



PCHQ 12V-2A Manual & Reference Guide

Ver. 1.1

Battery Management Solutions by
PowerDesigners



PowerCheq Manual and Reference Guide

TABLE OF CONTENTS

Important Safety Instructions.....1

Technical Specifications.....2

Introduction.....3

Package Content4

Operation.....6

Installation.....7

Installation Instructions8

Troubleshooting/FAQs.....10

Limited Warranty11

Contacting PowerDesigners, LLC12

Notes

Contacting PowerDesigners, LLC

Calls are answered 9 a.m. – 5 p.m. Monday – Friday central time.
After hour calls will be answered by voice mail and returned on the next business day.

Phone:
+1.608.231.0450

All mail, including shipping and returns can be sent to our office address:

PowerDesigners, LLC
931 E. Main St. Suite 4
Madison, WI 53703
USA

Questions and comments can also be received via fax.

+1.608.231.9979

Check our web site for updated company and product information:

<http://www.powerdesigners.com>

Important Safety Instructions

While every care has been taken to ensure the completeness and accuracy of this manual, PowerDesigners, LLC assumes no responsibility or liability for losses or damages resulting from the use of the information contained in this document. Due to technical improvements, some information contained in this manual may change without notice.

SAVE THESE INSTRUCTIONS -- This manual contains important instructions for PowerCheq that shall be followed during installation and maintenance of the charger.

Before attempting to install and begin equalizing with PowerCheq, please read this manual.

1) WARNING: RISK ELECTRICAL SHOCK. When working with batteries, one needs to have plenty of ventilation. Remove jewelry, wear protective clothing and eye wear (safety glasses), and exercise caution. Do not touch un-insulated battery connectors or terminals. Be sure to discharge static electricity from tools and body by touching a grounded surface in the vicinity of the batteries but away from the cells. All tools should be adequately insulated to avoid the possibility of shorting connections. **Whenever possible, follow the manufacturer's instructions for correctly installing batteries.**

2) CAUTION: RISK OF ELECTRIC COMPONENT FAILURE DUE TO IMPROPER CONNECTION. If PowerCheq modules are incorrectly wired to the battery string, the modules risk being damaged.

3) CAUTION: MODULES MAY BECOME HOT TO TOUCH. PowerCheq is encased in a flame retardant epoxy resin that meets UL 94V-0. This resin is thermally conductive. Please use caution if handling PowerCheq while module is in fully active mode.

Technical Specifications

Nominal Battery Voltage	12V
Operating Voltage	10.5V-16.5V
Max. Equalization Current	2A
Quiescent Current Draw	≤ 5mA
Operating Temperature*	-25°C – 50°C
Typical Efficiency	85%
Current Limit	PowerCheq will not exceed the maximum equalization current limit.
Voltage Sense Resolution	0.2% of nom. battery voltage
Operational Voltage Differential (V_{diff})**	➤ $V_{diff} < 75\text{mV}$ ($\pm 10\%$): No EQ ➤ $75\text{mV} < V_{diff} < 150\text{mV}$: Intermediate ➤ $V_{diff} > 150\text{mV}$ ($\pm 10\%$): Full EQ
Operating Modes	Equalizes during charge, discharge, and idle modes
Safety	➤ Under voltage shutdown <10.5V ➤ Over voltage shutdown >17.0V ➤ Reverse polarity protection ➤ Transient voltage protection ➤ Replaceable fuses
Fuse	2A mini ATO (replace with same fuse)
Dimensions	2.375" x 2.75" x 0.875"
Weight	0.3 lb. (136 g)
Patented	US Patent No. 6150795

* Contact PowerDesigners for further details.

** No EQ: quiescent current (5mA), Intermediate: >5mA-2A, Full EQ: 2A
Specifications are subject to change without further notice.

