

Installation and Operations Manual

eIQ vBoost Models

vBoost 250 and vBoost 350





vBoost | 250

vBoost | 350

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1. Purpose

The purpose of this document is to provide a product description, installation, and operating instructions for the eIQ vBoost 250 and 350 components.

Process Description

To ensure that the installation and operations of the vBoost component is performed safely and meets all requirements specified by Safety and Engineering.

2. Notes, Conventions, Labels

To reduce the risk of electrical shock, equipment damage, and to ensure the safe installation and operation of the eIQ vBoost, the following safety symbols appear in this document to indicate potentially hazardous conditions and important safety instructions.



NOTE: *This symbol indicates information particularly important for correct system installation and operation. Follow these instructions closely.*



IMPORTANT! *This symbol indicates that the user should take care when performing certain activities. Ignoring precautions could result in unfavorable consequences.*



CAUTION *This symbol indicates a potentially hazardous situation, that, if not avoided, could result in minor or moderate injury, and/or damage to property.*



WARNING *This symbol indicates a situation where failure to follow instructions may expose the user to electrical or other hazards, or cause serious hardware failure if not applied appropriately. Use caution when performing these tasks.*

3. IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important instructions for the vBoost that shall be followed during installation and maintenance of the equipment.



CAUTION

Electrical installations must be carried out in accordance with the National Electrical Code (NEC), ANSI/NFPA 70, and with any other codes and regulations applicable to the installation site



CAUTION

Only qualified personnel should install and/or replace eIQ Boosts.



CAUTION

Do not attempt to open the eIQ Boost; it contains no user-serviceable parts. In the unlikely event that one should fail, please contact eIQ Customer Service to obtain an RMA number and start the replacement process.



IMPORTANT! Tampering with or opening the eIQ vBoost will void the warranty.



CAUTION

The body of the eIQ vBoost may reach a temperature of 80° C (175° F) due to its location. To reduce risk of burns, do not touch.



WARNING

Do NOT disconnect the PV module from the eIQ vBoost without first removing the electrical load.



NOTE: For eIQ vBoost Warranty Terms and Conditions, refer to A1Limited Warranty in the Appendix of this manual.

4. Product Listing and Compliance Information

Your eIQ vBoost has been designed and independently tested to meet or exceed the following international requirements and standards:

USA

UL1741-2005 and IEEE 1547	"Inverters, converters and controllers for use in independent power systems"
FCC Part 15	Limits for a Class B device

CANADA

CAN/CSA-C22.2 No. 107.1-01	"General Power Supplies"
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EUROPE

This equipment is compliant with the applicable CE Mark Directives:

- Low Voltage Directive – 2006/95/EC
- Electromagnetic Compatibility Directive – 2004/108/EC
- Restriction of Hazardous Substances (RoHS) Directive – 2002/95/EC

The following standards were used in the evaluation to the above Directives:

EN60950	"Information Technology Equipment – Safety"
IEC 61000-6-1-2005	"Electromagnetic compatibility generic standards – immunity for residential, commercial and light-industrial environments"
IEC 61000-6-3-2006	"Electromagnetic compatibility generic standards – emission standard for residential, commercial and light industrial environments"

5. The eIQ vBoost System

5.1 Product Description

The vBoost from eIQ Energy represents the next stage of maximum power harvesting for renewable energy sources. Ideally suited for grid-tie installations, the vBoost performs a unique power conversion that allows parallel connection of virtually any photovoltaic (PV) panel to a system voltage bus. By connecting the generators in parallel, each generator becomes an independent source whose power harvesting can be maximized while minimizing its effect on the larger system. Whether a panel is operating under full sun or shaded conditions, its maximum power is delivered to the bus without affecting the bus voltage. The vBoost minimizes I^2R power losses by up-converting the panel voltage to a normalized direct current (DC) bus voltage of 200 V to 350 V. This stabilization or normalization of the bus voltage permits a more efficient and less expensive inverter.

Panel Power Maximization

Per-panel Mean Power Point Tracking (MPPT) ensures that each panel is operating at its maximum power output regardless of how its neighboring panels are operating. A shaded or underperforming panel affects only that panel's output. The vBoost MPPT is a real-time, instantaneous correction function with better than 99.7% tracking.

