WIND CHARGER
MANUAL
PRO Series

enair

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IMPORTANT SAFETY INSTRUCTIONS

This manual contains important instructions for model power-leader that shall be followed during installation and maintenance of the controller.

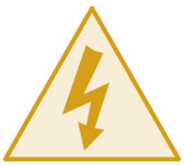
The manual will help you to become familiar with the RCE-ENAIR-120 features and capabilities. Some of these follow:

- LCD meter with easy to read messages.
- DIP switch to set up the wind charger for its intended use. All major functions can be set with DIP switches.
- Rated for 24 or 48 voltage systems and 120 amps current.
- Eight standard charging with DIP switches.
- Continuous self-testing with fault notification.
- LED indications and pushbutton functions.

To reduce the risk of electrical shock hazards and to make sure the equipment is safely installed; special safety symbols are used in this manual to highlight potential safety hazard and important safety information. The symbols are:

WARNING: the paragraphs highlighted by this symbol contain processes and instructions that must be absolutely understood and followed to avoid potential danger to people.

NOTE: the paragraphs highlighted by this symbol contain processes and instructions that must be understood and followed to avoid potential damage to the equipment and wrong results.



CAUTION: Risk of electric shock. Please operate the under the controller under the following explanation.

CAUTION: Risk of hot

Contents

1. Battery Charge Controller

1.1 Operating Parameters

The Controller will manage battery charging by 3-phase wind turbine from the battery to a dedicated diversion load.

Model	**RCE-ENAIR-120**
ELECTRICAL	
System Voltage Ratings	24, 48 VDC
Current Ratings-Battery Charge Control	120A
Current Ratings-Diversion Charge Control	120A (Diversion Load)
Accuracy	24V: ≦0.1%± 50mV 48V: ≦0.1%± 100mV
Min. DC Voltage to Operate	9 VDC
Max. Operating DC Voltage	68 VDC
Max. 3-phase AC Input Voltage	100 VAC
Total Current Consumption	While operating - 50mA At idle - 6mA
High Temp Shutdown	90ºC disconnect load / diversion load 70ºC reconnect load / diversion load
Transient Surge Protection	
Pulse Power Rating	7000 W
Response	< 5 nanosecond
BATTERY CHARGING / BTS	
Charge Algorithm	PWM, constant Voltage
Temp. Comp. Coefficient	-5mV / ºC / cell (25ºC ref)
Temp. Comp. Range	0ºC to 50ºC
Charge Algorithm	PWM, float, equalize (with BTS option)
MECHANICAL	
Dimension (H* W* D) mm	345* 248* 170
Weight (kgs)	8.4
Power Terminals	120A Rated
ENVIRONMENTAL	
Ambient Temperature	-40 to + 45ºC
Storage Temperature	-55 to + 85ºC
Humidity	100% (NC)
Enclosure	Indoor % vented (powder coated steel)

1.2 Adjustability

Eight DIP switches permit the following parameters to be adjusted at the installation site:

DIP Switch		POSITION – Wind Charger			
1		Always in OFF			
2	3	OFF	OFF	48V	
		ON	OFF	24V	Select Battery Voltage
		OFF	ON	12V	
4, 5 , 6		Standard battery charging programs			
7		OFF	Manual Equalization		
		ON	Auto Equalization		
8		Always in OFF			

1.3 General use

- The Controller is configured for negative ground systems. There are no parts in the wind charger's negative leg. The enclosure can be grounded using the ground terminal in the wiring compartment.
- There are no fuses or mechanical parts inside the Controller to reset or change.
- The Controller is rated for indoor use. The wind charger is protected by conformal coated circuit boards, stainless steel hardware, anodized aluminum, and a powder coated enclosure, but it is not rated for corrosive environments or water entry.
- The construction of the Controller is 100% solid state.
- With bulk charging, absorption, float and equalization stages.
- The Controller will accurately measure time over long intervals to manage events such as automatic equalizations or battery service notification.
- LED's, a pushbutton, and LCD meters provide both status information and various manual operations.

2. Controller Installation

The installation instructions describe wind battery charging.

