



# RVX16 and RVX24 Models Installation & Operation Manual



## TABLE OF CONTENTS

<b>REVOLUTION X SERIES</b> .....	<b>1</b>
<b>SAFETY PRECAUTIONS</b> .....	<b>2</b>
<b>REVOLUTION SPECIFICATIONS</b> .....	<b>5</b>
SPECIFICATIONS FOR THE REVOLUTION RVX16 480VAC MODELS.....	8
36V REVOLUTION X Chargers Dual Cable Chargers.....	8
48V REVOLUTION X Chargers Dual Cable Chargers.....	9
48V REVOLUTION X Single Cable Chargers.....	10
80V REVOLUTION X Dual Cable Chargers .....	11
80V REVOLUTION X Single Cable Chargers.....	12
SPECIFICATIONS FOR THE REVOLUTION RVX24 480VAC MODELS.....	13
48V REVOLUTION X Dual Cable Chargers .....	13
80V REVOLUTION X Dual Cable Chargers .....	14
80V REVOLUTION X Dual Cable Chargers .....	15
80V REVOLUTION X Single Cable Chargers.....	16
80V REVOLUTION X Single Cable Chargers.....	17
<b>INSTALLATION PROCEDURE</b> .....	<b>18</b>
CHARGER INSTALLATION .....	18
RV16 Models Installation .....	19
RV24 Models Installation .....	24
CHARGER ELECTRICAL INSTALLATION .....	29
RV16 & RV24 Electrical Instructions.....	30
<b>OPERATION PROCEDURE</b> .....	<b>32</b>
CHARGER CONTROLS AND USER INTERFACE .....	32
BASIC CHARGE CYCLE OPERATION.....	33
GETTING STARTED .....	35
CHARGER MAIN MENU .....	39
<b>MODULE REPLACEMENT</b> .....	<b>46</b>
<b>ENUMERATING INSTALLED MODULES</b> .....	<b>47</b>
<b>TROUBLESHOOTING</b> .....	<b>49</b>
<b>RETURN MATERIAL PROCESS</b> .....	<b>56</b>
<b>APPENDIX A – WALL MOUNT DIMENSIONS &amp; CLEARANCES</b> .....	<b>57</b>
RV16 MODELS .....	57
RV24 MODELS .....	58
<b>APPENDIX B – POST STAND DIMENSIONS AND ASSEMBLY INSTRUCTIONS</b> ..	<b>59</b>
RV16 MODELS .....	59
RV24 MODELS .....	60
<b>APPENDIX C – NOTE ON TEMPERATURE COMPENSATION</b> .....	<b>62</b>
<b>CONTACT INFORMATION</b> .....	<b>63</b>

# REVOLUTION X SERIES

The **REVOLUTION X** Series features very high charge cycle efficiencies and state-of-the-art MOSFET soft-switching technology resulting in lower energy costs, smaller sizes, and lighter weight units. The **REVOLUTION X** chargers maintain the charging efficiency greater than 90% over the entire charge cycle. This results in true energy savings of 6% or greater as compared to leading HF chargers. For a typical 36V/850Ahr battery, these savings will translate into approximately 1.5kWhr per charge cycle. In a typical application, the savings can be greater than 400kWhr per battery per year.

The **REVOLUTION** Series is a combination of cutting edge charging and energy management technologies, with a smaller footprint, lower acquisition costs, easy maintenance, and flexible configurations.

The **REVOLUTION X** chargers can support conventional, opportunity, and fast charge cycles. The **REVOLUTION X** chargers also offer programmability. All charger settings and features can be easily customized to match workloads and schedules. Finish and equalize cycles may be programmed to automatically run on certain days of the week. Additionally, the **REVOLUTION X** chargers may be tailored to meet the needs of any battery chemistry, including lithium, flooded, gel, and Absorbed Glass Mat (AGM), Thin Plate Pure Lead (TPPL) batteries.



# SAFETY PRECAUTIONS

## BEFORE ATTEMPTING TO INSTALL AND OPERATE THE CHARGER, READ THIS MANUAL CAREFULLY

This manual contains important instructions for the **REVOLUTION** series product line that shall be followed during installation and operation of the charger. Only qualified personnel should install, operate, or service this equipment.

### SAVE THESE INSTRUCTIONS



- **High Voltages.** Lethal voltages are present within the charger enclosure whenever the AC line is energized and/or the battery/load is connected. The heat sinks and other internal components present the risk of electric shock.
- **Stored Energy.** To avoid the risk of electric shock, wait at least two minutes after de-energizing the AC line and disconnecting the battery/load before removing the cover.
- **High Current Levels.** Do not touch uninsulated battery connectors or terminals. All tools should be adequately insulated to avoid the possibility of shorting connections. Inspect cables often for damage to the insulation. Replace cracked or worn cables immediately.
- **Improper Connections.** If the charger is incorrectly wired to input or output devices or wiring is not in accordance with local safety codes and standards, the **Revolution** charger and/or its components are at risk of being damaged.
- **Grounding.** The charger must be connected to an AC power supply incorporating an earth or ground. The grounding conductor must be of a size equal to or larger than the line (phase) conductors.
- **Explosive Gases.** Working in the vicinity of a lead-acid battery is dangerous. Batteries generate explosive gases during charge and discharge. To reduce the risk of ignition, follow these safety instructions as well as those published by the battery manufacturer. To minimize the potential for arcing and to reduce the risk of damage to the connector contacts, it is preferable to connect and disconnect a battery when the charger output is **OFF**.



- **Chemical Hazard.** Working with lead-acid batteries may result in exposure to highly corrosive acid. To protect eyes and skin, use the required **Personal Protective Equipment (PPE)** as mandated by your employer and local regulations. At a minimum, wear safety goggles and skin protection while connecting the battery charger or working in the vicinity of lead-acid batteries.
- **Follow the battery manufacturer's published instructions when installing, charging, and servicing batteries.**
- **Use only with rechargeable batteries.** Do not attempt to charge other battery types; doing so may cause equipment damage and result in serious personal injury.
- **Do not expose the charger to rain or snow.** The charger is **NOT** designed for outdoor use.
- **Adequate Cooling Required.** To prevent damage from overheating, proper airflow must be ensured. Do not restrict fan inlets or exhaust outlets. Do not mount the charger in a confined space or where the exhaust air will recirculate.
- **No User Serviceable Parts.** If service is required, contact Power Designers Sibex or its service representative.
- **These instructions assume a certain level of competence by the installer and/or user.** The following practices and codes contain relevant information, and should be consulted for safe installation, testing, handling, and maintenance of rechargeable lead-acid batteries. All applicable state and local codes must be followed.
  - **National Electrical Safety Code (NESC)**, ANSI/IEEE C2-2007 (or latest revision). Copies may be obtained by contacting: The Institute of **E**lectrical and **E**lectronics Engineers, Inc. (**IEEE**), Publications Office, 10662 Los Vaqueros Circle, P.O. Box 3014, Los Alamitos, CA 90720  
[www.ieee.org](http://www.ieee.org)
  - **National Electrical Code (NEC)** NFPA-70 (or latest version) available from: National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269  
[www.nfpa.org](http://www.nfpa.org)

- **Federal Codes**

29CFR1926.441 Batteries and Battery Chargers

29CFR1910.305 (j) Wiring Methods, Components and Equipment for General Use

OSHA Directive STD 01-08-002, including 29CFR1910.151(c) Medical Services and First Aid; 29CFR1926.50 and 29CFR1926.51, Medical Service and First Aid, and Sanitation, respectively; applicable to electric storage battery charging and maintenance areas.

- **EMC Compliance**

This device complies with Part 15 section 103 of FCC Rules as a digital device used exclusively as a power system in public utilities or industrial plants.

Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

# REVOLUTION SPECIFICATIONS

## Model Numbers

(CEC compliant versions add –CEC suffix)

### RVX16 Model Numbers

X16-450A-36V  
X16-495A-36V  
X16-540A-36V  
X16-585A-36V  
X16-630A-36V  
X16-675A-36V  
X16-700A-36V

X16-340A-48V  
X16-374A-48V  
X16-408A-48V  
X16-442A-48V  
X16-476A-48V  
X16-510A-48V  
X16-544A-48V

X16-408A-48V-SC  
X16-425A-48V-SC

X16-240A-80V  
X16-260A-80V  
X16-280A-80V  
X16-300A-80V  
X16-320A-80V

X16-240A-80V-SC  
X16-260A-80V-SC  
X16-280A-80V-SC  
X16-300A-80V-SC  
X16-320A-80V-SC

### RVX24 Model Numbers

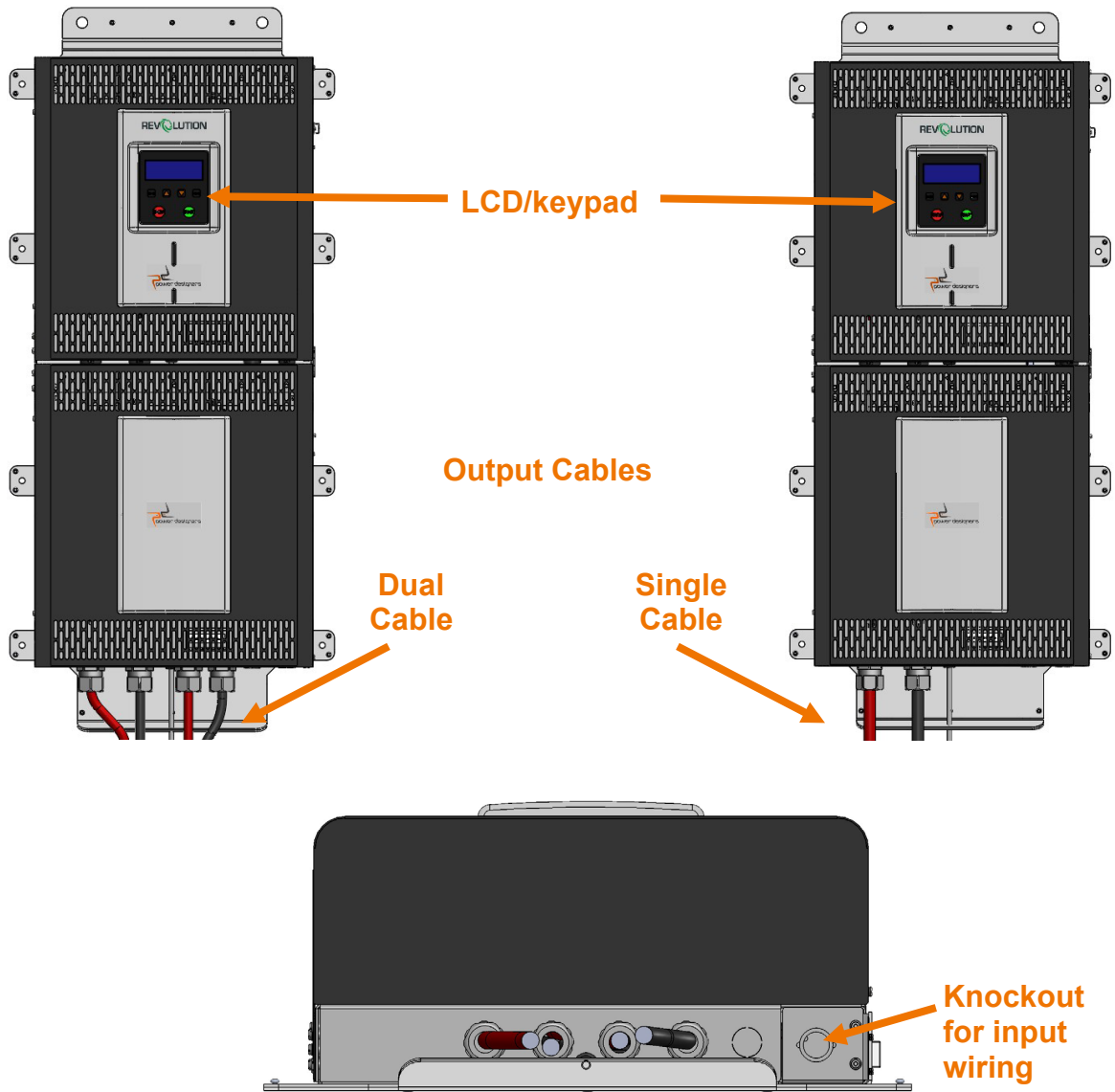
X24-612A-48V  
X24-646A-48V  
X24-680A-48V