Limited Warranty

1. PowerDesigners warrants the Product against any defects in materials and workmanship for a period of one (1) year commencing on the date of shipment of the Product (the "Warranty Period");
2. PowerDesigners shall replace the Product at no additional charge in the event of a defect in materials and workmanship during the Warranty Period (the "Limited Warranty");
3. The Limited Warranty shall not cover damage to the product resulting from
 - (a) improper installation of the Product;
 - (b) use of the product for a purpose other than its intended purpose;
 - (c) failure to follow PD's instructions concerning proper installation or use of the Product; and
 - (d) the negligence of a person or entity other than PD in the installation or use of the Product;
4. The occurrence of any event or action set for in Sections 3(a) through 3(d) of this Limited Warranty shall result in the voidance of this Limited Warranty;
5. In the event any Product fails to comply with the foregoing warranty Seller will, at its option, either (a) repair or replace the defective Product, or defective part or component thereof, F.O.B. sellers facility freight prepaid, or (b) credit Buyer for the purchase price of the Product. All warranty claims shall be made in writing. Seller requires all non-conforming Products be returned at Sellers expense for evaluation unless specifically stated otherwise in writing by Seller.
6. This warranty does not cover failure or damage due to storage, installation, operation or maintenance not in conformance with Seller's recommendations and industry standard practice or due to accident, misuse, abuse or negligence. This warranty does not cover reimbursement for labor, gaining access, removal, installation, temporary power or any other expenses which may be incurred in connection with repair or replacement. This warranty does not apply to equipment not manufactured by Seller. Seller limits itself to extending the same.

Troubleshooting/FAQs

SYMPTOM	PROBABLE CAUSE	ACTION
No LED lights	When the string has been equalized, PowerCheq enters into “idle” mode & all LEDs turn off. If the fuses are open, the LEDs will turn off.	➤ No action required, when batteries are in need of equalization the green LED light will turn on automatically. ➤ Check the fuses and replace with same type if blown
A Red LED light	1) There may be an intermittent connection between the battery terminal and the wire, or there may be a tear in the wire. 2) UVLO (Under Voltage Lockout) or OVLO (Over Voltage Lockout) has occurred.	1) Check the connection between the battery terminal and the wire to confirm that they are solidly connected and there aren't any tears in the wires. Also check that your wiring configuration between the PowerCheq and the batteries matches the diagram included in the installation diagram in the Installation section of this manual. 2) Check voltage on both sides of the PowerCheq for a failed battery. Once the battery returns to a safe voltage, the red LED will disappear. Note that PowerCheq is equipped with fuses that may blow under excessive OV or UV conditions.
A Blinking Green LED light	During equalization, the Green LED light will blink, this is normal and shows that PowerCheq is working properly.	No action required.
Blinking Red and Green LED lights	PowerCheq's white wire may not be connected or the connection may be broken.	Check to see if the white wire is properly connected..

Introduction

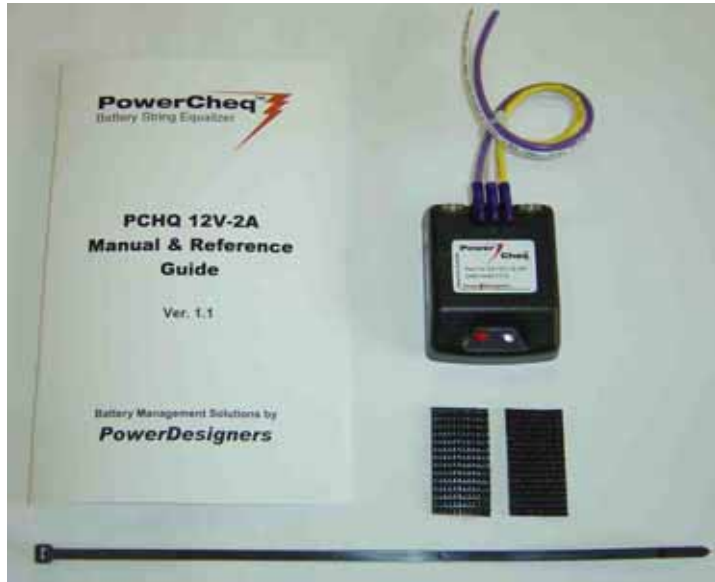
PowerCheq™ is a smart new alternative to string equalization. By equalizing individual batteries within the string, batteries are properly maintained and kept at the same level of charge. During charging, all batteries will receive a full charge, thus preventing under/overcharging. PowerCheq is the first real time equalization system that equalizes and maintains batteries during charging, discharging, and while sitting idle. With PowerCheq, the life cycle cost of motive and stationary batteries is greatly reduced.

