE 1. BATMAN KIT



The BATMAN comes in a kit, included in the kit is the following:

- BATMAN Battery Monitoring Unit
- Shunt (a resistor which allows current to flow through it, it produces a volt drop, which is measured by the battery monitor)
- Harness
- Fuse
- 1 x M8 Nut and Bolt
- 1 x Installation guide
- 1 x Strip of double-sided tape 80mm long for mounting

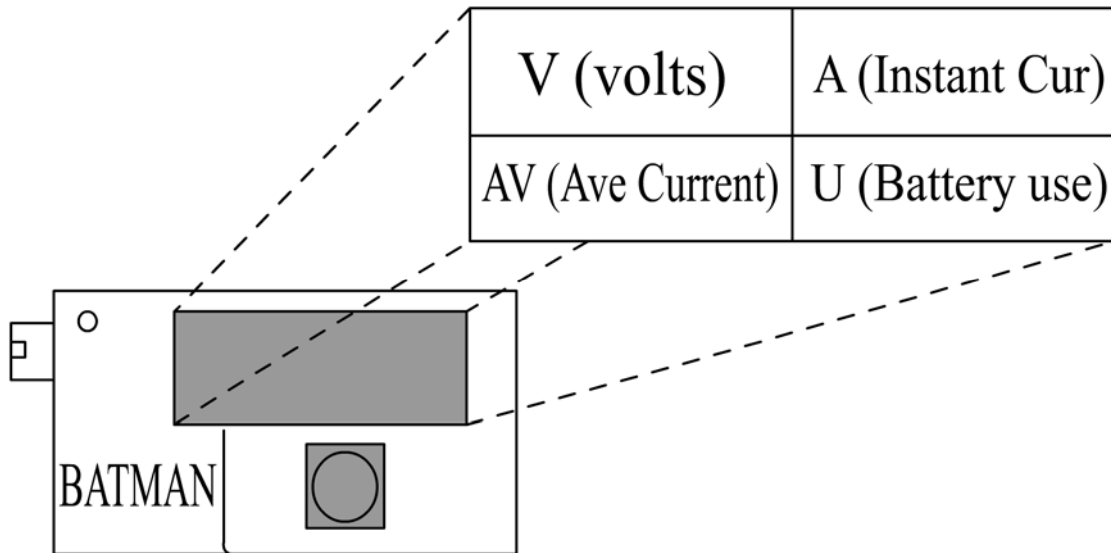
2. DISPLAY FIELDS OF THE UNIT

The unit has 4 display fields:

V	=	Battery Voltage
A	=	Instantaneous current
AV	=	Average current
U	=	Battery Capacity used

Key:
V = Voltage
A = Amp
AV = Average
U = Capacity
Used

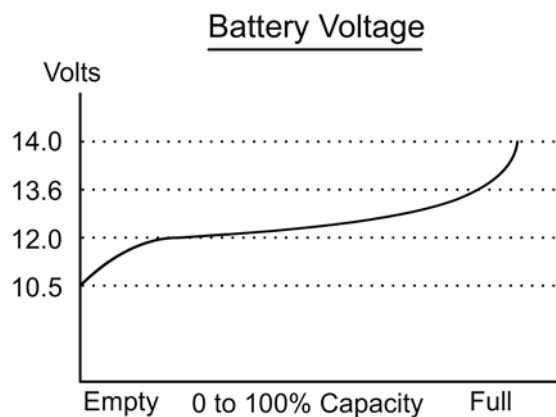
FIGURE 2. DISPLAY FIELDS



2.1 BATTERY VOLTAGE (V)

This is the voltage of the battery the BATMAN is connected to. The voltage depends on many factors: battery type, construction, age, temperature, current drawn or charge applied. The following is a typical graph of a battery:

FIGURE 3. BATTERY VOLTAGE



2.2 INSTANTANEOUS CURRENT (A)

This is the battery current. Positive numbers indicate CHARGING, negative numbers indicate DISCHARGING. The display is in AMPERE.