X24-360A-80V  
X24-380A-80V  
X24-400A-80V  
X24-420A-80V  
X24-440A-80V  
X24-460A-80V  
X24-480A-80V

X24-360A-80V-CN  
X24-380A-80V-CN  
X24-400A-80V-CN

X24-320A-80V-SC  
X24-340A-80V-SC  
X24-350A-80V-SC

X24-320A-80V-SC0  
X24-400A-80V-SC0  
X24-480A-80V-SC2



**Figure 1: RVX16 and RVX24 Battery Charger Features**



# Specifications for the REVOLUTION RVX16 480VAC models

## 36V REVOLUTION X Chargers Dual Cable Chargers

SPECIFICATIONS	X16-450A-36V	X16-495A-36V	X16-540A-36V	X16-585A-36V	X16-630A-36V	X16-675A-36V	X16-700A-36V
UL Model Number	RVX-31.7-700-36						
Nominal Volt (V) / Maximum Current (A)	36 V / 450 A	36 V / 495 A	36V / 540A	36V / 585A	36V / 630A	36 V / 675 A	36 V / 700 A
<b>INPUT SPECIFICATIONS</b>							
Voltage	480VAC, 3-phase±10%						
Current	28.1A rms/ph	30.9A rms/ph	33.7A rms/ph	36.5A rms/ph	39.3A rms/ph	42.2A rms/ph	43.7A rms/ph
Power Factor	>0.94						
Breaker Rating	60A						
<b>OUTPUT SPECIFICATIONS</b>							
Voltage	36V nom. / 50V max.						
Current	450A Max	495A Max	540A Max	585A Max	630A Max	675A Max	700A Max
Power	20.4kW Max	22.4kW Max	24.5kW Max	26.5kW Max	28.6kW Max	30.6kW Max	31.7kW Max
Output Cables	12', Dual 4/0						
Output Connectors	Dual Euro A320						
# of Battery Cells	12/18						
Peak-to-Peak Voltage Ripple	< 1%						
EFFICIENCY	Total charge cycle efficiency > 90%						
	Peak charging efficiency > 93%						
<b>PROTECTION</b>							
Input	<ul style="list-style-type: none"> <li>Under voltage</li> <li>Over voltage transients</li> </ul>						
Output	<ul style="list-style-type: none"> <li>Over current</li> <li>Over voltage</li> <li>Charger Over temperature; Battery Over Temperature</li> <li>Battery reverse polarity</li> </ul>						
<b>OPERATING CONDITIONS</b>							
Temperature	0–40°C						
Humidity	10-90% RH noncondensing						
<b>INTERFACE</b>							
User Interface	LCD & keypad, USB, wireless communication with PT Link+ Optional: Ethernet or CAN Interface						
<b>MECHANICAL</b>							
W x D x H	22" x 10" x 48"						
Weight	~216 lb	~220 lb	~223 lb	~227 lb	~231 lb	~235 lb	~239 lb
Cooling	Forced air (fans)						
Certifications	UL Listed; CEC certification available						

## 48V REVOLUTION X Chargers Dual Cable Chargers

SPECIFICATIONS	X16-340A-48V	X16-374A-48V	X16-408A-48V	X16-442A-48V	X16-476A-48V	X16-510A-48V	X16-544A-48V
UL Model Number	RVX-32.6-544-48						
Nominal Volt (V) / Maximum Current (A)	48 V / 340 A	48 V / 374 A	48 V / 408 A	48 V / 442 A	48 V / 476 A	48 V / 510 A	48 V / 544 A
<b>INPUT SPECIFICATIONS</b>							
Voltage	480VAC, 3-phase±10%						
Current	28.1A rms/ph	30.9A rms/ph	33.7A rms/ph	36.5A rms/ph	39.3A rms/ph	42.2A rms/ph	45.0A rms/ph
Power Factor	>0.94						
Breaker Rating	60A						
<b>OUTPUT SPECIFICATIONS</b>							
Voltage	48V nom. / 65V max.						
Current	340A Max	374A Max	408A Max	442A Max	476A Max	510A Max	544A Max
Power	20.4kW Max	22.4kW Max	24.5kW Max	26.5kW Max	28.6kW Max	30.6kW Max	32.6kW Max
Output Cables	12', Dual 4/0						
Output Connectors	Dual Euro A320						
# of Battery Cells	12/18/24						
Peak-to-Peak Voltage Ripple	< 1%						
EFFICIENCY	Total charge cycle efficiency > 90%						
	Peak charging efficiency > 93%						
<b>PROTECTION</b>							
Input	<ul style="list-style-type: none"> <li>Under voltage</li> <li>Over voltage transients</li> </ul>						
Output	<ul style="list-style-type: none"> <li>Over current</li> <li>Over voltage</li> <li>Charger Over temperature; Battery Over Temperature</li> <li>Battery reverse polarity</li> </ul>						
<b>OPERATING CONDITIONS</b>							
Temperature	0–40°C						
Humidity	10-90% RH noncondensing						
<b>INTERFACE</b>							
User Interface	LCD & keypad, USB, wireless communication with PT Link+ Optional: Ethernet or CAN Interface						
<b>MECHANICAL</b>							
W x D x H	22" x 10" x 48"						
Weight	~216 lb	~220 lb	~223 lb	~227 lb	~231 lb	~235 lb	~239 lb
Cooling	Forced air (fans)						
Certifications	UL Listed; CEC and cUL certification available						

+CN models have output restricted to 245A per cable for use with Euro A320 connectors in Canada

## 48V REVOLUTION X Single Cable Chargers

SPECIFICATIONS	X16-408A-48V-SC	X16-425A-48V-SC
UL Model Number	RVX-25.5-425-48-SC	
Nominal Volt (V) / Maximum Current (A)	48 V / 408 A	48 V / 425 A
Voltage	480VAC, 3-phase±10%	
Current	33.7A rms/ph	35.1A rms/ph
Power Factor	>0.94	
Breaker Rating	60A	
Voltage	48V nom. / 65V max.	
Current	408A Max	425A Max
Power	24.5kW Max	25.5kW Max
Output Cables	12', 4/0	
Output Connectors	Euro A320, 430A	
# of Battery Cells	12/18/24	
Peak-to-Peak Voltage Ripple	< 1%	
EFFICIENCY	Total charge cycle efficiency > 90%	
	Peak charging efficiency > 93%	
Input	<ul style="list-style-type: none"> <li>Under voltage</li> <li>Over voltage transients</li> </ul>	
Output	<ul style="list-style-type: none"> <li>Over current</li> <li>Over voltage</li> <li>Charger Over temperature; Battery Over Temperature</li> <li>Battery reverse polarity</li> </ul>	
Temperature	0–40°C	
Humidity	10-90% RH noncondensing	
User Interface	LCD & keypad, USB, wireless communication with PT Link* Optional: Ethernet or CAN Interface	
W x D x H	22" x 10" x 48"	
Weight	~195 lb	~199 lb
Cooling	Forced air (fans)	
Certifications	UL Listed; CEC certification available	

## 80V REVOLUTION X Dual Cable Chargers

SPECIFICATIONS	X16-240A-80V	X16-260A-80V	X16-280A-80V	X16-300A-80V	X16-320A-80V
UL Model Number	RVX-32.6-320-80				
Nominal Volt (V) / Maximum Current (A)	80V /240A	80V /260A	80V /280A	80V /300A	80V /320A
<b>INPUT SPECIFICATIONS</b>					
Voltage	480 VAC, ± 10%, 3-phase				
Current	33.7A rms/ph	36.5A rms/ph	39.3A rms/ph	42.2A rms/ph	45.0A rms/ph
Power Factor	>0.94				
Breaker Rating	60A				
<b>OUTPUT SPECIFICATIONS</b>					
Voltage	80V nom. / 110V max.				
Current	240A max.	260A max.	280A max.	300A max.	320A max.
Power	24.5kw max.	26.5kw max.	28.6kw max.	30.6kw max.	32.6kw max.
Output Cables	12', Dual 2/0				
Output Connectors	Dual Euro A320				
# of Battery Cells	18 / 24 / 36 / 40				
Peak-to-Peak Voltage Ripple	< 1%				
EFFICIENCY	Total charge cycle efficiency > 90%				
	Peak charging efficiency > 93%				
<b>PROTECTION</b>					
Input	<ul style="list-style-type: none"> <li>Under voltage</li> <li>Over voltage transients</li> </ul>				
Output	<ul style="list-style-type: none"> <li>Over current</li> <li>Over voltage</li> <li>Charger Over temperature; Battery Over temperature</li> <li>Battery reverse polarity</li> </ul>				
<b>OPERATING CONDITIONS</b>					
Temperature	0–40°C				
Humidity	10-90% RH noncondensing				
<b>INTERFACE</b>					
User Interface	LCD & keypad, USB, wireless communication with PowerTrac and PT Link* Optional: Ethernet or CAN Interface				
<b>MECHANICAL</b>					
W x D x H	26.5" x 9.5" x 21"				
Weight	~207 lb	~211 lb	~215 lb	~219 lb	~223 lb
Cooling	Forced air (fans)				
Certifications	UL Listed; CEC and cUL certification available				

## 80V REVOLUTION X Single Cable Chargers

SPECIFICATIONS	X16-240A-80V-SC	X16-260A-80V-SC	X16-280A-80V-SC	X16-300A-80V-SC	X16-320A-80V-SC
UL Model Number	RVX-32.6-320-80-SC				
Nominal Volt (V) / Maximum Current (A)	80V /240A	80V /260A	80V /280A	80V /300A	80V /320A
<b>INPUT SPECIFICATIONS</b>					
Voltage	480 VAC, ± 10%, 3-phase				
Current	33.7A rms/ph	36.5A rms/ph	39.3A rms/ph	42.2A rms/ph	45.0A rms/ph
Power Factor	>0.94				
Breaker Rating	60A				
<b>OUTPUT SPECIFICATIONS</b>					
Voltage	80V nom. / 110V max.				
Current	240A max.	260A max.	280A max.	300A max.	320A max.
Power	24.5kw max.	26.5kw max.	28.6kw max.	30.6kw max.	32.6kw max.
Output Cables	12', 4/0				
Output Connectors	<b>SB350, SBX350, Euro A320, DIN640</b>				
# of Battery Cells	18 / 24 / 36 / 40				
Peak-to-Peak Voltage Ripple	< 1%				
EFFICIENCY	Total charge cycle efficiency > 90%				
	Peak charging efficiency > 93%				
<b>PROTECTION</b>					
Input	<ul style="list-style-type: none"> <li>Under voltage</li> <li>Over voltage transients</li> </ul>				
Output	<ul style="list-style-type: none"> <li>Over current</li> <li>Over voltage</li> <li>Charger Over temperature; Battery Over temperature</li> <li>Battery reverse polarity</li> </ul>				
<b>OPERATING CONDITIONS</b>					
Temperature	0–40°C				
Humidity	10-90% RH noncondensing				
<b>INTERFACE</b>					
User Interface	LCD & keypad, USB, wireless communication with PowerTrac and PT Link* . Optional: Ethernet or CAN Interface				
<b>MECHANICAL</b>					
W x D x H	26.5" x 9.5" x 21"				
Weight	~195 lb	~199 lb	~202 lb	~206 lb	~210 lb
Cooling	Forced air (fans)				
Certifications	UL Listed; CEC and cUL certification available				

+CN models have output restricted to 245A per cable for use with Euro A320 connectors in Canada