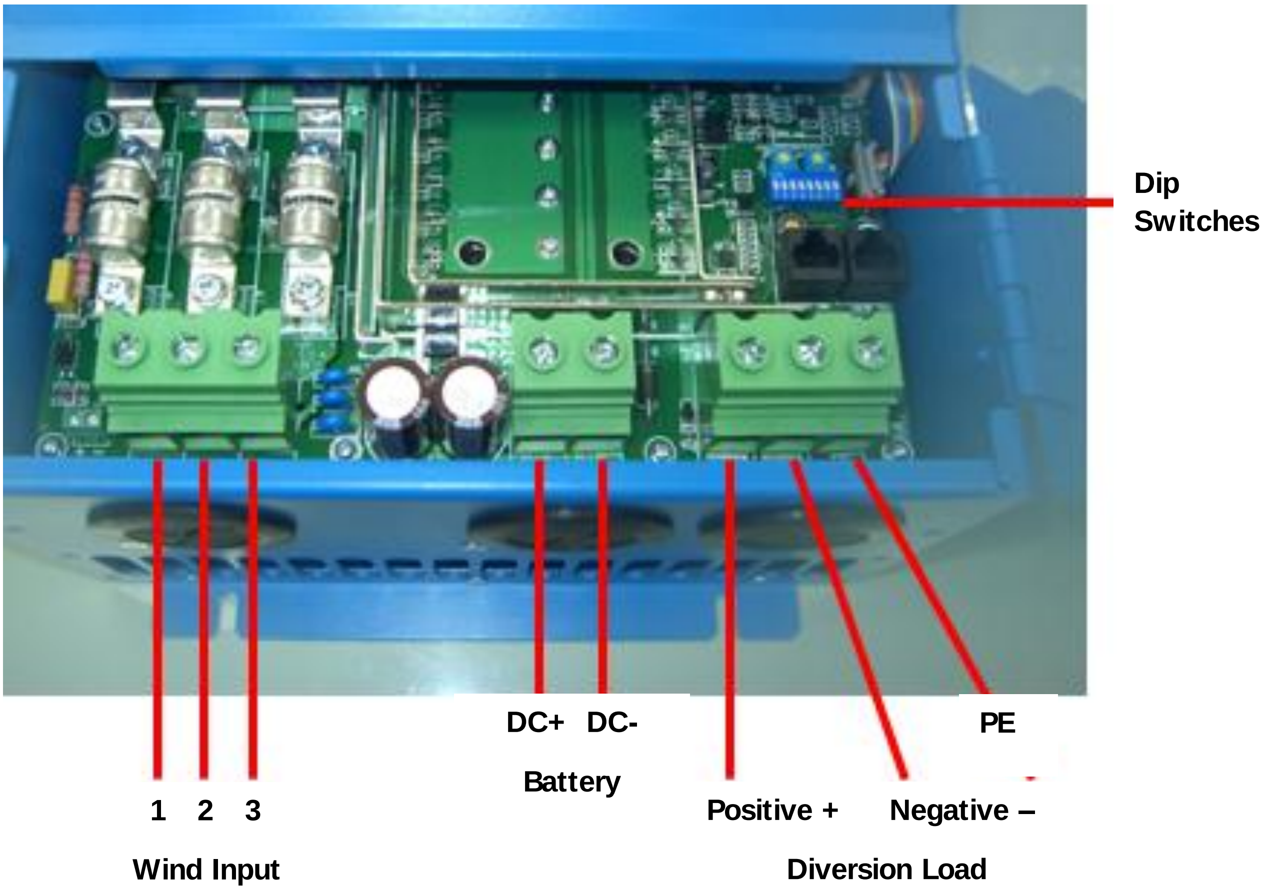
2.1 General information

The mounting location is important to the performance and operating life of the wind charger. The environment must be dry and protected as noted below. The wind charger may be installed in a ventilated enclosure with sealed batteries, but never in a sealed battery enclosure or with vented batteries.

2.2 Installation Overview

The installation is straightforward, but it is important that each step is done correctly and safely. A mistake can lead to dangerous voltage and current levels. Be sure to carefully follow each instruction in Section 2.3 and observe all cautions and warnings.

The following diagrams provide an overview of the connections and the proper order:



2.3 Control Terminal Connection

Name	Description
Wind Input 1	Connecting terminal for Wind Turbine
Wind Input 2	Connecting terminal for Wind Turbine
Wind Input 3	Connecting terminal for Wind Turbine
Battery +	Battery cable Positive connection
Battery -	Battery cable Negative connection
Diversion Load +	Connecting terminal for Diversion Load
Diversion Load -	Connecting terminal for Diversion Load
PE	Connecting terminal for Ground
Dip Switch 1	Always in the OFF position
Dip Switch 2, 3	Selection of battery voltage for 24 or 48V system
Dip Switch 4, 5, 6	Battery Charging algorithm
Dip Switch 7	Auto or Manual Equalization
Dip Switch 8	Always in the OFF position