2.3 AVERAGE CURRENT (AV)

This is the average current over the last 10 minutes. If you have a steady current flow, then the instantaneous and the average display will be the same after 10 minutes. However, when the load (current) cycles are on and off (like a fridge/freezer in normal running conditions) then the average display shows the REAL current consumption over that time period. Of course, if you have short bursts of charging intermingled with discharging then the average will correctly display the actual average current for the last 10 minutes. Again, a negative current indicates discharging, and a positive current indicates that it is charging.

2.4 BATTERY CAPACITY USED (U)

This is the most important display. It displays the Ampere-hours, by which you have depleted the battery. That is to say: The higher the number the closer the battery is to the EMPTY state.

In other words: If you are running off the battery and you have load connected, e.g. fridge, lights etc, the number will get bigger. If you are charging the battery, then the number gets smaller. Eventually, during charging, the number goes to zero. At this stage it is indicating that you have REPLACED the previous taken out Amp hours.

If you have started with a completely charged battery, then it is full again. But if you started with a half full battery, then it is just half full when the display returns to zero. In order to charge the battery fully you need to charge it over a prolonged time. The measured charge current is 'discounted' by 5% to compensate for the battery in-efficiency.

Practical experience has shown that the battery capacity displayed on the label cannot be used in the field. There are too many variables preventing you from getting 100% out of a battery. However, you should get 80-90% from the indicated battery capacity. That is to say that you should get 80-90AH from a FULLY charged 102AH battery.

3. INSTALLATION

The unit uses a shunt to measure the current, which flows in and out of the battery. A shunt is a type of resistor, which allows current to flow through it, and it produces a minute volt drop, which is measured by the battery monitor. The shunt is a piece of metal supplied in the kit with three wires coming from it. It is vital that the shunt is installed correctly.

The wires to the monitor can be extended as required, or if they are too long they can be rolled up. The direction of the shunt is critical: Remove all the wires that draw current from the negative of the battery and place the side with BAT stamped into the plate on the negative side of the battery. Replace the wires onto the negative terminal of the shunt. Give current back to the batteries.

It is recommended that the shunt is screwed DIRECTLY onto the negative battery terminal, but this is not absolutely necessary. If the shunt does not fit the available space, it has been designed to bend and therefore can be bent to fit.

The positive (Red) wire of the unit can be as long as required, but the supplied INLINE FUSE must be as close as possible to the battery.

See Figure 4 and 5 below for installation.