# Specifications for the REVOLUTION RVX24 480VAC models

## 48V REVOLUTION X Dual Cable Chargers

SPECIFICATIONS	X24-612A-48V	X24-646A-48V	X24-680A-48V
UL Model Number	RVX-40.8-680-48		
Nominal Volt (V) / Maximum Current (A)	48V / 612A	48V / 646A	48V / 680A
<b>INPUT SPECIFICATIONS</b>			
Voltage	480 VAC, 3-phase ± 10%		
Current	50.6A rms/ph	53.4A rms/ph	56.2A rms/ph
Power Factor	>0.94		
Breaker Rating	80A		
<b>OUTPUT SPECIFICATIONS</b>			
Voltage	48V nom. / 65V max.		
Current	612A Max	646A Max	680A Max
Power	36.7kw Max	38.8kw Max	40.8kw Max
Output Cables	12', Dual 4/0		
Output Connectors	Dual Euro A320		
# of Battery Cells	18/24		
Peak-to-Peak Voltage Ripple	< 1%		
EFFICIENCY	Total charge cycle efficiency > 90%		
	Peak charging efficiency > 93%		
<b>PROTECTION</b>			
Input	<ul style="list-style-type: none"> <li>• Under voltage</li> <li>• Over voltage transients</li> </ul>		
Output	<ul style="list-style-type: none"> <li>• Over current</li> <li>• Over voltage</li> <li>• Charger Over temperature; Battery Over temperature</li> <li>• Battery reverse polarity</li> </ul>		
<b>OPERATING CONDITIONS</b>			
Temperature	0-40°C		
Humidity	10-90% RH noncondensing		
<b>INTERFACE</b>			
User Interface	LCD & keypad, USB, wireless communication with PT Link* Optional: Ethernet or CAN Interface		
<b>MECHANICAL</b>			
W x D x H	30" x 10" x 48"		
Weight	~313 lb	~316 lb	~320 lb
Cooling	Forced air (fans)		
Certifications	UL Listed; CEC certification available		

## 80V REVOLUTION X Dual Cable Chargers

SPECIFICATIONS	X24-360A-80V	X24-380A-80V	X24-400A-80V	X24-420A-80V	X24-440A-80V	X24-460A-80V	X24-480A-80V
UL Model Number	RVX-49.0-480-80						
Nominal Volt (V) / Maximum Current (A)	80V / 360A	80V / 380A	80V / 400A	80V / 420A	80V / 440A	80V / 460A	80V / 480A
<b>INPUT SPECIFICATIONS</b>							
Voltage	480 VAC, 3-phase $\pm$ 10%						
Current	50.6A rms/ph	53.4A rms/ph	56.2A rms/ph	59.0A rms/ph	61.8A rms/ph	64.6A rms/ph	67.4A rms/ph
Power Factor	>0.94						
Breaker Rating	80A						
<b>OUTPUT SPECIFICATIONS</b>							
Voltage	80V nom. / 110V max.						
Current	360A Max	380A Max	400A Max	420A Max	440A Max	460A Max	480A Max
Power	36.7kw Max	38.8kw Max	40.8kw Max	42.8kw Max	44.9kw Max	46.9kw Max	49.0kw Max
Output Cables	12', Dual 2/0						
Output Connectors	Dual Euro A320						
# of Battery Cells	18/24/36/40						
Peak-to-Peak Voltage Ripple	< 1%						
EFFICIENCY	Total charge cycle efficiency > 90%						
	Peak charging efficiency > 93%						
<b>PROTECTION</b>							
Input	<ul style="list-style-type: none"> <li>• Under voltage</li> <li>• Over voltage transients</li> </ul>						
Output	<ul style="list-style-type: none"> <li>• Over current</li> <li>• Over voltage</li> <li>• Charger Over temperature; Battery Over temperature</li> <li>• Battery reverse polarity</li> </ul>						
<b>OPERATING CONDITIONS</b>							
Temperature	0–40°C						
Humidity	10-90% RH noncondensing						
<b>INTERFACE</b>							
User Interface	LCD & keypad, USB, wireless communication with PT Link* Optional: Ethernet or CAN Interface						
<b>MECHANICAL</b>							
W x D x H	30" x 10" x 48"						
Weight	~296 lb	~300 lb	~304 lb	~308 lb	~312 lb	~316 lb	~319 lb
Cooling	Forced air (fans)						
Certifications	UL Listed; CEC and cUL certification available						

\*SB350, SBX350 = 350A UL + CSA limit, Euro A320 = 350A UL, 270A CSA limit

## 80V REVOLUTION X Dual Cable Chargers

SPECIFICATIONS	X24-360A-80V-CN	X24-380A-80V-CN	X24-400A-80V-CN
UL Model Number	RVX-40.8-400-80		
Nominal Volt (V) / Maximum Current (A)	80V / 360A	80V / 380A	80V / 400A
<b>INPUT SPECIFICATIONS</b>			
Voltage	480 VAC, 3-phase ± 10%		
Current	50.6A rms/ph	53.4A rms/ph	56.2A rms/ph
Power Factor	>0.94		
Breaker Rating	80A		
<b>OUTPUT SPECIFICATIONS</b>			
Voltage	80V nom. / 110V max.		
Current	360A Max	380A Max	400A Max
Power	36.7kw Max	38.8kw Max	40.8kw Max
Output Cables	12', Dual 2/0		
Output Connectors	Dual Euro A320		
# of Battery Cells	18/24/36/40		
Peak-to-Peak Voltage Ripple	< 1%		
EFFICIENCY	Total charge cycle efficiency > 90%		
	Peak charging efficiency > 93%		
<b>PROTECTION</b>			
Input	<ul style="list-style-type: none"> <li>• Under voltage</li> <li>• Over voltage transients</li> </ul>		
Output	<ul style="list-style-type: none"> <li>• Over current</li> <li>• Over voltage</li> <li>• Charger Over temperature; Battery Over temperature</li> <li>• Battery reverse polarity</li> </ul>		
<b>OPERATING CONDITIONS</b>			
Temperature	0-40°C		
Humidity	10-90% RH noncondensing		
<b>INTERFACE</b>			
User Interface	LCD & keypad, USB, wireless communication with PT Link* Optional: Ethernet or CAN Interface		
<b>MECHANICAL</b>			
W x D x H	30" x 10" x 48"		
Weight	~296 lb	~300 lb	~304 lb
Cooling	Forced air (fans)		
Certifications	UL Listed; CEC and cUL certification available		



## 80V REVOLUTION X Single Cable Chargers

SPECIFICATIONS	X24-320A-80V-SC	X24-340A-80V-SC	X24-350A-80V-SC
UL Model Number	RVX-35.7-350-80-SC		
Nominal Volt (V) / Maximum Current (A)	80V / 320A	80V /340A	80V / 350A
<b>INPUT SPECIFICATIONS</b>			
Voltage	480 VAC, 3-phase ± 10%		
Current	45.0A rms/ph	47.8A rms/ph	49.2A rms/ph
Power Factor	>0.94		
Breaker Rating	80A		
<b>OUTPUT SPECIFICATIONS</b>			
Voltage	80V nom. / 110V max.		
Current	320A Max	340A Max	350A Max
Power	32.6kw Max	34.7kw Max	35.7kw Max
Output Cables	12', 4/0		
Output Connectors	'SB350, SBX350, Euro A320		
# of Battery Cells	18/24/36/40		
Peak-to-Peak Voltage Ripple	< 1%		
EFFICIENCY	Total charge cycle efficiency > 90%		
	Peak charging efficiency > 93%		
<b>PROTECTION</b>			
Input	<ul style="list-style-type: none"> <li>• Under voltage</li> <li>• Over voltage transients</li> </ul>		
Output	<ul style="list-style-type: none"> <li>• Over current</li> <li>• Over voltage</li> <li>• Charger Over temperature; Battery Over temperature</li> <li>• Battery reverse polarity</li> </ul>		
<b>OPERATING CONDITIONS</b>			
Temperature	0–40°C		
Humidity	10-90% RH noncondensing		
<b>INTERFACE</b>			
User Interface	LCD & keypad, USB, wireless communication with PT Link* Optional: Ethernet or CAN Interface		
<b>MECHANICAL</b>			
W x D x H	30" x 10" x 48"		
Weight	~276 lb	~280 lb	~284 lb
Cooling	Forced air (fans)		
Certifications	UL Listed; CEC certification available		

## 80V REVOLUTION X Single Cable Chargers

SPECIFICATIONS	X24-320A-80V-SC0	X24-400A-80V-SC0	X24-480A-80V-SC2
UL Model Number	RVX-40.8-400-80-SC		RVX-49.0-480-80-SC2
Nominal Volt (V) / Maximum Current (A)	80V / 320A	80V / 400A	80V / 480A
<b>INPUT SPECIFICATIONS</b>			
Voltage	480 VAC, 3-phase ± 10%		
Current	45.0A rms/ph	56.2A rms/ph	67.4A rms/ph
Power Factor	>0.94		
Breaker Rating	80A		100A
<b>OUTPUT SPECIFICATIONS</b>			
Voltage	80V nom. / 110V max..		
Current	320A Max	400A Max	480A Max
Power	32.6kw Max	40.8kw Max	49.0kw Max
Output Cables	12' 4/0		12' 250 mcm
Output Connectors	Euro, 430A		DIN640
# of Battery Cells	18/24/36/40		
Peak-to-Peak Voltage Ripple	< 1%		
EFFICIENCY	Total charge cycle efficiency > 90%		
	Peak charging efficiency > 93%		
<b>PROTECTION</b>			
Input	<ul style="list-style-type: none"> <li>• Under voltage</li> <li>• Over voltage transients</li> </ul>		
Output	<ul style="list-style-type: none"> <li>• Over current</li> <li>• Over voltage</li> <li>• Charger Over temperature; Battery Over temperature</li> <li>• Battery reverse polarity</li> </ul>		
<b>OPERATING CONDITIONS</b>			
Temperature	0-40°C		
Humidity	10-90% RH noncondensing		
<b>INTERFACE</b>			
User Interface	LCD & keypad, USB, wireless communication with PT Link* Optional: Ethernet or CAN Interface		
<b>MECHANICAL</b>			
W x D x H	30" x 10" x 48"		
Weight	~276 lb	~292 lb	~311 lb
Cooling	Forced air (fans)		
Certifications	UL Listed; CEC certification available		

# INSTALLATION PROCEDURE

## Charger Installation

The following procedure describes proper installation of the **REVOLUTION** series of chargers.

### Charger Unpacking and Inspection

Upon receipt of a **REVOLUTION** charger, ensure that there is no physical damage to the chassis, the **Liquid Crystal Display (LCD)**/keypad, or the DC cables. If any damage is apparent, contact the shipping carrier.



**Do not install or operate the charger if it has any visible damage.**

Preparing for the Installation:

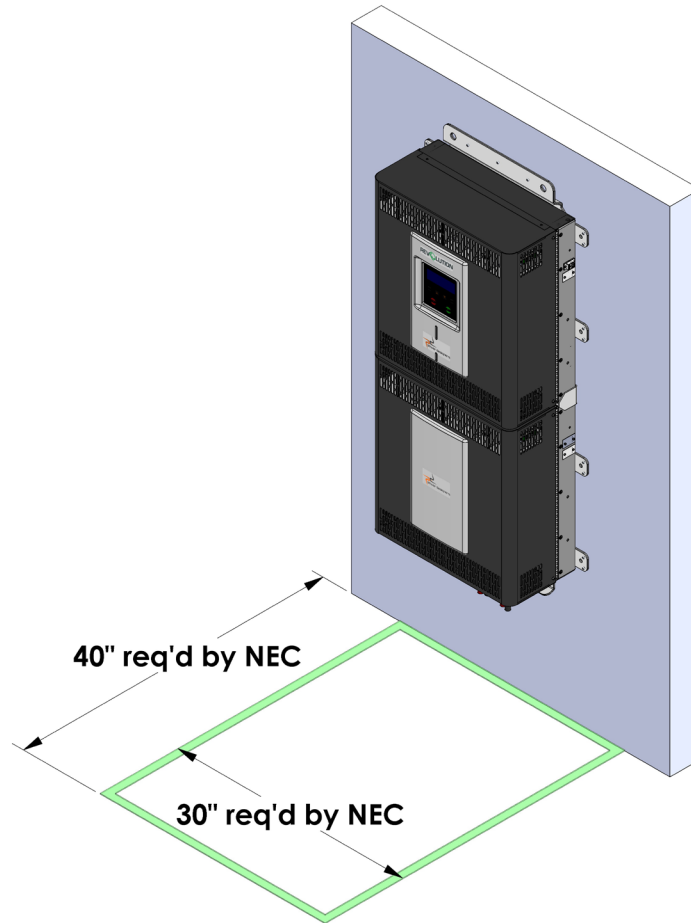
**Failure to meet these minimum requirements may result in a voided warranty.**

- **Adequate Cooling Required** – To prevent damage from overheating, proper airflow must be ensured. Do not restrict fan inlets or exhaust outlets. Do not mount the charger in a confined space or where the exhaust air will recirculate.