Series connected battery strings are used as power sources in many applications including stationary (backup) and motive power systems. Proper maintenance of batteries within the string is key to ensuring maximum performance and life of the whole string.

Differences in cell chemistries and temperature gradients across the string can lead to imbalances between individual batteries. Within a string, the batteries are charged in series, and it is unlikely that all batteries will receive an equal and proper charge. This improper charge leads to some batteries receiving a full charge while others receive an insufficient charge (undercharged). During subsequent discharge cycles, the undercharged batteries may be driven to very low voltages and the batteries could be forced into cell reversal, leading to permanently damaged batteries.

If undercharged batteries are not maintained properly, battery string capacity and longevity is greatly compromised. Many battery manufacturers recommend battery string equalization to circumvent the negative impacts of improper charging. String equalization of batteries is generally accomplished by periodically providing a boost charge to the string, in which a low level charging current is maintained for enough time to ensure that the weakest battery (most undercharged) within the string is brought to a full charge. Unfortunately, this will also lead to overcharging the fully charged batteries resulting in gassing and heat build up, which will potentially damage the battery. In fact, many recent studies have shown that string equalization schemes significantly reduce the life cycle of the battery string.

Package Content



PowerCheq package

The PowerCheq package contains the following items:

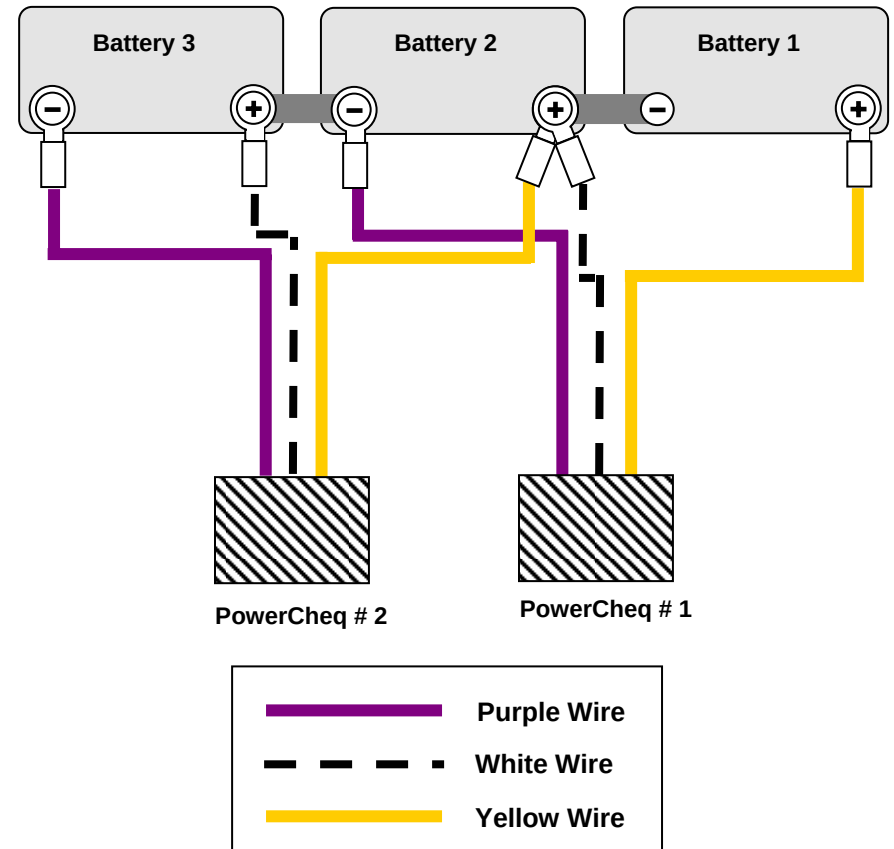
- 1 PowerCheq unit
- 1 Installation and Reference Guide manual
- 1 Tie wrap for mounting the unit
- 1 Set of industrial velcro for mounting the unit

A close up of the PowerCheq module is shown below. Two external and replaceable fuses are housed in the back of the unit to protect the device in case of fault. **Replace only with 2A mini ATO type fuses.**

All subsequent PowerCheq modules are connected in the same manner.