FIGURE 4. DUAL BATTERY SYSTEM WITH SINGLE AUXILIARY BATTERY

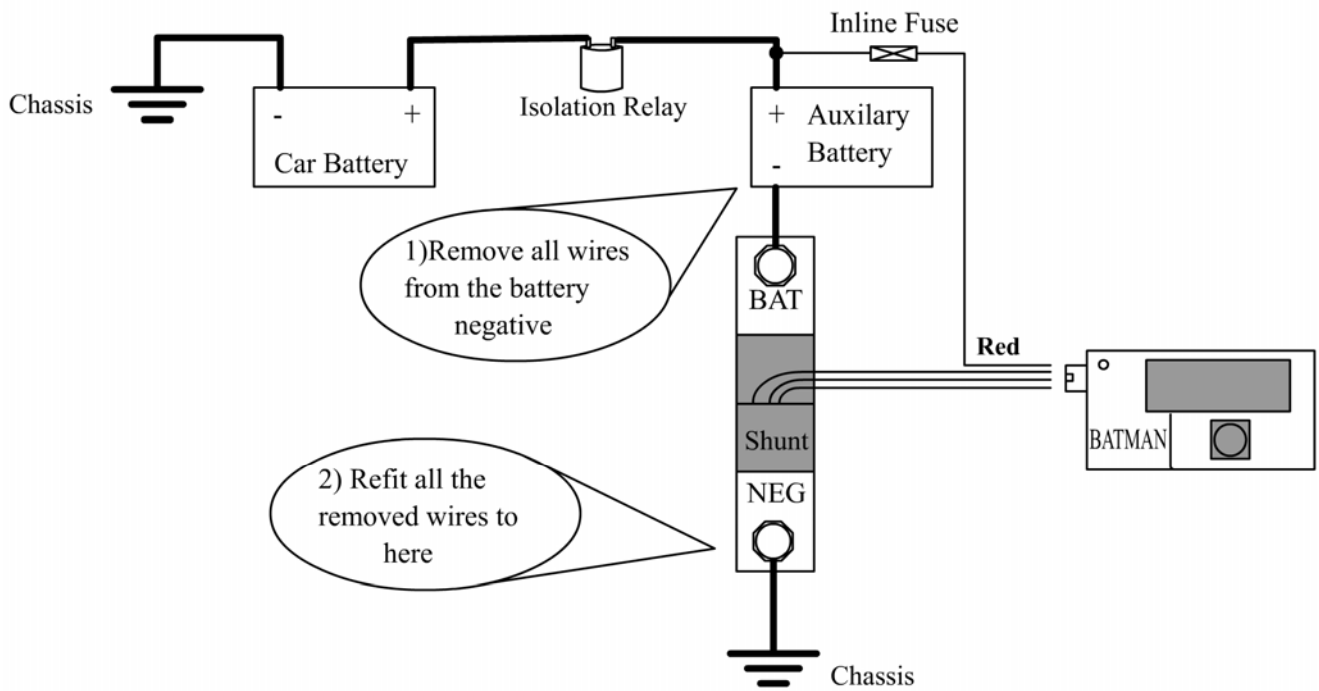