Mix and Match

The normalization of the output of each generator allows an unprecedented ability to mix and match PV panels of any technology or size, regardless of their individual operating characteristics. Panel mismatch, either initial or caused by age-related degeneration or destabilization, does not have any systemic effect. Various PV generators, such as BIPV, thin film, or silicon, can all coexist on the same bus, leading to a single point of grid-tie.

Easy Expansion

The parallel architecture allows easy system expansion, so additional panels can simply be added to an existing installation. Retrofit to existing installations is quick and simple.

Panel Identification, Monitoring and Reporting

Each panel is identified and continuously monitored for performance data gathering as well as fault-condition alerts. Panels can be either individually or collectively shut off for emergencies or maintenance, and the panel output is disabled if an inverter is not operational or is disconnected from the bus. Panel data is sent over the DC bus power line and collected at the inverter, where it is sent via web services to the database for storage and reporting. Trend tracking can be used to plan preventive maintenance.

Reliability

System reliability is greatly enhanced by redistributing the concentrated heat generation at the inverter into smaller, easily dissipated segments. Smaller, standard power conversion devices can exploit significant economies of scale, resulting in no net cost increases to the system over conventional string installations. Each converter is fused, making PV panel series fuses in combiner boxes unnecessary.

5.2 Benefits of the eIQ vBoost

Safety

Each vBoost is constantly monitoring the status of the system, including the inverter. If the inverter is switched off (or fails), the vBoosts immediately shut off. This means that all DC voltage is removed except the output of each PV panel to its vBoost. This situation is much safer for emergency servicing or for anyone who has to access the PV wiring.

Each vBoost has its own internal fuse (1.5 A) on the output, which provides series protection for each PV Module and for the cable to the junction box. Each vBoost also has diode protection on its output, which protects both the vBoost and the PV module from potentially harmful reverse currents in the event of a PV module failure.

Inverters can sustain damage if they are exposed to excessive voltage. These high voltages can occur when panel temperatures decrease, causing their open-circuit voltage to increase. Due to the mode of operation of the vBoost, the voltage is maintained below 350 VDC regardless of the number of panels attached or the ambient temperature.

The vBoost housing is watertight and complies with the NEMA 4 / IP 66 environmental enclosure rating standards. The eIQ vBoosts are designed to operate normally at ambient temperatures as high as 65°C (150°F).

Parallel Systems

Parallel-connected PV systems are inherently more reliable than serially connected ones. The parallel nature of the system ensures that there is no single point of failure associated with the PV modules. If a PV module fails, or is shaded, the vBoost system ensures that it does not degrade the overall power output of the system, as it would in a series system.

PV systems using eIQ vBoosts are very simple to design and install. Because the PV arrays are connected in parallel, string voltage calculations are not required. Individual PV modules can also be installed in any combination of module quantity, type, age, and orientation. Each vBoost quickly mounts on the PV racking, adjacent to each PV module.

Cost Reduction

The use of a parallel architecture reduces the amount and complexity of cabling and components needed for an installation. The constant voltage output of the vBoost units eliminates the need to have large numbers of small 'strings' running to expensive combiner boxes and the usual precautions related to system overvoltage that can occur due to temperature fluctuations.

6. Installation



IMPORTANT! Before installing the vBoost, read all instructions and cautionary markings on the vBoost and on the photovoltaic array in the User Manual.



CAUTION Perform all electrical installations in accordance with all local electrical codes and the National Electrical Code (NEC), .ANSI/NFPA.

The eIQ vBoost can quickly be mounted on the PV racking adjacent to each PV module. The mounting adaptor bracket allows for a wide range of mounting configurations to suit the installation configuration and hardware.

The vBoost is secured by using either $\frac{3}{8}$ " or $\frac{1}{4}$ " or 10-mm or 6-mm bolts through the slots and holes provided in the bracket. This hardware should be stainless steel as used elsewhere in the assembly of the installation.