**Continue on page 15 for RV16 Installation Procedure**  
**Continue on page 20 for RV24 Installation Procedure**

## RV16 Models Installation

- Mount the charger vertically, observing the minimum spacing shown below:

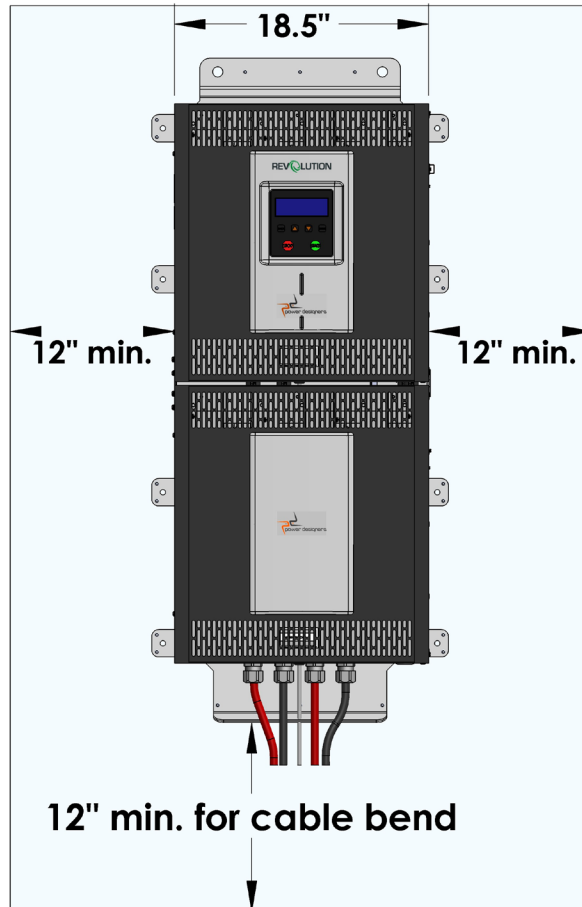


**Figure 2: RV16 NEC minimum spacing**

- Ensure that the charging area is well ventilated, dry, and clean.
- **Do not expose the charger to rain or snow.**

The charger is NOT designed for outdoor use.

- There must be at least 12” of spacing between the sides of the charger and any adjacent walls or barriers, and 12” of spacing between the bottom of the charger and the floor or any other obstruction. This is to allow for service and tool access to the Charger.



**Figure 3: RV16 minimum spacing**

- Ambient Temperature Range 0 – 40° C
- Ambient Humidity Range 10-90% RH non-condensing

## 1. Preparing the Mounting Area:

- The Charger must be mounted vertically as illustrated, using 5/16" hardware. (User provided) The Charger may be directly mounted to masonry or concrete, structural framing channels, or onto the Floor Stand. (purchased separately; see Appendix B)

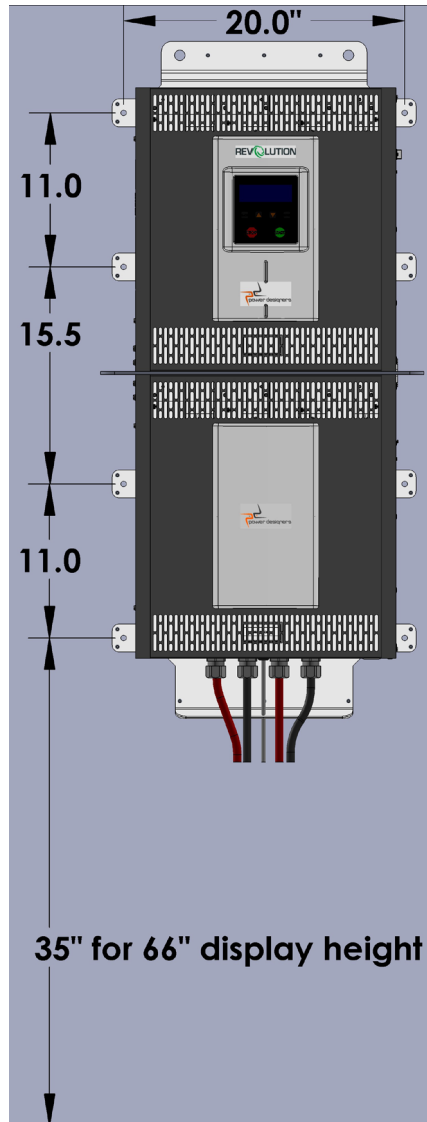
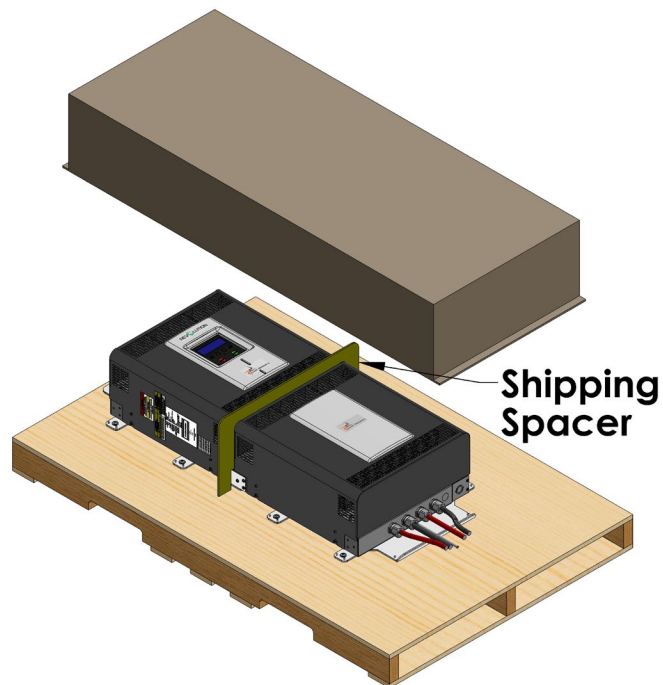


Figure 4: RV16 mounting height

- Charger should be fastened to the mounting surface using 5/16" hardware (User provided). Threaded mounting studs protruding from surface are recommended for ease of installation.
- **Charger Weight: 210 lbs. maximum**

## 2. Unpacking the Charger:

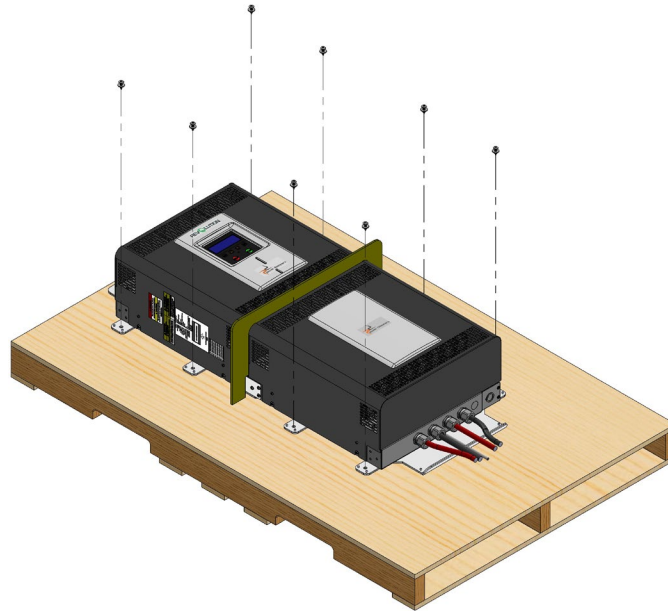
- Move the Charger's pallet to the installation area. **DO NOT** remove Charger from pallet until at the installation area. **The Charger IS NOT** designed to be transported in any position other than horizontal!
- Remove the cardboard box cover from the pallet. **DO NOT REMOVE** the Shipping Spacer; it is necessary to prevent damage to the Charger when lifting.



**Figure 5: RV16 Box Removal**

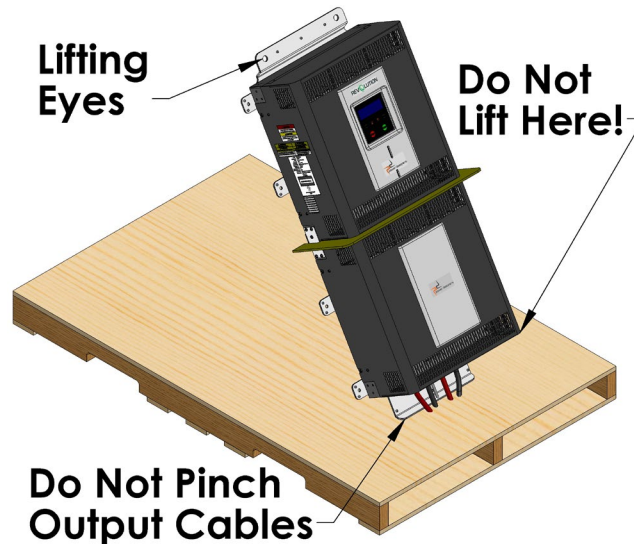
The Charger's output cables (not shown, for clarity) will be coiled at the base of the charger.

- Remove the 8 screws securing the Charger to the pallet: (Figure 6)



**Figure 6: RV16 Shipping Screw Removal**

- Using a hoist, forklift, or other appropriate lifting equipment, attach a chain or strap to the lifting eyes at the top of the charger and pick it up off the pallet. Position the Charger on the installation location and fasten the charger permanently.



**Figure 7: RV16 Lifting**

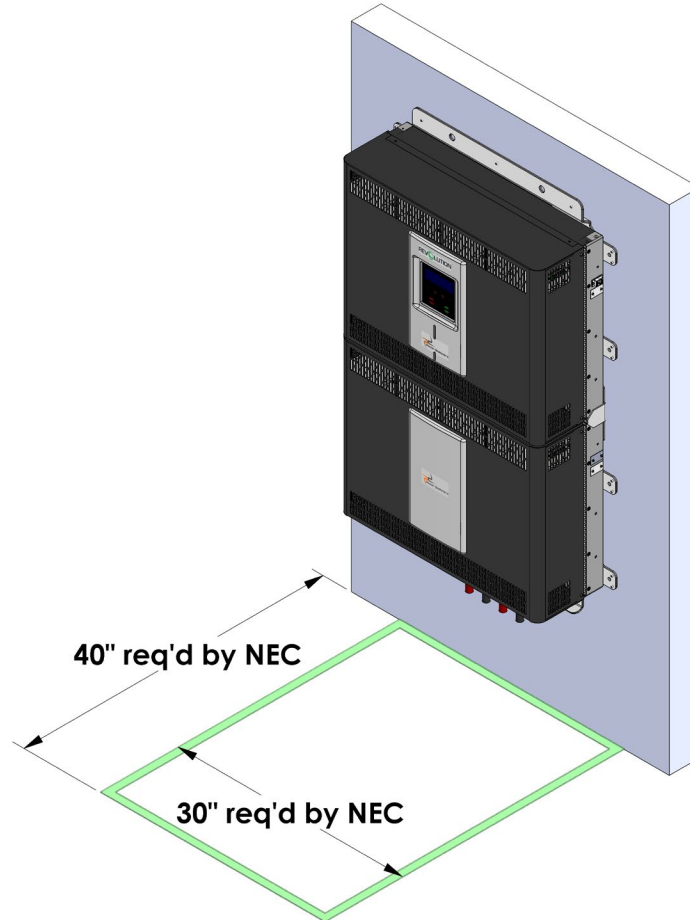
Once the Charger has been permanently mounted, the Shipping Spacer can be removed, and electrical installation can be completed.