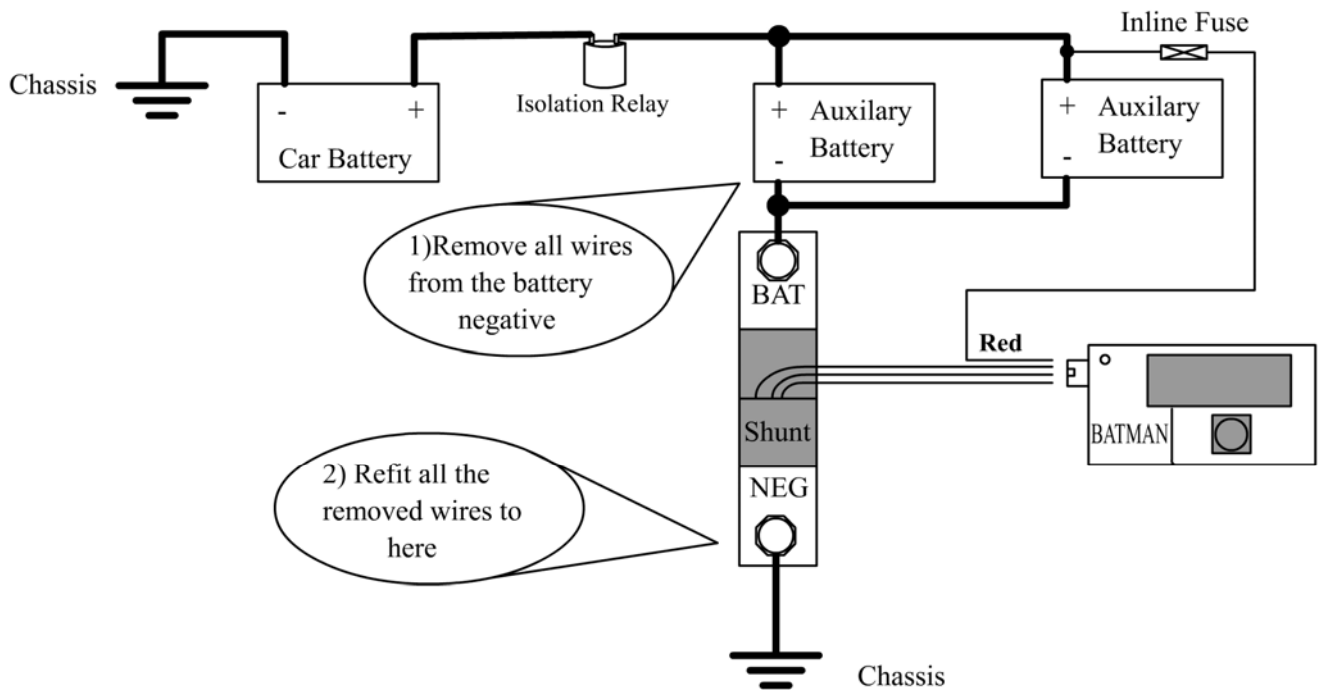
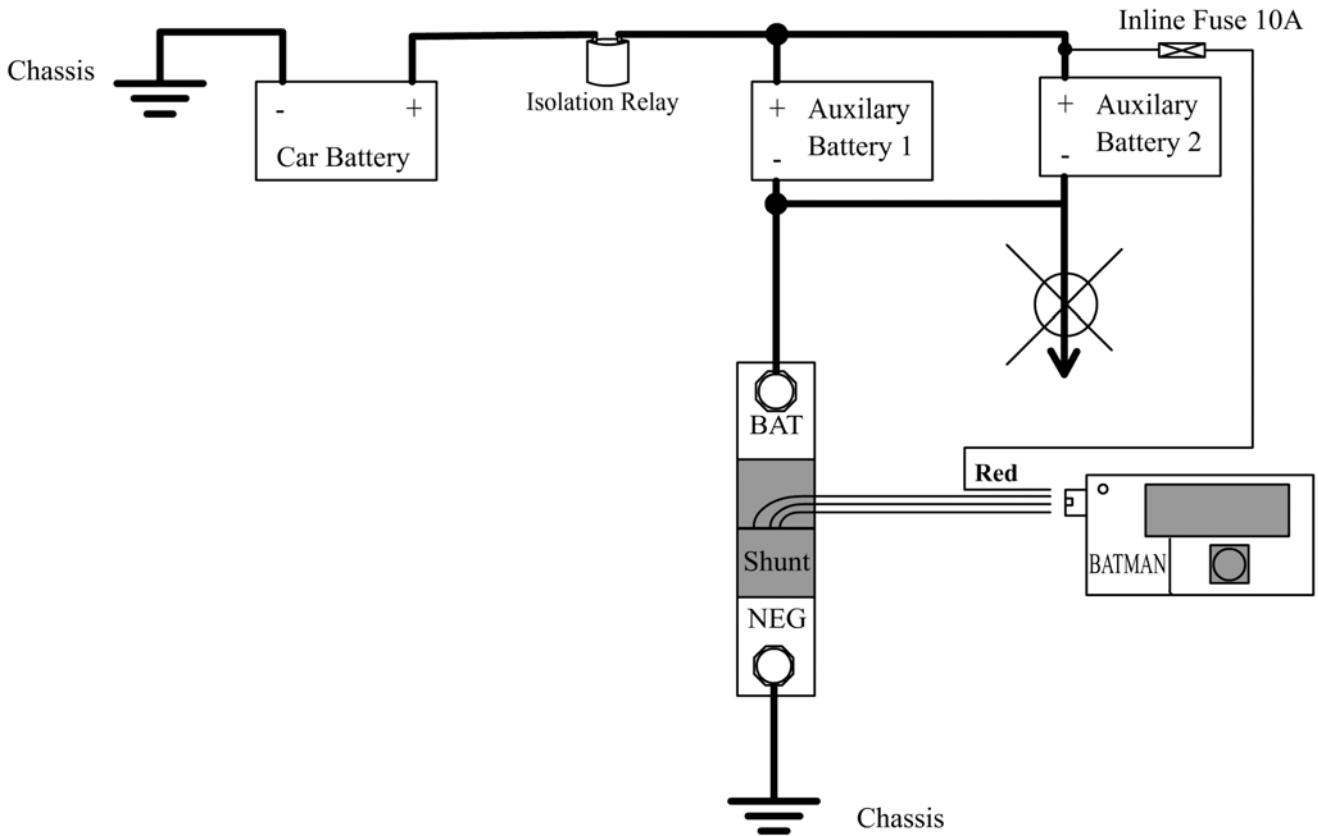