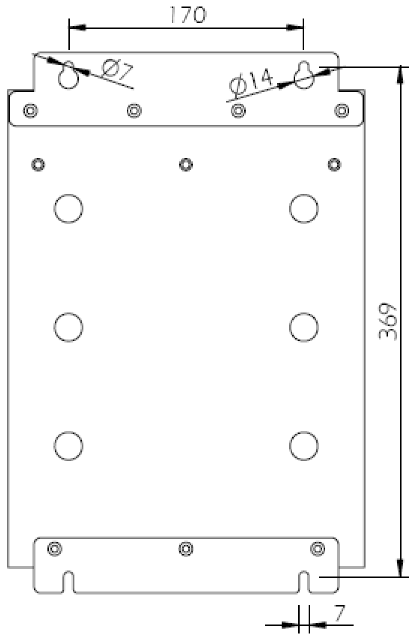
2.4 Installation Steps

The Controller wind charger must be installed properly and in accordance with the local and national electrical codes. It is also important that the installation be done safely, correctly and completely to realize all the benefits that the Controller can provide for your wind system.

Before starting the installation, review these safety notes:

- Do not exceed a battery voltage of 48V (nominal). Do not use a battery less than 12V.
- Charge only 24, or 48V lead-acid batteries when using the standard battery charging programs or NI-CAD batteries when DIP switch number 4~6 is ON position in the Controller
- Verify the nominal charging voltage is the same as the nominal battery voltage.
- Do not install the Controller in a sealed compartment with batteries.
- Never open the Controller access cover unless both the wind turbine and battery power has been disconnected.
- Never allow the Wind Turbine to be connected to the Controller with the battery and Diversion load disconnected. This can be a dangerous condition with high voltage present at the terminals.