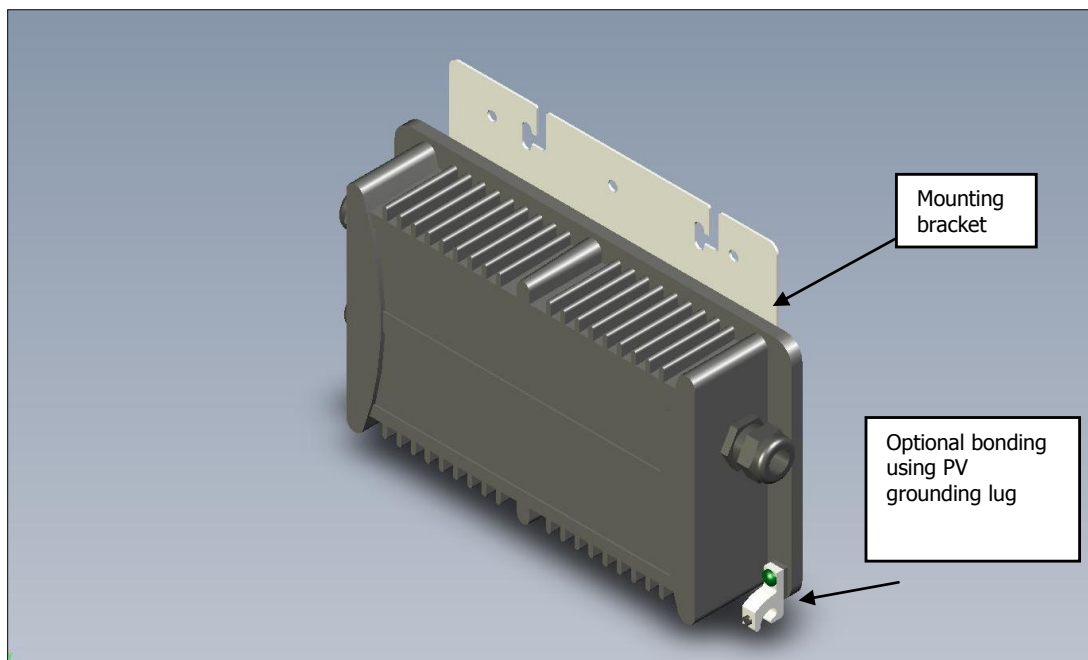


Figure 1. vBoost Mounting and Bonding Options

The vBoost can be attached in any orientation that suits the installation. The interconnect cables are designed to connect directly between adjacent units. Aligning the vBoosts in the same orientation along an array enables the wiring to be easily attached and secured.

If required, the case may be electrically bonded to the panel mounting structure by fastening an approved bonding attachment to the stud provided on the case. Bonding can then be achieved by attaching the same grounding conductor that is used to ground the array structure. These bonding lugs can be obtained from a PV part supplier. Refer to Figure 1 for an illustration of the bonding lug.

6.1 Installation Procedure

Installing the eIQ vBoost System involves six key steps:

1. Choosing the locations for your vBoosts – See Section 6.2 *Choosing a Location*
2. Attaching the vBoosts to the racking – See Section 6.3 *Attaching the vBoosts to the Racking*
3. Connecting the vBoost wiring harnesses – See Section 6.4 *Connecting the vBoost Wiring Harnesses*
4. Bonding the system if required by local or national Code – See Figure 1
5. Grounding the system, if necessary – See Section 6.5 *Grounding the System*
6. Completing the eIQ installation map – See Section 6.6 *Completing the eIQ Installation Map*

6.2 Choosing a Location

The vBoost is designed to be mounted to a wide range of PV array racking types. The brackets that are available with the vBoost also allow the unit to be mounted in a wide variety of orientations.

The cables for interconnecting the vBoosts are designed to fit correctly for a range of PV panels and are configured for lengths between 36" and 48" (90 cm and 120 cm) long, allowing for a wide range of mounting options. Choose a location that allows for the connection of the module cables and for the connection of the bus cables between boxes. Allow adequate slack for cable tension relief. Refer to Figure 2. **Error! Reference source not found.**

The vBoost should be mounted behind the PV module where possible, here it is protected from direct sunlight and helps ensure the box and cables are not in a position where they could be an obstruction or get damaged.



Figure 2. Mounting the vBoost to PV Array

6.3 Attaching the vBoosts to the Racking

The vBoosts can be fitted before or after the PV modules are installed. It is generally easier to attach them before securing the panels because this method improves access for installing fastening hardware and making minor adjustments.

Install the mounting hardware in the chosen location and mount the vBoost using the hardware normally provided with the racking system.

The vBoost can be mounted in a wide variety of orientations, depending on the type of racking and available space.

Confirm that the wiring easily reaches between the modules and the boxes. When the unit is correctly positioned, fasten the hardware.



WARNING Ensure that the vBoost is not touching the rear surface of the PV module. Direct contact can lead to heat buildup and damage to the PV module.