**Continue on page 25 for Charger Electrical Installation**



## RV24 Models Installation

- Mount the charger vertically, observing the minimum spacing shown below:

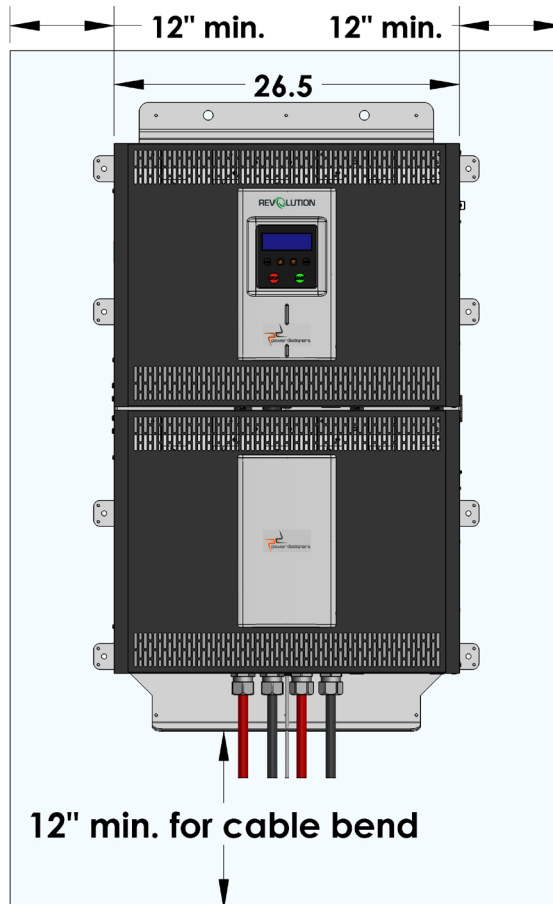


**Figure 8: RV24 NEC minimum spacing**

- Ensure that the charging area is well ventilated, dry, and clean.
- **Do not expose the charger to rain or snow.**

The charger is NOT designed for outdoor use.

- There must be at least 12" of spacing between the sides of the charger and any adjacent walls or barriers, and 12" of spacing between the bottom of the charger and the floor or any other obstruction. This is to allow for service and tool access to the Charger.

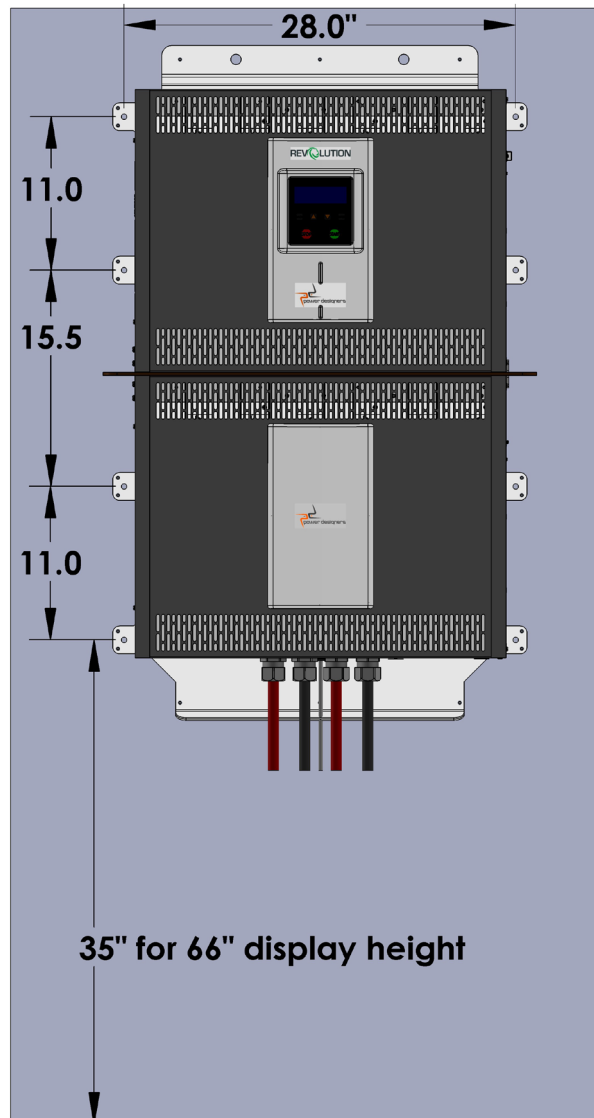


**Figure 9: RV24 minimum spacing**

- Ambient Temperature Range 0 – 40° C
- Ambient Humidity Range 10-90% RH non-condensing

## 1. Preparing the Mounting Area:

- The Charger must be mounted vertically as illustrated, using 5/16" hardware. (User provided) The Charger may be directly mounted to masonry or concrete, structural framing channels, or onto the Floor Stand. (purchased separately; see Appendix B)

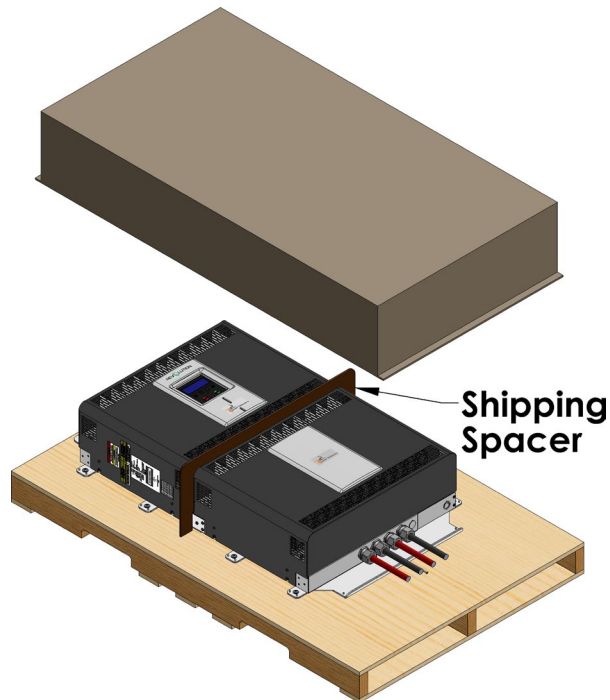


**Figure 10: RV24 mounting height**

- Charger should be fastened to the mounting surface using 5/16" hardware (User provided). Threaded mounting studs protruding from surface are recommended for ease of installation.
- **Charger Weight: 300 lbs. maximum**

## 2. Unpacking the Charger:

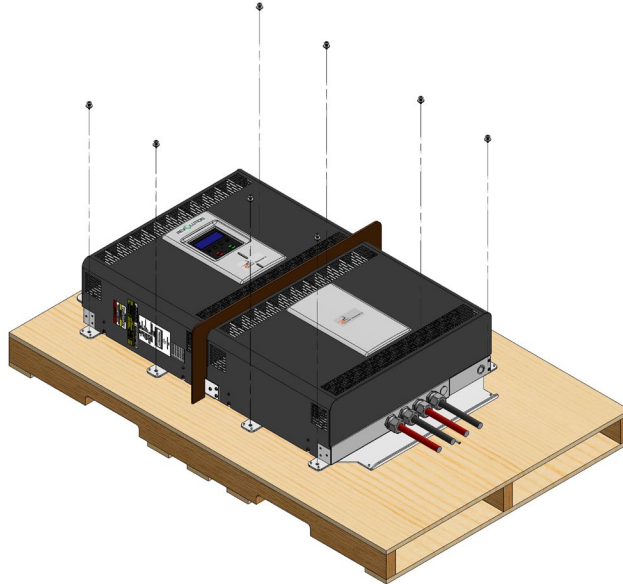
- Move the Charger's pallet to the installation area. **DO NOT** remove Charger from pallet until at the installation area. **The Charger IS NOT** designed to be transported in any position other than horizontal!
- Remove the cardboard box cover from the pallet. **DO NOT REMOVE** the Shipping Spacer; it is necessary to prevent damage to the Charger when lifting.



**Figure 11: RV24 Box Removal**

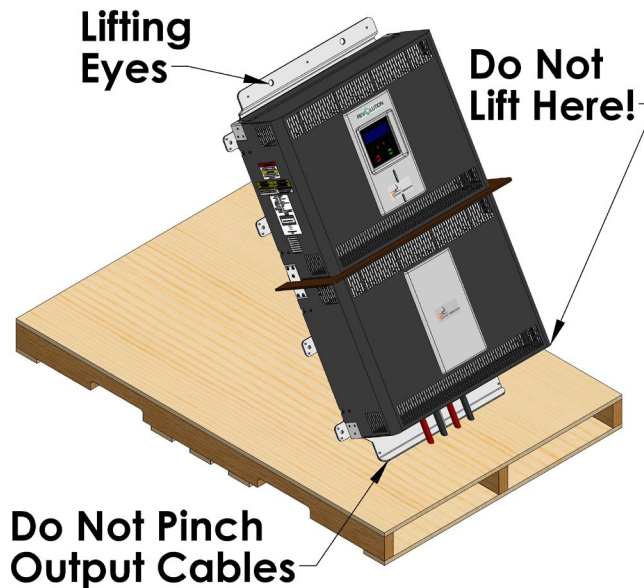
The Charger's output cables (not shown, for clarity) will be coiled at the base of the charger.

- Remove the 8 screws securing the Charger to the pallet: (Figure 12)



**Figure 12: RV24 Shipping Screw Removal**

- Using a hoist, forklift, or other appropriate lifting equipment, attach a chain or strap to the lifting eyes at the top of the charger and pick it up off the pallet. Position the Charger on the installation location and fasten the charger permanently.



**Figure 13: RV24 Lifting**

- Once the Charger has been permanently mounted, the Shipping Spacer can be removed and electrical installation can be completed.

**Continue on page 25 for Charger Electrical Installation**

# Charger Electrical Installation



**DANGEROUS VOLTAGES AND CURRENTS ARE PRESENT IN THE AC MAINS WHEN ENERGIZED. ONLY TRAINED PERSONNEL SHOULD PERFORM THE INSTALLATION, USING PROPER EQUIPMENT AND PROCEDURES.**

**VERIFY THAT INPUT AND OUTPUT WIRING ADHERES TO ALL LOCAL SAFETY CODES AND STANDARDS.**

1. The REVOLUTION chargers require a 480 VAC 3Ø, four-wire Wye or Delta electrical supply with a separate ground (Figure 14).

REVOLUTION Model	480 VAC Current Draw	Circuit Protection at 125%
RV16	30 A	40 A
RV24	44 A	60 A