FIGURE 5. DUAL BATTERY SYSTEM WITH MULTIPLE AUXILIARY BATTERIES



The diagram below shows a typical installation error. Because the battery terminals have many wires attached, and if the batteries are in a different location, the shunt wiring becomes very difficult. It is recommended to consult an electrician.

FIGURE 6. WRONG WIRING FOR DUAL BATTERY SYSTEM WITH MULTIPLE AUXILIARY BATTERIES



It is recommended that the Red wire of the unit is connected directly to the battery. This means the unit permanently has power. When storing the batteries for a prolonged time you may want to disconnect the BATMAN.

4. CALIBRATION

The unit leaves the factory fully calibrated.

5. CONTROLS

There is one PUSH-BUTTON. Its primary function is to switch the backlight on. Once pressed, the light will stay on for 2 minutes so that the display is readable in darkness. The display is readable in daylight conditions without the backlight.

5.1 SPECIAL CONTROL OPERATION: AUTO ZERO

Hold the button down for 10 seconds: The AUTO ZERO calibration is activated. This zero's the current reading. This operation MUST be performed with NO CURRENT drawn from the battery. So make sure everything is switched OFF.

5.2 SPECIAL CONTROL OPERATION: ZERO BATTERY USE

Press the button 10 times within 10 seconds: The BATTERY USE display is set to zero. This operation is required if you change batteries, or have the batteries removed for charging.

6. USING THE BATTERY MONITOR

The monitor helps to estimate the efficient battery utilization and ensures efficient use of the available power sources and consumers.

Power sources (Charging) are:

- 1) Mains battery charger
- 2) Charging from the car alternator
- 3) Charging from a solar panel
- 4) Generator

Power consumers (Discharging) are:

- A) Fridge/freezer
- B) Lights
- C) Inverters
- D) Other

6.1 MAINS BATTERY CHARGER

Try it out and monitor the charge current. The charge current will be higher when the battery is empty and dwindles to zero when the battery is full. To rephrase this: the charge current dwindles to zero when the charger 'thinks' the battery is full. The engineers have optimized the charger to a safe level of operation, which does not coincide with a full charge.

To establish the mains charger operation we suggest the following test:

- a) Put a load on to the battery so that you get a 'U' reading of 5-10AH. Then take the load off.
- b) Then put the mains charger on and monitor the time it takes to replace the used energy until the 'U' reading is zero again.

You have now a 'wild estimate' of your mains charger operation. If you have done the test with a full battery, then the time to replace the discharge will be long. It will go much faster with an empty battery. Normal charging voltage from mains is 13.6 Volt.

6.2 CHARGING WITH A CAR ALTERNATOR

The car alternator is optimized for your car battery. It is not optimized for your camping power! But, it does charge your external batteries. The amount of charge can be tested as follows:

- a) Take all loads off the battery and connect up to the car. Start the engine and monitor the current.
- b) The charge current may be small. The actual current depends on the type of alternator, the wiring, and the battery state.
- c) Switch on any load (like the fridge) while the engine is running. You may find that the charge current is reduced, but less than the additional load current.
- d) Late model car alternators charge the battery to ~14.1Volts, early models to 13.6 Volts.

You have now a 'wild estimate' of your car charging ability. Again, the car alternator charges an empty battery better than a full one.

6.3 CHARGING FROM A SOLAR PANEL

There are two solar chargers available: NON-MPPT (MPPT stands for Maximum Power Point Tracking) and MPPT. The NON-MPPT charger is economical for a panel of 100W or less, and the MPPT is called for at 200W panels. The MPPT charger is expensive, but gets the 'WATTS' out of the panel. A NON-MPPT gets approx. 30% less out of your panel. That is to say that a 100W panel charges approx. 70Watt with a non-MPPT charger.

A MPPT charger is also a little clever (hence its price) and handles the charging differently. Whatever system you have, try it out.

- a) Take all loads of the battery and connect the solar panel and charger.
- b) Measure the charge current.
- c) Put the fridge on and measure the charge current again.

You have now a good idea of the solar charging ability of your system. Like all other charging systems: the charge is very little on a full battery.

6.4 CHARGING FROM A GENERATOR

If a generator is allowed, then use it. Check how much it charges!

6.5 FRIDGE/FREEZER LOAD

Two different fridge systems are available: the Thermoelectric and the 'compressor' type. The Thermoelectric type presents a steady load and the compressor type a 'cycling' load. It draws current as long as the motor is running. The actual on/off times depend on:

- Inside temperature
- Outside temperature
- Manufacturer

The cycling load is measured with the average display. It measures the motor inrush current as well.