6.4 Connecting the vBoost Wiring Harnesses

The two DC input wires (for connection to the PV module) are approximately six inches long. For most PV panels, these are terminated with single-pole, multi-contact (MC) type connectors. Where applicable, MC4 type connectors may be present. The PV module cables plug into these connectors.

Each vBoost also has one incoming and one outgoing DC bus harness. The bus harnesses are linked between each of the vBoost boxes and, ultimately, to the inverter. The connectors on the bus harnesses are oriented so that multiple vBoosts can be connected to

form one continuous DC circuit. In the unlikely event that one vBoost becomes inoperable the other vBoost units on this common bus will not be affected.

The order of connection is as follows:

1. Connect the PV module wires to the vBoost "Panel DC" input wires.
2. Plug the DC interconnector of the first vBoost into the connector of the next vBoost, and so on, to form a continuous DC circuit.
3. Connect the last vBoost in each string to the junction box. This can be done using the eIQ Energy 'termination cable', or by creating a cable of suitable length with connectors. Trim the cable to length and terminate in accordance with local codes, the National Electrical Code (NEC), and ANSI/NFPA70.



WARNING The maximum number of vBoosts that can be connected in one 'string' is determined by derating factors including the maximum ambient temperature at the installation site. These factors define the maximum current permitted in the 10 AWG conductors used in the interconnect cables. Refer to the National Electrical Code (NEC) 70, Article 310 for details.

6.5 Grounding the System



The vBoost does not require safety grounding. If equipotential bonding is required, it can be achieved by using suitable ground circuit washers approved for the array racking when mounting the unit. Alternatively, a PV grounding lug can be attached to the stud provided on the case and used to bond the case to the frame using bare copper grounding conductors (refer to NFPA 70, Art 690).

6.6 Completing the eIQ Installation Map

The eIQ monitoring system allows you to track the performance of individual vBoost modules. To provide a physical context to the installation and each unit's performance, the system provides you with a location grid that can be used to represent the physical layout of your PV grid. This system is represented by a series of rows and columns that can be used to provide a physical reference to your site (see Figure 3).