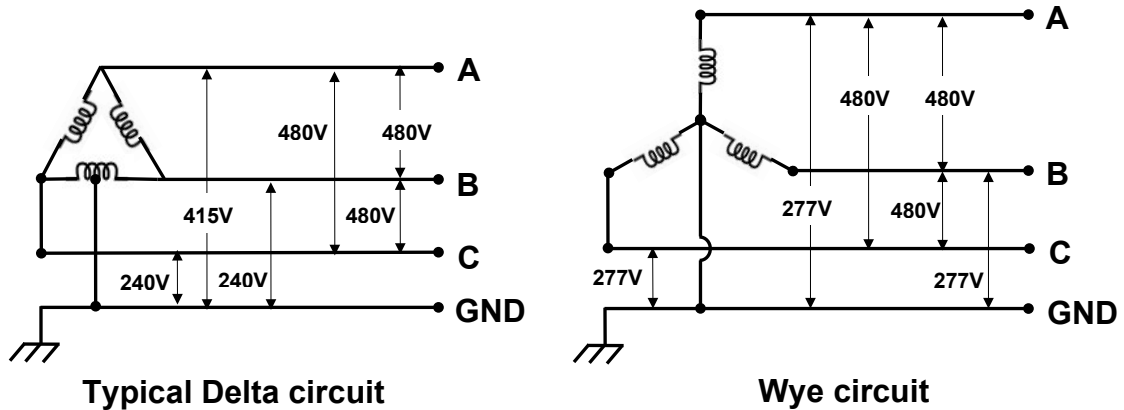


Figure 14: AC input wiring diagrams

2. Verify that the source circuit is locked and tagged out before connecting power to the charger.

## RV16 & RV24 Electrical Instructions

3. With a #2 Phillips screwdriver, remove the four 10-32 screws securing the Charger hinge: (Figure 15)

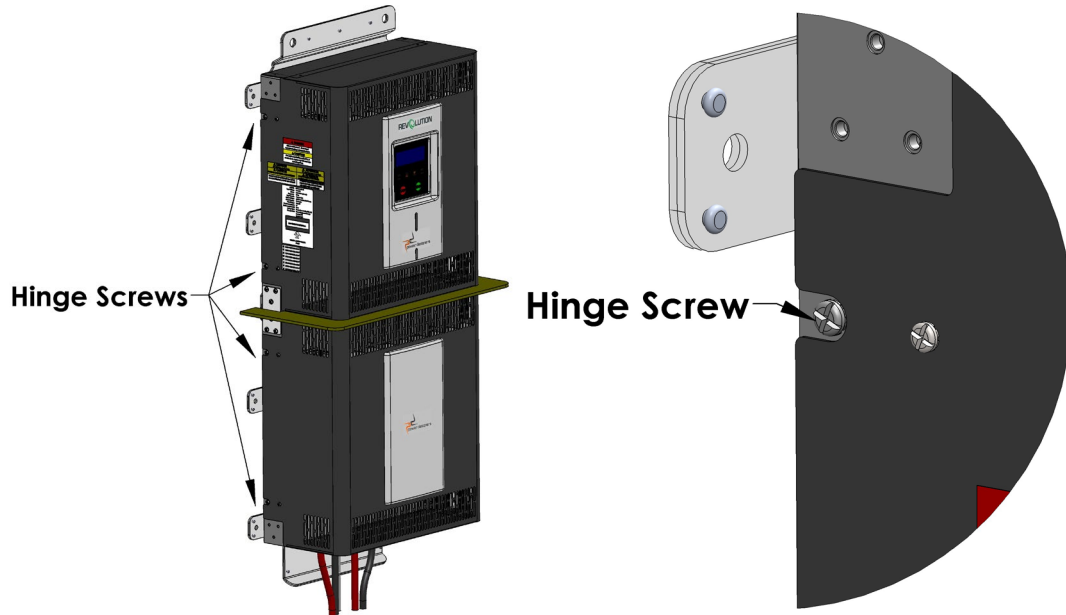
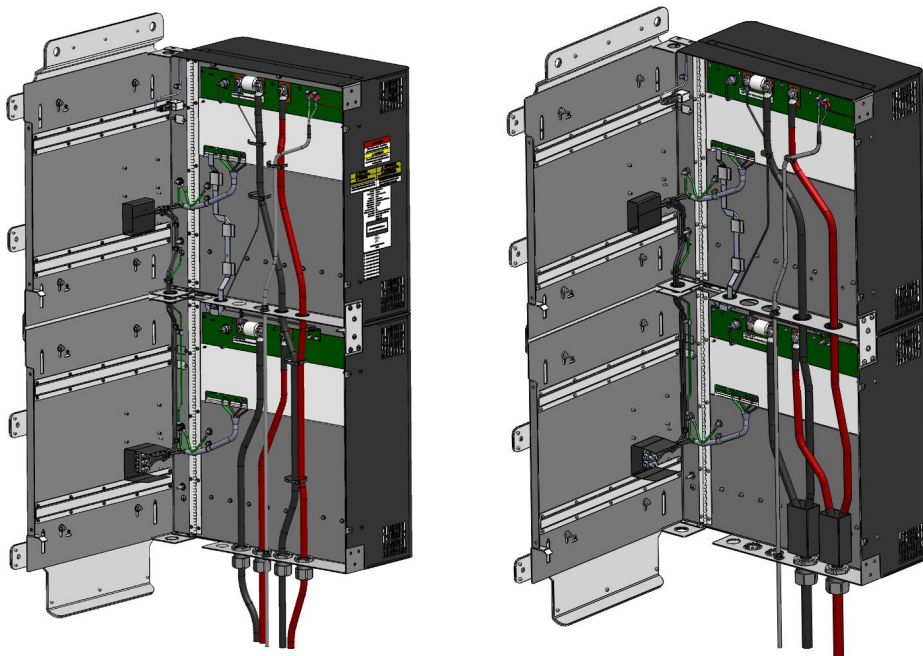


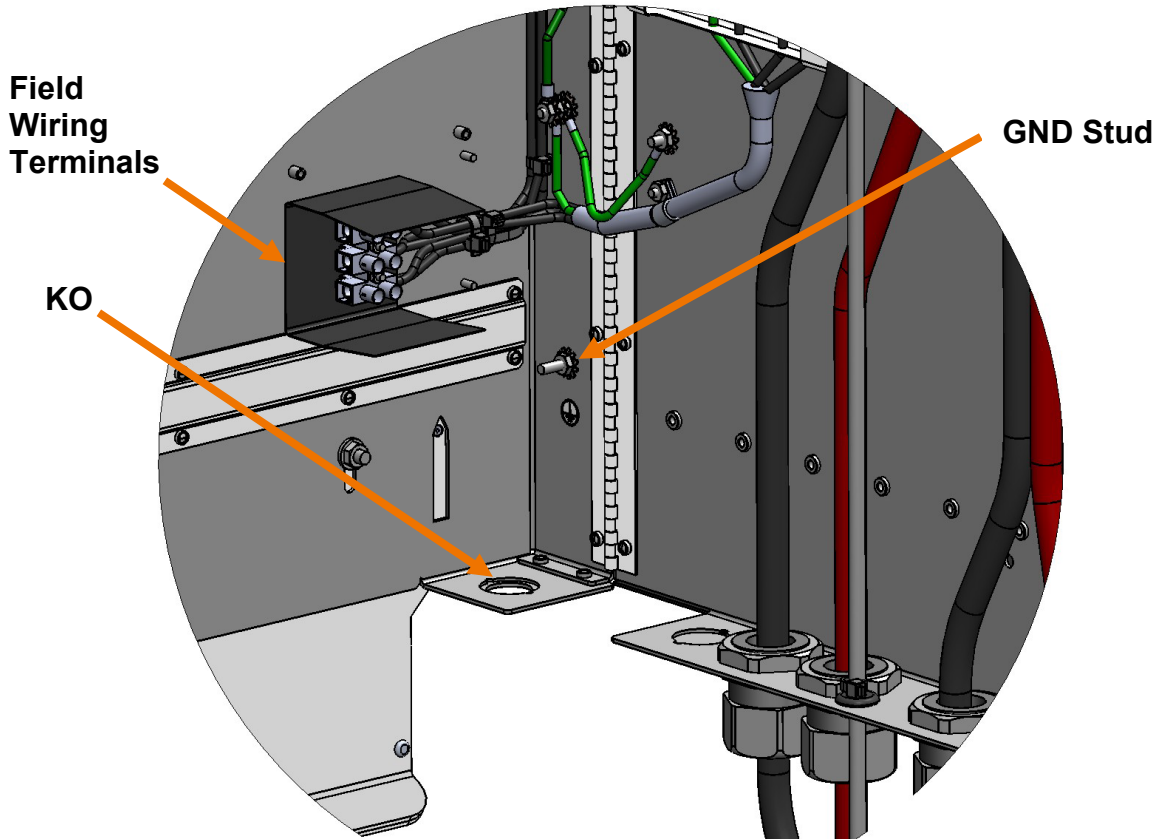
Figure 15: RV16 Hinge Screw Locations and Detail

4. Open the Charger hinge. Determine whether the  $\frac{1}{2}$ " or  $\frac{3}{4}$ " conduit hole will be utilized; if  $\frac{3}{4}$ " is desired, punch out the outer ring from the KO provided. (Figures 16 & 17)



**Figure 16: Hinge Open**

5. Pass the 480 VAC input power wires through, using the appropriate conduit or strain relief fittings per local and national codes.



**Figure 17: RV16 Electrical Connections**

6. Crimp a #10 ring tongue terminal to the ground (**GND**) wire and connect it to the GND terminal (Figure 17). **Tighten the nut to 15 in-lb +/- 2 in-lb.**
7. Strip the conductors back 0.5 inch (12 mm) and connect them to the AC Terminal Block. **Tighten the terminal screws to 12 in-lb +/- 2 in-lb. NOTE:** The charger is not phase-rotation sensitive. Be sure any excess wire does not get pinched when the Charger door is closed.
8. Once the Electrical connections have been made, the Charger door should be closed, and secured with the 10-32 screws previously removed. **Tighten the 10-32 screws to 12 in-lb +/- 2 in-lb.**
9. Verify the line and ground connections of the outlet or junction box/disconnect.
10. Energize the source circuit and verify proper AC voltage to the Charger. All line-to-line voltages should be 480 VAC  $\pm$  10% and matched within 10 VAC.



# THE CHARGER IS NOW READY FOR OPERATION

## OPERATION PROCEDURE

### Charger Controls and User Interface

Users operate the **REVOLUTION** series of chargers through each charger's front panel LCD/keypad (Figure 18).

This is the main user interface for viewing operation and fault messages. It also allows limited charger programming options. (For programming information, see **Charger Main Menu**, page 31 of this manual.)

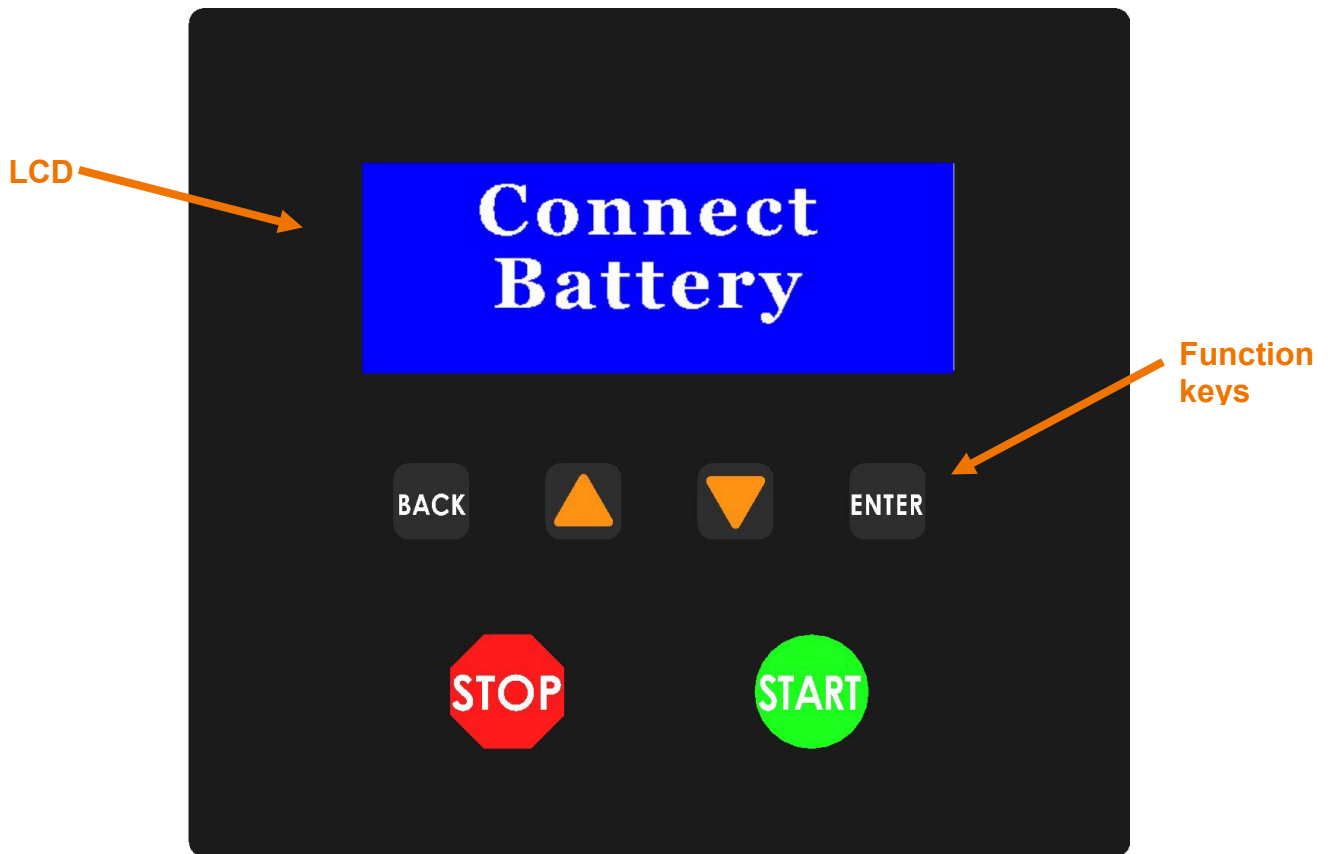
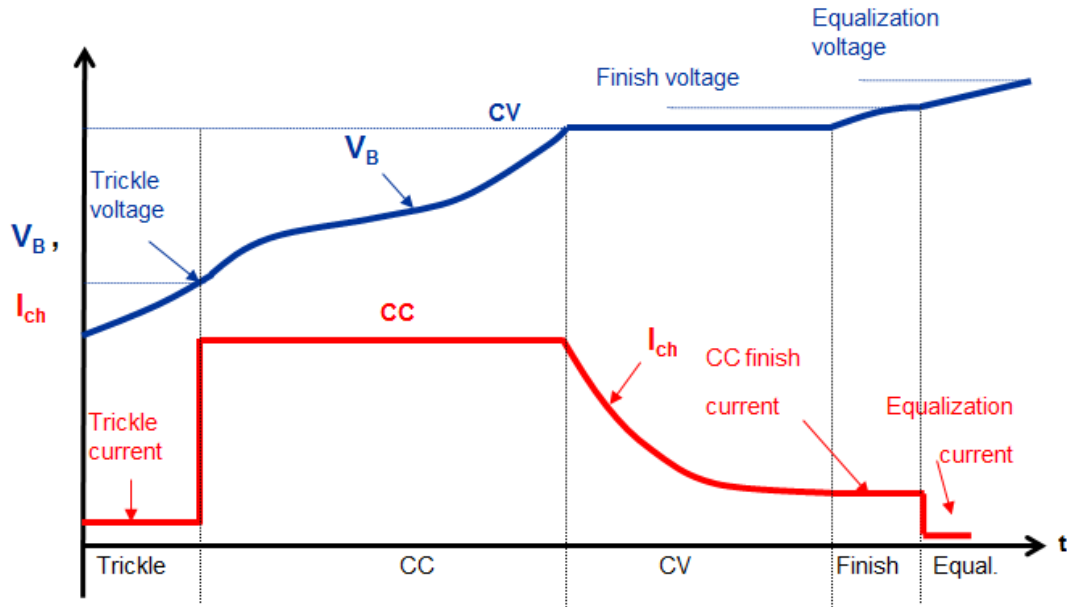