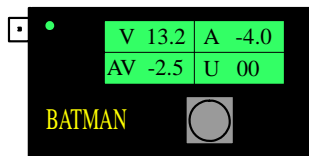
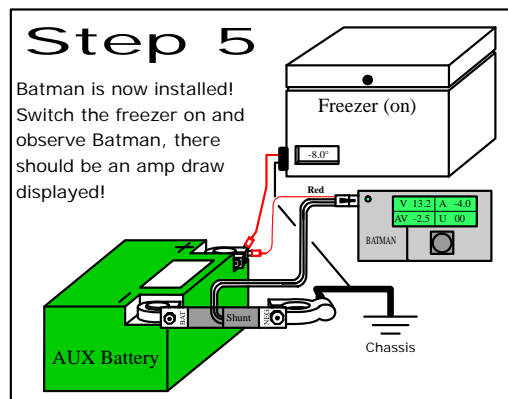
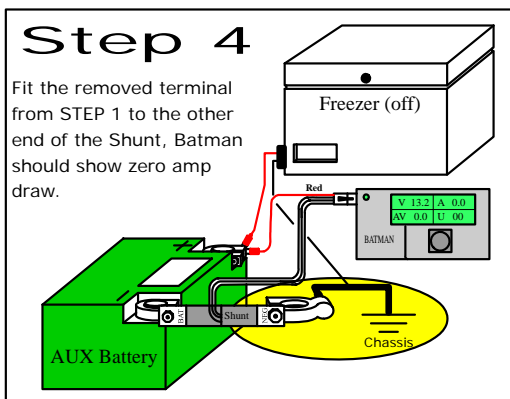
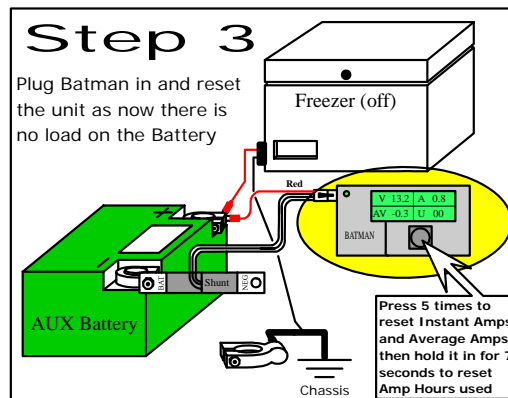
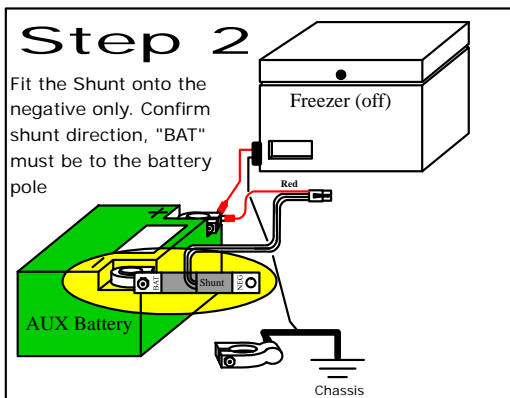
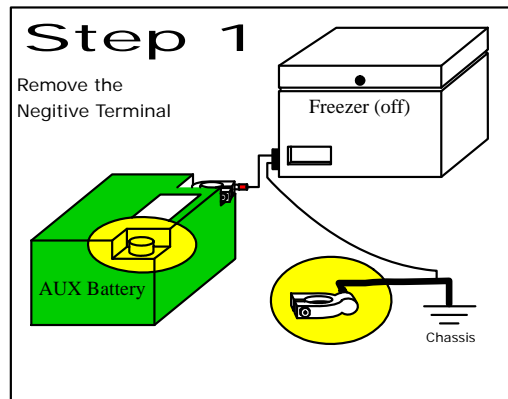
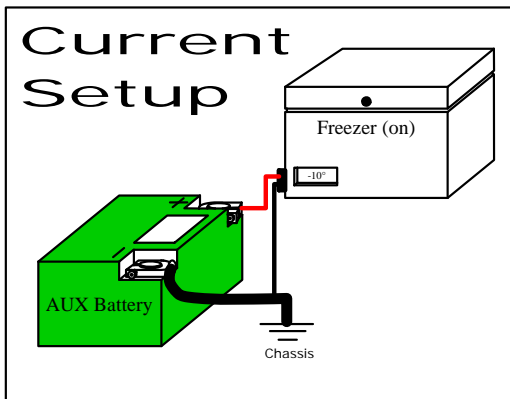
6.6 LIGHTS

Most of them present a steady current draw with different inrush currents.