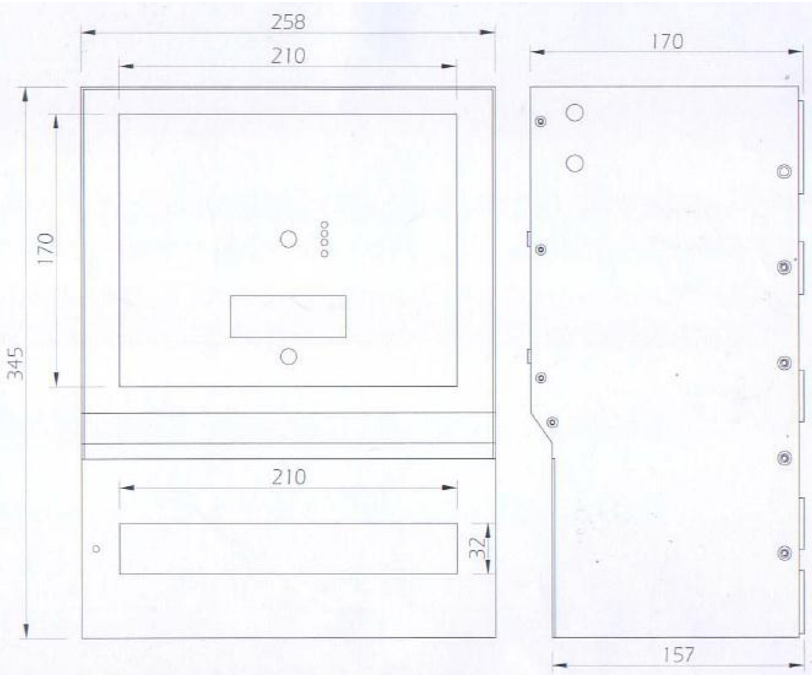
2.4.1 Mounting



Unit: mm

Mounting Dimensions

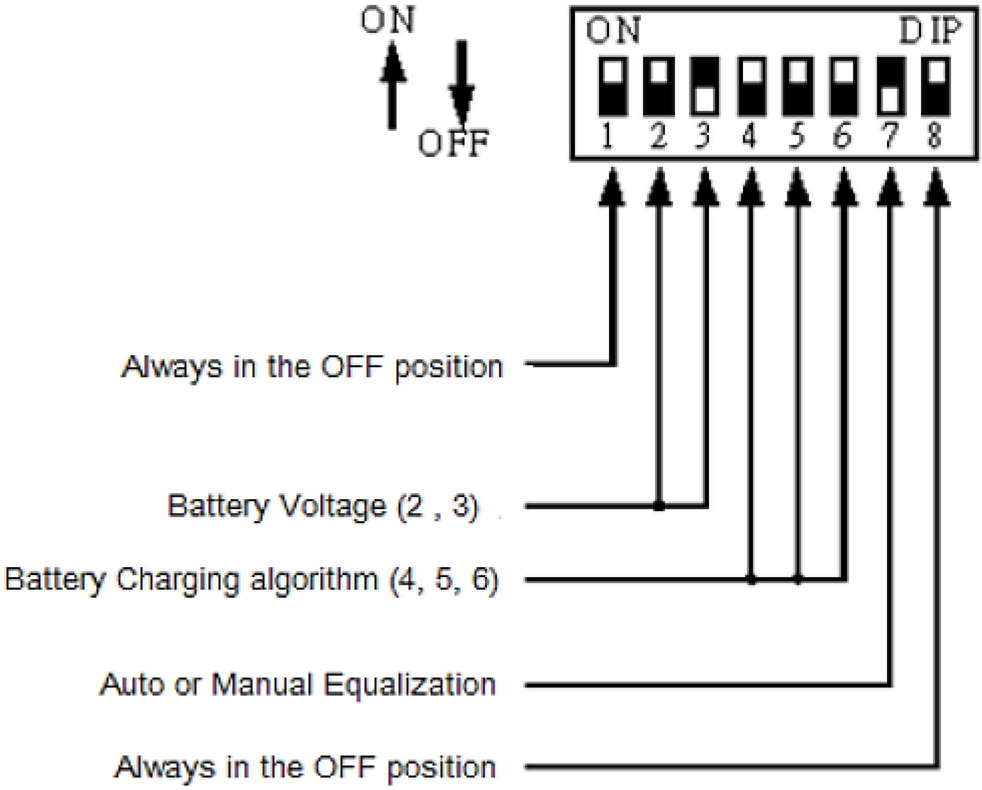
- Locate the Controller on a wall protected from direct sun, high temperatures, and water. Do not install in a confined area where battery gasses can accumulate.
- When mounting the Controller, make sure the air flow around the controller and heat sink is not obstructed. There should be open space above and below the heat sink, and at least 75 mm (3 inches) clearance around the heat sink to allow free air flow for cooling.
- Before starting the installation, place the Controller on the wall where it will be mounted and determine where the wires will enter the controller.



Unit: mm

2.4.2 Diversion Charge Control DIP Switch Settings

The 8 DIP switches are located on the top of the PE terminal. Each switch is numbered. The wind battery charging functions that can be adjusted with the DIP switches follow:



DIP Switch Functions

- As shown in the diagram, all the positions are in the "OFF" position except switch number 3 and 7 which are in the "ON" position.

NOTE: The DIP switches should be changed only when there is no power to the wind charger. Turn off disconnect switches and remove all power to the wind charger before changing a DIP switch. A fault will be indicated if a switch is changed while the wind charger is powered

CAUTION: The controller is shipped with all the switches in the "OFF" position. Each switch position must be confirmed during installation. A wrong setting could cause damage to the battery or other system components

CAUTION: To change a switch from OFF to ON, slide the switch up toward the top of the wind charger. Make sure each switch is fully in the ON of OFF position

DIP Switch Number 1 and 8: Always in the OFF position

DIP Switch Number 2 and 3: System Voltage

Switch 2	Switch 3	System Voltage
OFF	OFF	48V system
ON	OFF	24V system
OFF	ON	12V system

DIP Switch Number 4, 5 and 6: Battery charging algorithm

DIP-4	DIP-5	DIP-6	Bulk Voltage	Float Voltage	Equalize Voltage	Equalize Time (hours)	Equalize Interval (days)
OFF	OFF	OFF	14.0V	13.4V	-	-	-
OFF	OFF	ON	14.1V	13.4V	14.2V	1	28
OFF	ON	OFF	14.3V	13.4V	14.4V	2	28
OFF	ON	ON	14.4V	13.4V	15.1V	3	28
ON	OFF	OFF	14.6V	13.4V	15.3V	3	28
ON	OFF	ON	14.8V	13.4V	15.3V	3	28
ON	ON	OFF	15.0V	13.4V	15.3V	3	14
ON	ON	ON	16.0V	14.5V	-	-	-

Select one of the 7 standard battery charging algorithms, or select NiCad to determine the charging of the battery.