Figure 18: User interface LCD/keypad

# Basic Charge Cycle Operation



**Figure 19: Typical charge cycle – charge modes**

The typical charge cycle for conventional and opportunity chargers consists of the first four modes (TR, CC, CV, FI) on a daily basis, with all five modes (TR, CC, CV, FI, EQ) occurring on a weekly basis. The typical charge cycle for fast chargers consists of the first three modes (TR, CC, CV) on a daily basis, with all five modes (TR, CC, CV, FI, EQ) occurring on a weekly basis. A brief description of the various modes is listed below and all modes are shown above in Figure 29.

**Trickle:** Trickle mode is rarely used, as it is typically only encountered when a battery is extremely discharged (average cell voltage of <1.85 volts). This mode charges the battery at a very low current (typically ~3% of Ahr capacity) until the battery voltage rises above the trickle voltage setting.

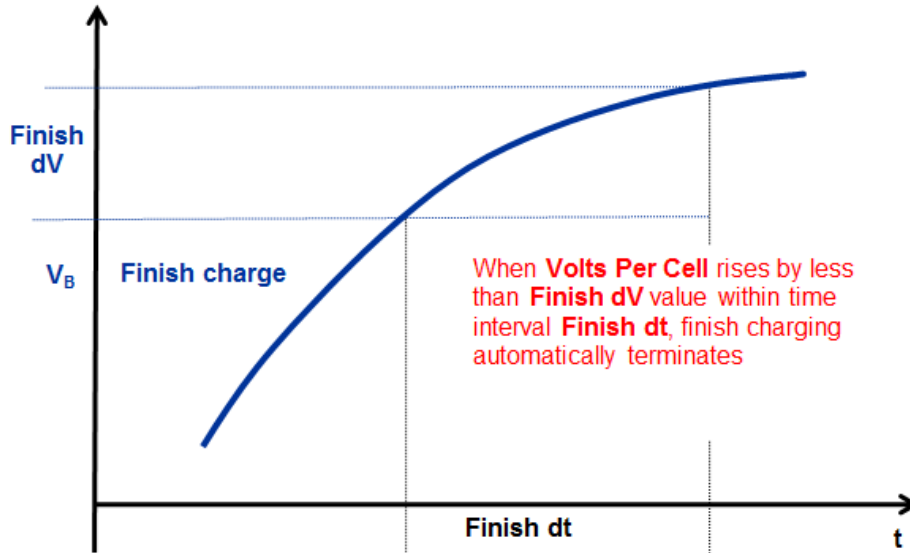
**CC:** CC mode is where the bulk of the battery charging occurs. This mode is the Constant Current mode where the current is held steady at ~15%-50% of the battery capacity. This mode continues until the battery voltage rises to an average cell voltage of ~2.4 volts (CV voltage), and the charge cycle then transitions into the CV mode. This voltage is partially inflated above the true battery voltage due to the fact that current is being pushed into the battery and the internal battery resistance causes the battery voltage to artificially rise above the resting battery voltage.

**CV:** CV mode ensures the battery rises to ~95% charged. This mode holds the voltage of the charge steady at approximately 2.4 volts per cell and allows the current into the battery to taper off as the battery voltage gets closer to holding itself at the set voltage. The current will continue to taper off until it reaches the CV Finish Current, at which time the charge cycle will terminate, unless finish is enabled. If Finish is enabled, the current will continue to decrease until it reaches the Finish Current, at which time the charger will transition into Finish mode.

**Finish:** Finish mode will hold the current into the battery constant, and the battery voltage will slowly rise. The charge cycle will terminate when one of three conditions exists: The charger has been in the finish mode for the full duration of the finish timer, the Finish dv/dt is reached, or the Finish Voltage is achieved. The Finish dv/dt is reached when the battery voltage rises less than the

Finish  $dV$  (typically  $\sim 5\text{mv/cell}$ ) over the length of time defined by the Finish  $dt$  (typically  $\sim 20$  minutes). (Figure 30)

**Equalize:** The equalize mode ensures that all cells of the battery are equally charged. During charge/discharge, the inner and outer cells of the battery will tend to be at slightly different voltage. The equalize mode charges at a low fixed current ( $\sim 3\%$  of Ahr capacity) for a fixed amount of time (Typically  $\sim 3\text{-}6$  hr), and ensures that all cells are fully and equally charged.



**Figure 20: Finish charge termination criteria**

**Opportunity and Fast Charging:** Opportunity and fast charging typically utilize a temperature sensor (thermistor) on the battery to allow more rapid recharge of the battery, without the risk of damage to the battery. The thermistor may be mounted to an intercell strap or post (external type), or mounted through the cover of the cell to monitor the electrolyte temperature directly (internal type). The thermistor is connected to the charger through the auxiliary contacts of the battery connector. The charger uses the temperature that is calculated from the thermistor to adjust the voltages at which the charger transitions to the CV and Finish/Equalize modes of operation, and to limit the temperature rise of the battery to a safe level. See Appendix D for further details. Installation instructions for the thermistor can be obtained at <http://powerdesignerssibex.com/>.

**REVOLUTION** Chargers can include optional interfaces for communication with the PowerTrac Battery monitoring devices. The PowerTrac, battery data logger option allows the charger to have multi-voltage (24/36/48)\* capabilities, giving the charger the ability to automatically adapt to the battery voltage and Ahr capacity.

\*48V chargers are capable of charging 24/36/48 batteries  
36V chargers are capable of charging 24/36 batteries

Adding RS-485 interface to the charger allows the charger to communicate to the PowerTrac SP+ with automatic detection of either a thermistor or PowerTrac SP+ presence.

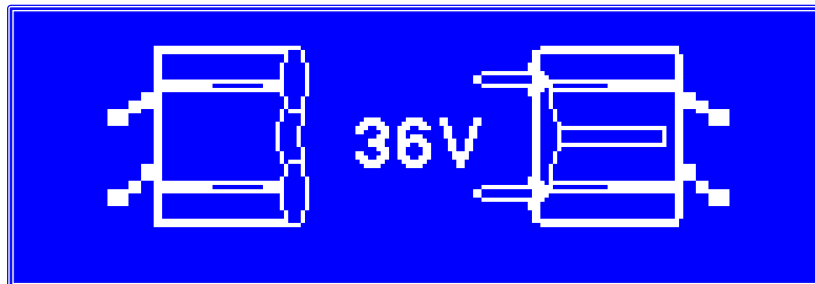
To communicate wirelessly to a PowerTrac 3 (PT3), the charger must be ordered with the RMC communication option.

# Getting Started

The LCD display on **REVOLUTION** series presents various screens and **SCREEN MESSAGES**.

## 1. Powering the Charger

- Energize the AC mains at the main panel (turn the local AC disconnect switch to the **ON** position, if one exists).
- Verify that the LCD display is lit and displays the **CONNECT BATTERY** screens, alternating between the animation and message as shown below.



**DANGEROUS VOLTAGES AND CURRENTS ARE PRESENT IN THE AC MAINS WHEN ENERGIZED. ONLY TRAINED PERSONNEL SHOULD PERFORM THESE CHECKS, USING PROPER EQUIPMENT AND PROCEDURES.**

- If the charger does not power up, carefully verify the source circuit and wiring to the charger and correct any problems. If appropriate, check that all fuses in the local disconnect switch box on the wall are intact, and that the supply voltage for all three phases (AC mains line-to-line) is  $480V \pm 10\%$ , and matches to within 10VAC or better between phases.
- Restart the charger; if the problem persists, contact the Dealer or Power Designers Sibex.

## 2. Starting a Charge Cycle

- Connect the battery to the charger. **REVOLUTION** Chargers incorporate a detection circuit that distinguishes between a PowerTrac Battery Monitor and a thermistor. If a PowerTrac is detected when the battery is connected, the LCD will momentarily display a screen similar to this:



If the Charger has been set up to accept the PowerTrac battery charge parameters, charging of the battery will proceed using the displayed values. Following this display, one of two messages appears on the LCD:

The LCD displays the **PUSH START** screen.



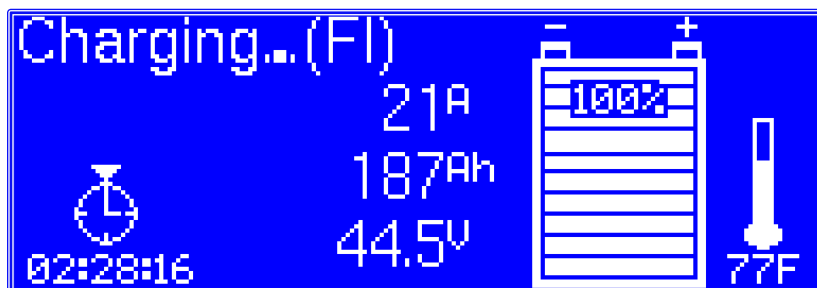
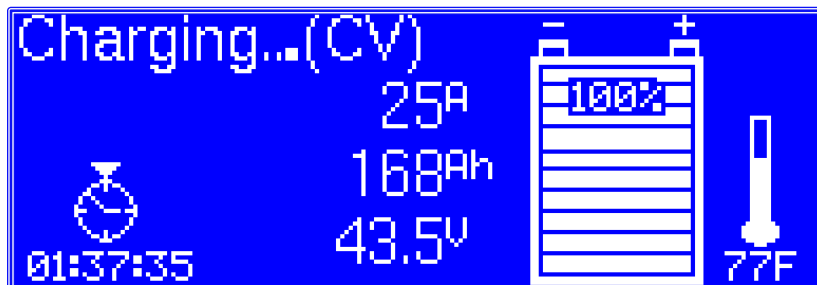
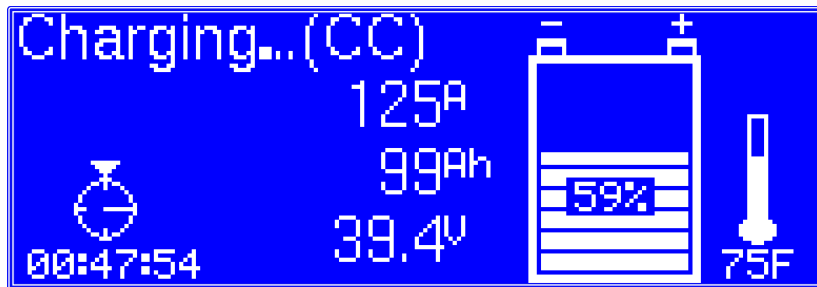
Or, if **Charge Autostart** is enabled, the charger automatically starts the charge cycle, and briefly displays an **AUTO START** with a timer count-down message as shown below. The timer will count down from 5 to 1 before the charge cycle starts.



If either the "Start" or "Auto Start" screens are not displayed, the battery has not been detected. Make sure that the battery cables are connected properly.