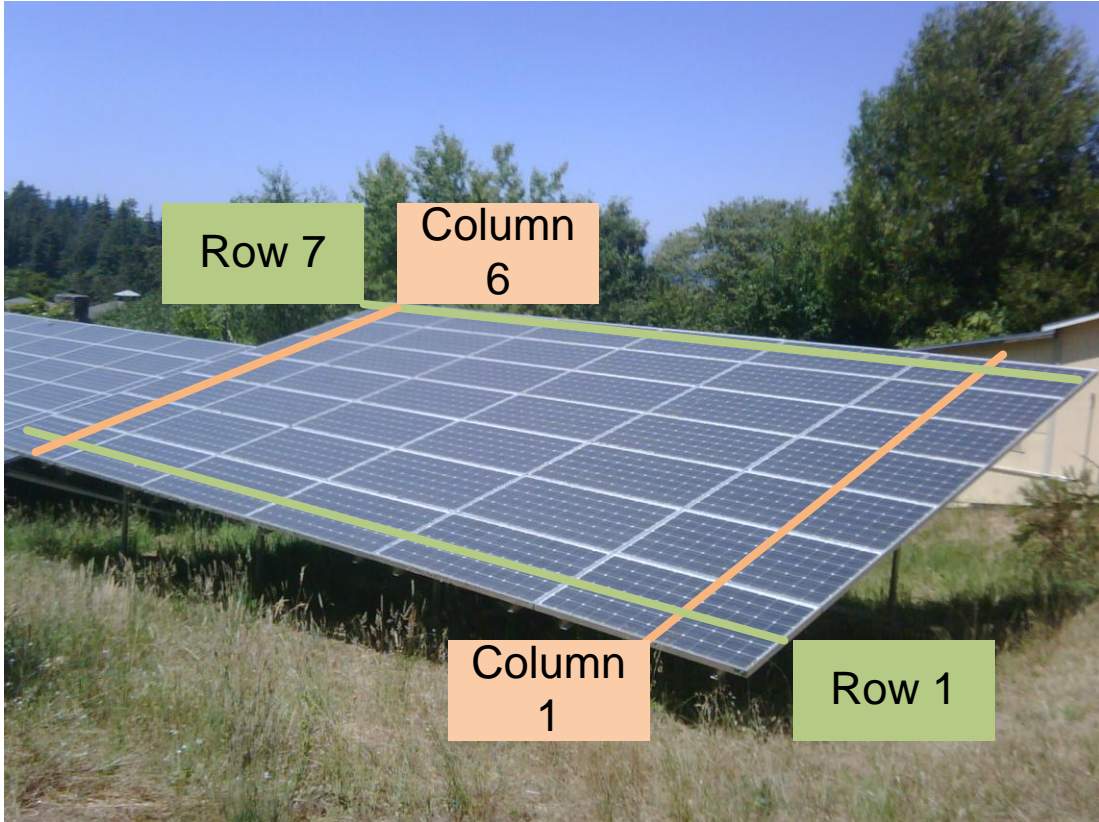


Figure 3. Example of Defining Columns and Rows on a PV Grid

Procedure

1. Refer to Figure 3 and the form on the following page to design your installation map.
2. Each eIQ vBoost has a removable serial number label located on the top cover. Peel the removable serial number label from each eIQ vBoost and affix it to the respective location on the eIQ installation map.
3. Access the Parallax EDC administrator software to enable the monitoring capability of the Parallax system. This application allows you to associate your Communication Module with a specific location on the PV grid and identify the vBoost units that are connected to it.
4. When the associations are complete, use the column and row fields in the vBoost configuration screens to enter the information. This process displays the vBoost units in their physical orientation in the various graphical representations in the Parallax monitoring application.

Location: _____	Array: _____										Date: _____									
Column	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Row 1																				
Row 2																				
Row 3																				
Row 4																				
Row 5																				
Row 6																				
Row 7																				
Row 8																				
Row 9																				
Row 10																				
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Row 17																				
Row 18																				
Row 19																				
Row 20																				

Figure 4

7. Commissioning

Commissioning the vBoost system is the process by which you provide the information to the online data system regarding the physical orientation of the vBoost units. This information will then be used by the various reporting services associated with the installation to properly represent the data being provided from the vBoost units.

To commission the eIQ vBoost PV system it is necessary to have a completed chart as provided in figure 4 above. This will provide the necessary information on the column and row configuration for your vBoost array.

8. In Use

The data from the vBoost units can be viewed in raw format using the EDC website provided by eIQ Energy. This data is available in raw format and can be downloaded into an excel spreadsheet. For more information please see the eIQ Energy web site.

9. Troubleshooting

It is necessary for the vBoost units to see the Communications Module on the line before they will power up. If the vBoost units do not power up please check the following:

1. Verify that the vBoost modules are properly connected so that starting from the end of the run furthest from the inverter, that each vBoost unit output is connected to the vBoost input on the next unit closer to the inverter.
2. Verify that all DC disconnects are in the "powered on" position prior to turning on the Communications Module and the Inverter.
3. Verify that the Communication Module is receiving 120VAC power.

If the vBoost units are still not producing power, using a DC voltage probe check that the modules connected to the vBoost unit has voltage present.

If after you have completed these steps the vBoost unit still is not producing power into your inverter then please see our website at www.eiqenergy.com for further troubleshooting tips and contact information for customer support.



WARNING Do not attempt to repair the eIQ vBoost; it contains no user-serviceable parts. If troubleshooting methods fail, the vBoost must be returned to your distributor for replacement.



WARNING Only qualified personnel should troubleshoot the PV array and the eIQ vBoost.

10. Disconnecting the eIQ vBoost from the PV Module

Before disconnecting any vBoost connections, the load must be removed from the system the vBoost is connected to. Depending on the layout of the system, this may be done by opening the DC disconnect for that line, or by turning off the inverter (refer to inverter manual for instructions).

When the load is removed, the vBoost cables may be safely disconnected.

If a replacement vBoost is not immediately available, the system can be put back into operation by bypassing this vBoost. Simply install an eIQ jumper cable of the correct length between the two adjacent vBoosts on either side, and return the load to the system.