- The above setting voltage value is in the condition of 12V system. The voltage will be twice of above values in the 24V system and it will be four times of above values in the 48V system.
- Refer to section 7.0 of the manual for battery charging information.
- The 7 standard charging algorithms above are described in section 4.2-standard battery charging programs.

DIP Switch Number 7: Equalization

DIP-7	Equalization
ON	Auto
OFF	Manual

2.4.3 Finish Installation

Inspect for tools and loose wires that may have been left inside the enclosure.

Check the power conductors to make sure they are located in the lower part of the wiring compartment and will not interfere with the cover and the LCD meter assembly.

NOTE: If the power conductors are bent upwards and touch the LCD meter assembly, pressing the cover down on the wires can damage the meter.

- Carefully place the cover back on the wind charger and install the one cover screw.
- Closely observe the system behavior and battery charging for 2 to 4 weeks to confirm the installation is correct and the system is operating as expected.

3. Controller Operation

3.1 LED Status Indicators

Battery Voltage (Using LED Status Indicator)			
LED Status	Solid Red	Fault Mode	
	Blinking Orange	Equalization	
	Green LED	Solid	Float Stage
		Blinking	Charge Control or Diversion Control
Always ON	Battery at FLOAT setting		
5 Blinks	Battery at BULK setting		
Bulk Setting Minus (-)			
4 Blinks	0.25VDC	0.50VDC	1.00VDC
3 Blinks	0.50VDC	1.00VDC	2.00VDC
2 Blinks	0.75VDC	1.50VDC	3.00VDC
1 Blink	> 0.75VDC Below Bulk	> 1.50VDC Below Bulk	> 3.00VDC Below Bulk
DC Voltage	12V	24V	48V

Table1. Battery Voltage LED Indication

NOTE: A single green flash indicates the battery is below the bulk voltage setting. It does not indicate the batteries are charging

3.2 LCD Displays

Sequence of screens when you push: Display Select

Amp Watts BatV **0.0 0.0 24.0**	Amp – DC Load (0 – 120A) Watts (0 – 6000W) Battery Voltage (10.5 – 80V)
Amp-Hours **0Ah**	Average Amp-hours in last hour
Total Amp-Hours **0Ah**	Totalizing Amp-hours: 0 to 999999Ah; reset to 0 when power is disconnected
Load Current **0.0A**	Diversion Load Current
Mode: Charger **State: BULK**	Battery Charging Status
Bulk Float **14.0V 13.4V**	Display of Bulk and Float voltage setting value
EQU EQU-T CYCLE **14.2V 1hrs 28days**	Display of Equalization Voltage, Time and Interval
Heatsink BTS **25°C 25°C**	Display of heat sink temperature
ALARM: CODE **DESCRIPTION**	Fault Messages

3.2.1 Fault Messages

The LCD displays might have the following fault messages when Controller stops operating.

Refer to their description and causes listed as below in order to remove the faults

Display	Description	Cause Details
Alarm : OC Over Current	Over Current	The current exceeds 150% of rated current
Alarm : OT Over Temperature	Heat sink Over Temperature	Heat sink temperature exceeds 90ºC
Alarm : CPF00 Link Master Err	Display Panel Error	The CPU is not able to exchange data with the display panel

4. Battery Charging

Selecting the best method for charging your battery together with a good maintenance program will ensure a healthy battery and long service life. Although the Controller´ s battery charging is fully automatic, the following information is important to know for getting the best performance from your Controller wind charger and battery.