6.7 INVERTERS

These are used for microwave and home computers. Their current draw is dependant on the load they are facing.

7. BATMAN QUICK INSTALLATION GUIDE



V 13.2	Is the present Battery Voltage
A -4.0	Is the Instantaneous Amp draw from the Battery
AV -2.5	Is the Average Amp draw calculated over 10 minutes
U 00	Is the total Amp/Hours used, when it is not charging

8. TROUBLE SHOOTING THE UNIT

The unit has no adjustable parts, or requires maintenance. The wires can be as long as required for easy visibility of the display.

The display must come on when power is applied. If not, check the in-line fuse.

If the unit is suspected of showing the wrong current reading then:

- a) Check the connections on the shunt
- b) Test the units display by applying a known load

9. TROUBLE SHOOTING THE BATTERY SYSTEM

In most applications the batteries are not fully or sufficiently charged. Test your charging methods independent from each other before going into the field. You may face the possibility that your trusted mains charger charges only to 70% of the capacity that the car alternator charges or even less, but that a clever MPPT charger gets close to 95%.

Once you have identified the charging problem then it is very difficult to rectify or improve it. Consult an electrician to help you.

If a car alternator is the problem then the wires and the connector in line to your leisure battery can be enlarged. But beyond that you are stuck. Check out the alternator voltage. If it is 13.6 volts then check if you can get a 14.1 volt type.

If the mains charger is insufficient then you can replace it with a better one. Test the new one before buying it.

One way to improve the charging is increasing the battery capacity. If a battery only takes 5A, but you need to charge with 15A, then you can use three batteries however this is not always possible.

If your load is too much (for the time you are without any charge) then you have only two options:

- a) Reduce the load
- b) Increase the battery capacity

The load is most likely the Fridge/Freezer. It by far consumes the most power. Turn the thermostat up and check by how much the load is decreasing. You will be surprised by the difference it makes. Check if you can better the insulation of the fridge walls.

10. FAQ

Q: My charge polarity shows opposite (negative)

A: Your shunt may be fitted the wrong way around.

Q: The car alternator does not charge sufficiently

A: The charge current depends very much on the size of wire used, and the connection between the car alternator and the leisure battery.

Q: The deep cycle batteries take too long to charge

A: This is normal. They don't like to be charged. Rule of thumb: if you are charging 1/10 of the capacity then you have a very good charger.

Q: How can I increase the charging rate of my deep cycle batteries?

A: If you go higher than 1/10 of the capacity you are prone to damaging the battery. Consult the battery manufacturer for more details.

Q: Will a clever MPPT solar charger help?

A: Yes, but they are expensive. At present you pay ~R42/Watt on a solar panel and a MPPT charger is approx. R3000 or more. The MPPT increases the charging by approx. 30%

Q: What is a 'FAIR' charging rate for deep cycle batteries?

A: 5 to 9% of capacity when empty, reducing to 1-2% when near full.

11. TERMINOLOGY

Ampere Hour (AH): The current (Ampere) multiplied by time (Hour).

Current: The instantaneous current flowing

Capacity: Measured in Ampere Hours (AH). The 'U' display is in AH!

12. SPECIFICATIONS

Voltage accuracy: 1%

Current accuracy: 3%

Current consumption: 0.02A without display

0.12A with background display on

Waterproof: NO

Ambient Temperature: -10 to +65C

13. WARRANTY

3 month return and exchange policy. Should the unit fail to operate within three months of purchase, please return the unit to your supplier. The manufacturer agrees to exchange the unit within 3 months of purchase from the supplier.