Caution: When connecting **PowerCheq**, the white wire is always connected last. When disconnecting **PowerCheq**, the white wire is removed first.

PowerCheq™ Installation Wiring Diagram



Installation Instructions

Preparation of Wires: PowerCheq comes pre-assembled with 5/16" terminal lugs. Suitable connections on the wires will need to be made for lead length customization. Many of the battery connections will have two wires attached so **DO NOT** tighten battery connections until all of the PowerCheq modules have been put into place. Diagram 1 represents a typical wiring scheme.

Locate the **POSITIVE** terminal of the first battery in the series connected string of batteries.

NOTE: The positive terminal of the first battery in the series connected string is not connected to any other battery.

Locate the **NEGATIVE** terminal of the last battery in the series connected string of batteries.

NOTE: The negative terminal of the last battery in the series connected string is not connected to any other battery.

The PowerCheq modules must be hooked up starting with the **first** battery in the string, working towards the **last** battery in the string. It is critical that this order be followed. When the connections are being made a small spark will be generated. This is normal and is caused by PowerCheq energizing rapidly.

1. Connect the **yellow** wire of **PowerCheq #1** to the positive terminal of Battery 1.
2. Connect the **purple** wire of **PowerCheq #1** to the negative terminal of Battery 2.
3. Connect the **white** wire of **PowerCheq #1** to the positive terminal of Battery 2.
4. Connect the **yellow** wire of **PowerCheq #2** to the positive terminal of Battery 2.
5. Connect the **purple** wire of **PowerCheq #2** to the negative terminal of Battery 3.
6. Connect the **white** wire of **PowerCheq #2** to the positive terminal of Battery 3.



Operation

PowerCheq is a bi-directional battery equalization device that is connected across pairs of batteries within a string. A battery string with N batteries requires N-1 PowerCheq modules. The PowerCheq modules interconnect batteries in a series string creating a bidirectional charge transfer path between neighboring batteries, thus enabling the entire battery string to be equalized. Bi-directional equalization ensures that all batteries in a string are equalized no matter where the low voltage battery is located.

This patented equalization approach takes the guesswork out of the timing and duration of the charge equalization process. If the difference between two series batteries within the stack exceeds a preset level, the respective PowerCheq automatically detects the mismatch and is activated in a progressive manner.

LED LIGHTS DURING OPERATION:

GREEN LED

- SOLID LED indicates that PowerCheq is in full equalization mode.
- FREQUENT BLINKING LED indicates that PowerCheq is in the equalization process.
- INFREQUENT BLINKING LED indicates that equalization is just beginning or it is tapering off.
- NO LED indicates that PowerCheq is deactivated and all batteries are at an equal charge.

RED LED

- SOLID LED indicates that a battery is exceeding or falling below normal operating voltage or that there is a problem with the wiring connection.

PowerCheq derives its control power from the battery string. It requires no external power source. The efficiency of PowerCheq is typically 85% while equalizing. When the string has been equalized, PowerCheq enters into “idle mode” and all LEDs are turned off. SEE TROUBLESHOOTING for more details.

Installation



Warning:

Risk of Electrical Shock. When working with batteries, one needs to have plenty of ventilation, remove jewelry, wear protective clothing and eyewear (safety glasses), and exercise caution. Whenever possible, please follow the manufacturer’s instructions for correctly installing batteries.

Caution:

Risk of Electrical Component Failure due to Improper Connection. If the PowerCheq modules are incorrectly wired to the battery, the PowerCheq module will be damaged.