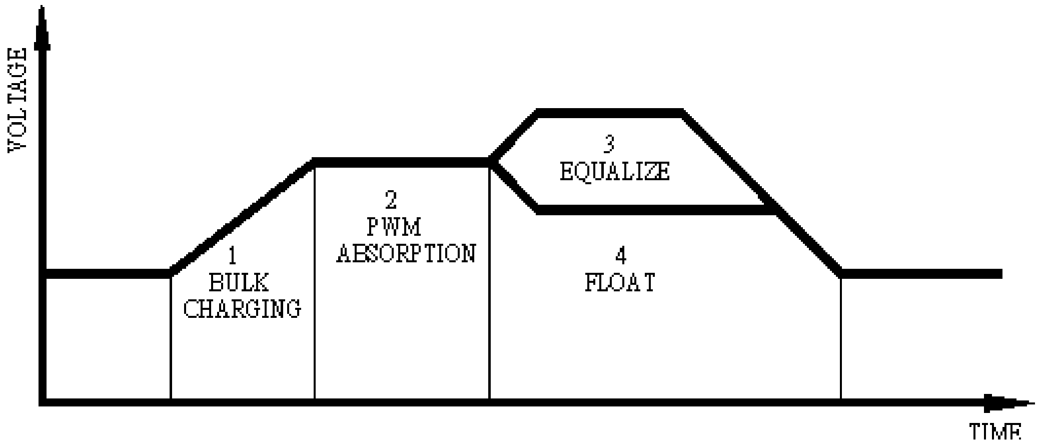


Figure 4.1.1 Charging Stages

Stage of Charging		Description
1	Bulk Charging	In this stage, the battery will accept all the current provided by the wind system.
2	PWM Absorption	When the battery reaches the regulation voltage, the PWM begins to hold the voltage constant. This is to avoid over-heating and over-gassing the battery. The current will taper down to safe levels as the battery becomes more fully charged
3	Equalization	Many batteries benefit from a periodic boost charge to stir the electrolyte, level the cell voltages, and complete the chemical reactions.
4	Float	When the battery is fully recharged, the charging voltage is reduced to prevent further heating or gassing of the battery.

4.1 Standard Battery Charging Programs

The Controller provides 8 standard battery charging algorithms (programs) that are selected with the DIP switches. These standard algorithms are suitable for lead-acid batteries ranging from sealed (gel, AGM, maintenance free) to flooded to L-16 cells and Ni-cad etc.

The table below summarizes the major parameters of the standard charging algorithms. Note that all the voltages are for 12V systems (24V = 2X, 48V = 4X).

All values are 25ºC (77ºF)

DIP 4-5-6	Battery Type	Bulk Voltage	Float Voltage	Equalize Voltage	Equalize Time (hours)	Equalize Interval (days)
Off-off-off	1 – Sealed	14.0V	13.4V	-	-	-
Off-off-on	2 – Sealed	14.1V	13.4V	14.2V	1	28
Off-on-off	3 – Sealed	14.3V	13.4V	14.4V	2	28
Off-on-on	4 – Flooded	14.4V	13.4V	15.1V	3	28
On-off-off	5 – Flooded	14.6V	13.4V	15.3V	3	28
On-off-on	6 – Flooded	14.8V	13.4V	15.3V	3	28
On-on-off	7 – L-16	15.0V	13.4V	15.3V	3	14
On-on-on	8 – NiCad	16.0V	14.5V	-	-	-

Table 4.2 Standard Battery Charging Programs

These 8 standard battery charging algorithms will perform well for the majority of battery systems.

5. Diversion Charge Control

The most important factor for successful diversion charge control is the correct sizing of the diversion load.

As the battery becomes fully charged, the Controller will divert excess current from the battery to a dedicated diversion load. This diversion load must be large enough to absorb all the excess energy, but not too large to cause a controller overload condition.

It is critical that the diversion load be sized correctly. If the load is too small, it cannot divert enough power from the source (wind, hydro, etc). The battery will continue charging and could be overcharged. If the diversion load is too large, it will draw more current than the rating of the Controller.

The maximum diversion load current capability for the Controller is 120A. The diversion loads must be sized so that the peak load current cannot exceed the maximum rating.

CAUTION: The diversion load must be able to absorb the full power output of the source, but the load must never exceed the current rating of the Controller wind charger. Otherwise, the battery can be overcharged and damaged

6. Trouble Shooting

General Troubleshooting	• Confirm that all circuit breakers and switches in the system are closed • Check all fuses • Check for loose wiring connections and wiring continuity • Verify that the battery voltage is not below 9Vdc • Verify that the battery power connection is not reversed polarity
Troubleshooting Charging	• Over-charging or under-charging the battery • DIP switch settings may be wrong • Over-temperature condition is reducing the charging current (heat sink cooling may be blocked) • Voltage drop between Controller and battery is too high • Load is too large and is discharging the battery
Not charging the battery	• DIP switch settings may be wrong (check each switch position carefully) • Circuit breaker or disconnect is open • Reversed polarity connections at the PMG terminals • Short circuit in the wind system has eliminated part of the wind power output • Wind energy is not providing enough current • Battery is failing and cannot hold a charge
Troubleshooting Diversion Control	• Diversion load is too small so PWM reaches 99% • Diversion load is burned out so PWM reaches 99% • Diversion load is too large so Controller faults on overcurrent • An over temperature condition may have caused the load to be disconnected • Voltage drops between the Controller and battery are too high

7. Battery Information

The standard battery charging programs in the Controller charger, as described in Section 4.2, are typical charging algorithms for four battery types:

• sealed (VRLA)

• flooded (vented)

• L-16 group

• NiCad and NiFe

CAUTION: Never attempt to charge a primary (non-rechargeable) battery

All charging voltages noted below will be for 12V batteries at 25° C.