11. Technical Data

11.1 Technical Considerations

The eIQ vBoosts are designed to operate with most PV module configurations. For more information, refer to the eIQ website (<http://www.eIQenergy.com>)

11.2 Technical Specifications

Parameter	vBoost S250BST	vBoost S350BST
INPUT		
Power min / max	0 / 250W	0 / 350W
Voltage min / max	20 / 50Vdc	30 / 100Vdc
Current min / max	0 / 10Adc	0 / 10Adc
OUTPUT		
Power min / max	0 / 250W	0 / 350W
Voltage min / max	200 / 350Vdc	250 / 350Vdc
Current min / nom / max	0 / 0.85A / 1.25Adc	0 / 0.85 / 1.25Adc
Efficiency	97-98%	97-98%
MPPT		
OPERATING CONDITIONS		
Ambient Temp(°C)	-40 to +65	-40 to +65
Ambient Temp (°F)	-40 to +150	-40 to +150
Night Power Consumption	0 Watts	0 Watts
Output Fuse Rating	1.5 A	1.5 A
Current Limiting Level	1.25 A (internal)	1.25 A (internal)
Over Voltage Protection	350 V (internal)	350 V (internal)
Preferred Inverter Input State	Constant Voltage Mode	Constant Voltage Mode
Line Fault Detection	No bus voltage = no output	No bus voltage = no output
ENCLOSURE		
Environmental Protection	IP66 / NEMA 4	IP66 / NEMA 4
Input Connection Type		
Output Connection Type	Multi-pin proprietary	Multi-pin proprietary
Dimensions (exc. bracket)	10.5" x 5" x 2"	"10.5" x 5" x 2"
	20 cm x 8 cm x 5 cm	20 cm x 8 cm x 5 cm
Weight	3 lbs	3 lbs
DATA COMMUNICATIONS		
vBoost to Inverter	Input power / current / voltage; Output power / current / voltage; Efficiency; ambient temp. Alerts: over-current; over-voltage.	

Appendix

A1 Limited Warranty

eIQ Energy Inc. ("eIQ") has developed a highly reliable vBoost system that is designed to withstand normal operating conditions when used for its originally intended purpose in compliance with the eIQ User Manual supplied with the originally shipped system. The eIQ limited warranty ("Limited Warranty") covers defects in workmanship and materials of the eIQ vBoost ("Defective Product") for a period of twenty-five (25) years from the date of original purchase of such vBoost at point of sale to the originally-installed end user location (the "Warranty Period").

During the Warranty Period, the warranty is transferable to a different owner as long as the vBoost remains installed at the originally-installed, end user location. During the Warranty Period, eIQ will, at its option, repair or replace the Defective Product free of charge, provided that eIQ through inspection establishes the existence of a defect that is covered by the Limited Warranty. eIQ will, at its option, use new and/or reconditioned parts in repairing or replacing the Defective Product. eIQ reserves the right to use parts or products of original or improved design in the repair or replacement of Defective Product. If eIQ repairs or replaces a Defective Product, the Limited Warranty continues on the repaired or replacement product for the remainder of the original Warranty Period or ninety (90) days from the date of eIQ's return shipment of the repaired or replacement product, whichever is later.

The Limited Warranty covers both parts and labor necessary to repair the Defective Product, but does not include labor costs related to un-installing the Defective Product or re-installing the repaired or replacement product. The Limited Warranty also covers the costs of shipping repaired or replacement product from eIQ, via a non-expedited freight carrier selected by eIQ, to locations within the United States (including Alaska and Hawaii) and Canada, but not to other locations outside the United States or Canada. The Limited Warranty does not cover, and eIQ will not be responsible for, shipping damage or damage caused by mishandling by the freight carrier and any such damage is the responsibility of the freight carrier. To obtain repair or replacement service under this Limited Warranty, the customer must comply with the following policy and procedure:

All Defective Products must be returned with a Return Merchandise Authorization (RMA) number which the Customer must request from eIQ. Before requesting the RMA, however, the customer should contact an eIQ technical support representative to evaluate and troubleshoot the problem while the eIQ vBoost is in the field, since many problems can be solved in the field. If in-field troubleshooting does not solve the problem, the Customer may request the RMA number. This request must include the following information:

- Proof-of-purchase of the Defective Product in the form of (1) the dated purchase receipt from the original purchase of the product at point of sale to the end user; or, (2) the dated dealer invoice or purchase receipt showing original equipment manufacturer

(OEM) status; or (3) the dated invoice or purchase receipt showing the product exchanged under warranty.

- Model number of the Defective Product
- Serial number of the Defective Product
- Printout of the data report from the monitoring system verifying the problem
- Detailed description of the defect
- Shipping address for return of the repaired or replacement product

All Defective Products authorized for return must be returned in the original shipping container or other packaging that is equally protective of the product.