7.1 Sealed Batteries (VRLA)

The general class of sealed batteries suitable for renewable systems is called VRLA (Valve Regulated Lead-Acid) batteries. The two main characteristics of VRLA batteries are electrolyte immobilization and oxygen recombination. As the battery recharges, gassing is limited and is recombined to minimize the loss of water.

The two types of VRLA batteries most often used in renewable systems are AGM and Gel.

7.1.1 AGM

Absorbed Glass Mat batteries are still considered to be a "wet cell" because the electrolyte is retained in fiberglass mats between the plates. Some newer AGM battery designs recommend constant voltage charging to 2.45 volts/cell (14.7V). For cycling applications, charging to 14.4V or 14.5V is often recommended.

AGM batteries are better suited to low discharge applications than daily cycling. These batteries should not be equalized since gassing can be vented which causes the battery to dry out. There is also a potential for thermal runaway if the battery gets too hot, and this will destroy the battery. AGM batteries are affected by heat, and can lose 50% of their service life for every 8° C (15° F) over 25° C (77° F).

It is very important not to exceed the gas recombination capabilities of the AGM. The optimum charging temperature range is from 5 to 35° C (40 to 95° F).

7.1.2 GEL

Gel batteries have characteristics similar to AGM, except a silica additive immobilizes the electrolyte to prevent leakage from the case. And like AGM, it is important to never exceed the manufacturer's maximum charging voltages. Typically, a gel battery is recharged in cycling applications from 14.1V to 14.4V. The gel design is very sensitive to overcharging.

For both AGM and Gel batteries, the goal is for 100% recombination of gasses so that no water is lost from the battery. True equalizations are never done, but a small boost charge may be needed to balance the individual cell voltages.

7.1.3 Other Sealed Batteries

Automotive and "maintenance-free" batteries are also sealed. However, these are not discussed here because they have very poor lifetimes in renewable cycling applications.

NOTE: Consult the battery manufacturer for the recommended charging settings for the battery being used.

7.2 Flooded Batteries

Flooded (vented) batteries are preferred for larger cycling renewable systems.

The advantages of flooded batteries include:

- Ability to add water to the cells
- Deep cycle capability
- Vigorous recharging and equalization
- Long operating life

In cycling applications, flooded batteries benefit from vigorous charging and equalization cycles with significant gassing. Without this gassing, the heavier electrolyte will sink to the bottom of the cell and lead to stratification. This is especially true with tall cells. Hydro caps can be used to limit the gassing water loss.

Note that a 4% mixture of hydrogen in air is explosive if ignited. Make certain the battery area is well ventilated.

Typical equalization voltages for flooded batteries are from 15.3 volts to 16 volts. However, a renewable system is limited to what the renewable system can provide. If the equalization voltage is too high, the array I-V curve may go over the "knee" and sharply reduce the charging current.

7.2.1 Lead-Calcium

Calcium batteries charge at lower voltages (14.2 to 14.4 typically) and have strong advantages in constant voltage or float applications. Water loss can be only 1/10th of antimony cells. However, calcium plates are not as suitable for cycling applications.

7.2.2 Lead-Selenium

These batteries are similar to calcium with low internal losses and very low water consumption throughout their life. Selenium plates also have poor cycling life.

7.2.3 Lead –Antimony

Antimony cells are rugged and provide long service life with deep discharge capability. However, these batteries self-discharge much faster and the self-discharging increases up to five times the initial rate as the battery ages. Charging the antimony battery is typically from 14.4V to 15.0V, with a 120% equalization overcharge. While the water loss is low when the battery is new, it will increase by five times over the life of the battery.

There are also combinations of plate chemistries that offer beneficial tradeoffs. For example, low antimony and selenium plates can offer fairly good cycling performance, long life, and reduced watering needs.

NOTE: Consult the battery manufacturer for the recommended charging settings for the battery being used.

7.3 L-16 Cells

One particular type of flooded battery, the L-16 group, is often used in larger renewable systems. The L-16 offers good deep-cycle performance, long life, and low cost.

The L-16 battery has some special charging requirements in a renewable system. A study found that nearly half of the L-16 battery capacity can be lost if the regulation voltage is too low and the time between finish-charges is too long. One standard charging program in the Controller is specifically for L-16 batteries, and it provides for higher charging voltages and more frequent equalizations. Additional equalizations can also be done manually with the pushbutton.

NOTE: The best charging algorithm for flooded, deep-cycle batteries depends on the normal depth-of-discharge, how often the battery is cycled, and the plate chemistry. Consult the battery manufacturer for the recommended charging settings for the battery being used.

7.4 NiCad and NiFe Batteries

The Wind Controller is compatible with Nicad (nikel-cadmium), NiFe (nikel-iron) and alkaline type batteries which must be charged to a higher voltage level to achieve a full charge. When Nicad mode is selected, the equalization process is disabled.

8. Warranty

LIMITED WARRANTY CONDITIONS

ENAIR ENERGY SL ensures that the Controller RCE-ENAIR-120 are free from defects in material and workmanship for a period of 24 months from the date of purchase, under normal and individual use proper installation, commissioning and periodic maintenance.

The warranty covers repair or replacement of damaged parts and labor in our workshops.

EXCLUSIONS AND LIMITATIONS OF WARRANTY

This warranty shall not apply if the client or user previously not been returned duly completed warranty card..

Generally, they are exempt from the guarantee rights established herein, damage and malfunctions or service of controller ENAIR originating in:

1) Negligent, improper or inappropriate use of the product.

2) Failure to observe the instructions for installation, use, maintenance and periodic reviews established in the equipment manual, and technical and safety rules in force, local, national or international standing, which were applicable at any time (Electrotechnical Regulation of Low voltage, and Technical Instructions, electromagnetic compatibility, etc.)

3) Manipulations performed by unqualified personnel. Understood by staff competent professionals with experience in electrical installations, companies engaged in distribution, sale or installation of RES.

4) Damage caused by natural disasters (floods, plagues, earthquakes, hurricanes, cyclones, tornadoes, lightning, hail, fires ...), vandalism, actions of third parties or any other force majeure outside the normal operating conditions of the equipment and control of ENAIR ENERGY S.L.

5) Products that have not been paid in full.

Intervention costs arising from dismantling the faulty equipment or the subsequent reinstallation of equipment parts warranty rights established herein do not cover transportation costs of controller or defective items, of returning to ENAIR ENERGY S.L. It does not cover, also.

ENAIR ENERGY S.L we reserve the right to supply a different model of controller or component to resolve claims accepted under guarantee, as a replacement and if the original model is no longer manufactured. In this case, the new model will be of equal or higher performance.

ENAIR ENERGY S.L it undertakes to make use of the obligations described in the conditions of this Limited Warranty, and in the event of repair or replacement of default attributable to the manufacturer, cover the transport costs of the subsequent return to the address registered customer and have them available within a maximum period of 60 days from the date of receipt.

If ENAIR ENERGY S.L were to determine that the problem of the controller is not due to a defect in materials and workmanship, then the Customer shall bear the costs of testing and processing generated.

Defective complained Products which do not meet the specifications will become the property of ENAIR ENERGY S.L., as soon as they have been replaced or paid.

Any return of material and replacement by ENAIR ENERGY SL under warranty conditions, constitute full settlement and release of all subsequent claims of any person covered by damages or other relief, and will be an impediment to any I dispute subsequently presented to the person who accepts an agreement of this type.

LIMITATION OF LIABILITY

ENAIR ENERGY S.L it will not be liable to the customer, directly or indirectly, for any failure or delay in the implementation of its warranty obligations, which may be caused by majeure force or any other unforeseen incident to the will of ENAIR ENERGY S.L.

ENAIR responsibility for ENERGY S.L. arising from this Guarantee Certificate is limited to the obligations expressed above, expressly excluding any liability for consequential damages such as loss of income or operating profits.

When the subject of the claim is the result of improper installation, ENAIR ENERGY S.L. shall be liable only when explicitly that installation was part of the scope of supply of the sales contract.

Any other security that is not expressly mentioned in this certificate is excluded.

To activate the warranty of the controller, it is necessary to send this duly signed and stamped by the installer document. Once the document is registered, the controller will have 2-year warranty since manufacture registered.

Model: **RCE-ENAIR-120**

Serial Nº/ voltage:

…………………………………………

Installation date:

…………………………………………

Stamp and signature Installer:

User

Name: ……………………………………………………………………

Address: ………………………………………………………………….

Zip Code.:…………………Location: ……………………….

Province/State:

…………………………………………………………………………….

Telephone: …………………………………………………………….

e-mail: ……………………………………………………………………

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