The returned Defective Product must not have been disassembled or modified without the prior written authorization of eIQ.

The Limited Warranty does not cover normal wear and tear of eIQ vBoosts or costs related to the removal, installation, or troubleshooting of the customer's electrical systems. The Limited Warranty does not apply to, and eIQ will not be responsible for, any defect in or damage to any eIQ vBoost that:

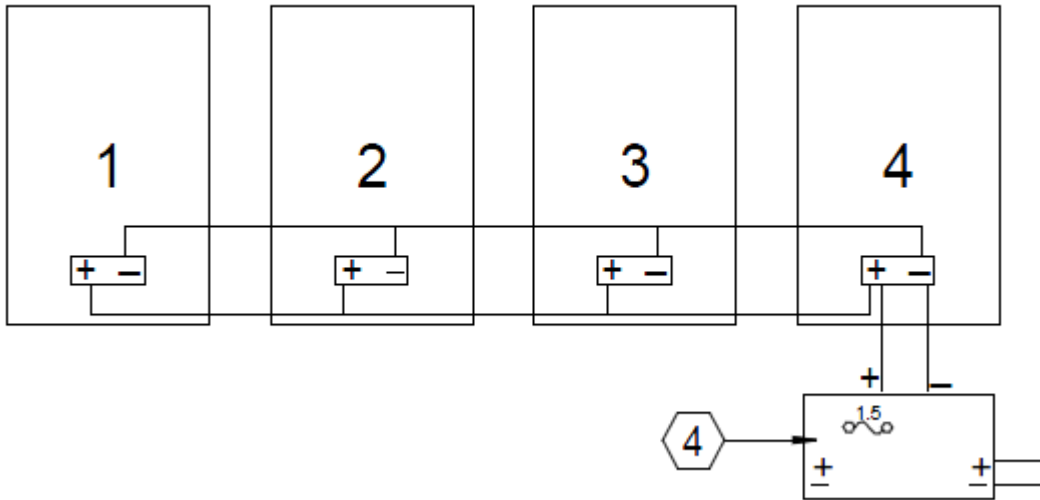
1. has been misused, neglected, tampered with, altered, or otherwise damaged, either internally or externally;
2. has been improperly installed, operated, handled or used, including use under conditions for which the product was not designed, use in an unsuitable environment, or use in a manner contrary to the eIQ User Manual or applicable laws or regulations;
3. has been subjected to fire, water, generalized corrosion, biological infestations, acts of God, or input voltage that creates operating conditions beyond the maximum or minimum limits listed in the eIQ vBoost specifications, including high input voltage from generators or lightning strikes;
4. has been subjected to incidental or consequential damage caused by defects of other components of the solar system; or,
5. if the original identification markings (including trademark or serial number) of such vBoost have been defaced, altered, or removed. The Limited Warranty does not extend beyond the original cost of the eIQ vBoost.

THE LIMITED WARRANTY IS THE SOLE AND EXCLUSIVE WARRANTY GIVEN BY eIQ AND, WHERE PERMITTED BY LAW, IS MADE EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, STATUTORY OR OTHERWISE, INCLUDING, WITHOUT LIMITATION, WARRANTIES OF TITLE, QUALITY, MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OR WARRANTIES AS TO THE ACCURACY, SUFFICIENCY OR SUITABILITY OF ANY TECHNICAL OR OTHER INFORMATION PROVIDED IN MANUALS OR OTHER DOCUMENTATION. IN NO EVENT WILL eIQ BE LIABLE FOR ANY SPECIAL, DIRECT, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, COSTS OR EXPENSES HOWEVER ARISING, WHETHER IN CONTRACT OR TORT, INCLUDING WITHOUT LIMITATION ANY ECONOMIC LOSSES OF ANY KIND, ANY LOSS OR DAMAGE TO PROPERTY, OR ANY PERSONAL INJURY.

To the extent any implied warranties are required under applicable law to apply to the eIQ vBoost, such implied warranties shall be limited in duration to the Warranty Period, to the extent permitted by applicable law. Some states and provinces do not allow limitations or exclusions on implied warranties or on the duration of an implied warranty or on the limitation or exclusion of incidental or consequential damages, so the above limitation(s) or exclusion(s) may not apply.

This Limited Warranty gives the customer specific legal rights, and the customer may have other rights that may vary from state to state or province to province.

A2 eIQ Installation Map





vBoost | 250

vBoost | 350

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