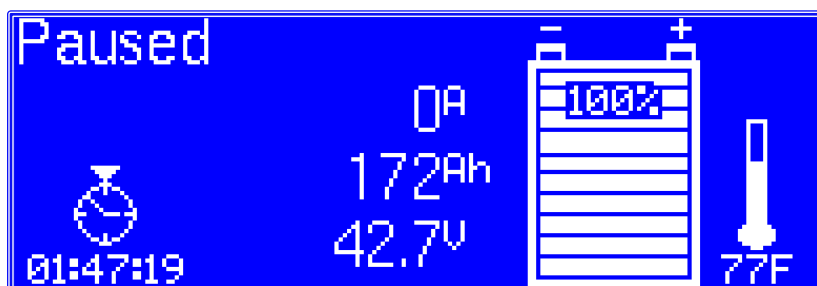
- If the charger is not set to start automatically, start the charge cycle by pushing the green **START** button on the keypad.

- The charge cycle begins and a screen similar to one of the following, showing the charging operation, appears:



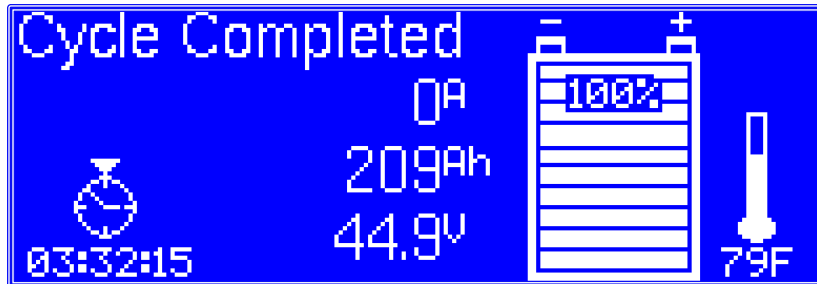
The **Charging ... (XX)** field in the upper left corner indicates the active charging mode, the **XX** will indicate **TR** for trickle, **CC** for constant current, **CV** for constant voltage, **FI** for finish, or **EQ** for equalize. The screen also displays a charge timer (lower left), a battery icon with % state of charge gauge along with actual readings of charging amps (**A**), returned amp-hours (**Ah**), and battery voltage (**V**). The right side of the screen has a thermometer icon which gives the current battery temperature (°F or °C).

- To stop the charge cycle, select the **STOP** button. A **PAUSED** message appears.



Selecting **STOP** for the second time stops the charger completely and defaults to the **PUSH START** screen. Selecting **START** from the **CHARGING STOPPED** screen starts a new charge cycle and the screen will again display the charging operation display.

- Once the charge cycle has completed, the charger displays the **CYCLE COMPLETED** screen.



On this screen appears the total charging time and total returned amp-hours along with the final state of charge of the battery.

# Charger Main Menu

From the charger **MAIN MENU** screen, access is provided to the following list of screens:

- Manual Equalize
- Desulfation Cycle
- Charge History
- Lifetime Summary
- Model & SN
- Network Settings

These screens may only be accessed when the charger is in idle mode (i.e., when either the **CONNECT BATTERY** or the **PUSH START** screens are displayed).

Pushing the **ENTER** key selects the charger **MAIN MENU** screens.

The up/down arrow (**▲/▼**) keys scroll between the various screens.

The **BACK** button is used to return to the previous screen and/or back to the main menu.

Selecting the **ENTER** button within a main menu will select a setting, go to the next screen, or toggle between two screens.

## 1. Manual Equalize

- While in **MAIN MENU**, press **▲/▼** until the **MANUAL EQUALIZE** screen appears.



- Press **ENTER** to access screen.



- Press **▲/▼** to select **YES** or **NO**.

**NOTE: Once an Equalization is activated, it remains active only for the next charge cycle.**



d. Press **ENTER** key to save selection and return to the main menu. The LCD display now indicates the Equalization charge is activated with an “E” in the upper right corner of the display, and one of the following displays will be observed, depending on the setup of the Charger.



## 2. Desulfation Cycle

One of the unique features of this charger is the ability to run a safe, tailored recovery cycle for sulfated batteries. This can easily be done through the **DESULFATION CYCLE** screen.

The operator enters the battery nominal voltage, Ah capacity, and the cycle duration. The charger will output a constant current of 5% of the Ah capacity ( $.05 \times C$ ) for the defined duration (in the time range of 6:00 hours to 18:00 hours). Any battery capacity above 1200 Ah will have the desulfation current limited to 60A.

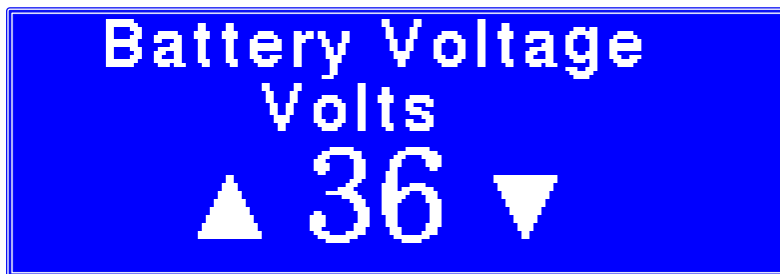
- a. Connect the battery to be recovered. If the charger is set to auto-start the charge cycle, press the stop button until you are back on the “Push Start” screen

**NOTE: Do not attempt to recover a battery with a capacity of less than 250 amp-hours.**

- b. While in **MAIN MENU**, press ▲/▼ until the **DESULFATION CYCLE** screen appears.



- c. Press **ENTER** to access the recovery cycle set-up screens. The first screen selects the appropriate battery voltage.

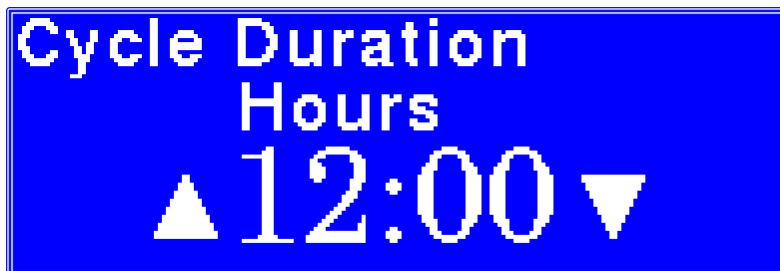


Pressing ▲/▼ toggles the battery voltage setting. Select the correct voltage and select **ENTER**. The **Battery Capacity** screen appears.



Pressing ▲/▼ allows users to enter the correct battery amp-hour capacity. The recovery charge current is fixed at 5 A/100 Ahrs (5% of rated capacity).

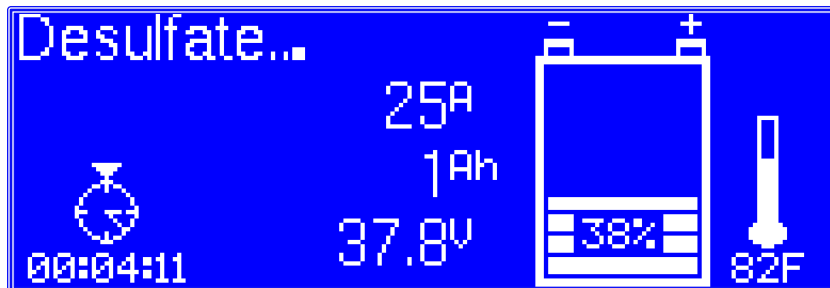
- d. Press the **ENTER** key once the correct value is selected. The **Cycle Duration** timer screen appears.



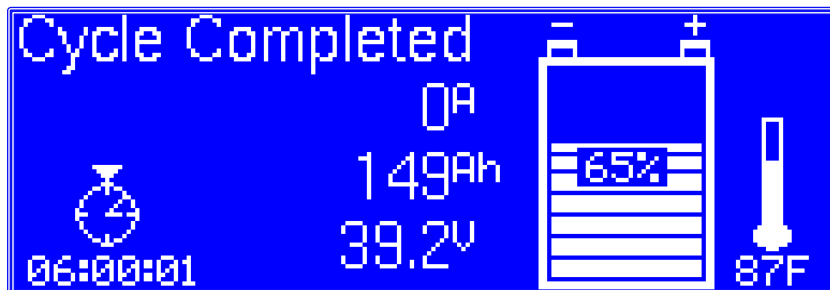
Pressing ▲/▼ allows adjustment of the charge timer setting in 15-minute increments. The charge timer setting can be set up to 18 hours. Select the desired value, then select **ENTER**. Next, the **START DESULFATION CYCLE** screen appears.



e. Push **START** to initiate the desulfation cycle.



Once the cycle is complete, a **CYCLE COMPLETED** message appears.



**NOTE: The desulfation cycle is a separate cycle; activating it does not affect other charger settings.**

### 3. Charge Cycle History

- a. While in **MAIN MENU**, press ▲/▼ until the **CHARGE HISTORY** screen appears.



Press the **ENTER** to access the **Charge History** screens.

- b. The first screen that appears is the Charge Cycle history screen as shown below. Users can access the charge history for up to 400 charge cycles, beginning with the most recent charge cycle. Pressing ▲/▼ allows scrolling through the saved charge cycles, from the most recent cycle to the earliest (Charge 0), in descending order.



The first screen of the charge history displays the charge number, the date and time when the charge was started, the charge duration, end battery voltage, the total amp-hours returned to the battery, and the Charger status.

**STATUS** indicates whether the cycle was completed successfully (**COMPLETED**), interrupted by the user (**STOPPED**), interrupted due to a power outage or disconnection (**TURNED OFF**), or interrupted due to a fault (e.g., **OV FAULT** for an overvoltage fault).

Press **ENTER** to access the second screen of the charge history which shows the profiles that were activated in the charge cycle, and any Charger faults. Pressing **ENTER** again will return to the first screen. Pressing the **BACK** key returns to the **CHARGE HISTORY** screen from the first screen only.



Charge:062 02/17/14 09:28  
Profiles: TR CC CV

**PROFILES** lists the profiles activated during the charge cycle. Trickle charge appears as **TR**, constant current as **CC**, constant voltage as **CV**, finish as **FI**, and equalize as **EQ**.

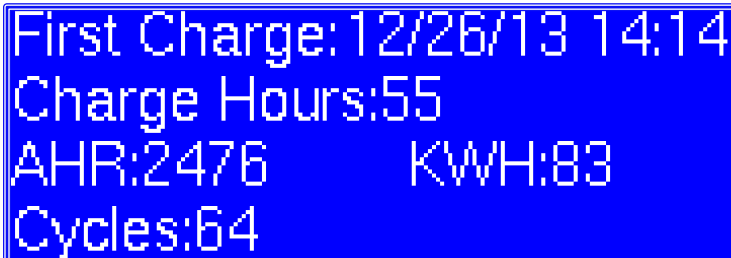
#### 4. Lifetime Summary

- a. While in **MAIN MENU**, press ▲/▼ until the **LIFETIME SUMMARY** screen appears.



Lifetime  
Summary

- b. Pressing the **ENTER** key will display a screen summarizing charger lifetime summary stats since installation.

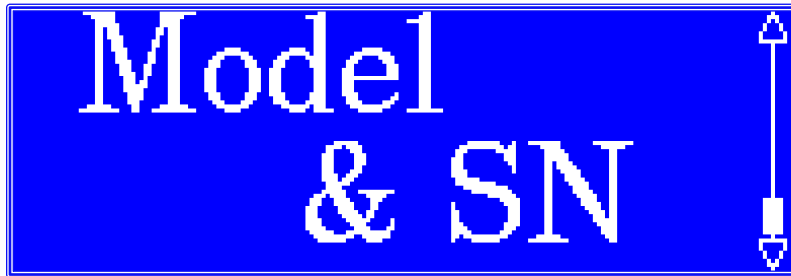


First Charge:12/26/13 14:14  
Charge Hours:55  
AHR:2476      KWH:83  
Cycles:64

This screen allows verification of charger usage: First charge date and time, total charge hours, amp-hours, and kW-hours, and the total number of cycles completed since installation. This information may be used to compare usage on different chargers.

## 5. Charger Model

- a. While in **MAIN MENU**, press ▲/▼ until the **MODEL & SN** screen appears.



- b. Pressing the **ENTER** key displays the charger model number, manufacturing ID, and firmware revision for reference.



## 6. Network Settings (Ethernet Option Only)

- a. While in **MAIN MENU**, press ▲/▼ until the **Network Settings** screen appears.



- b. Pressing the **ENTER** key displays the IP Configuration Screen:

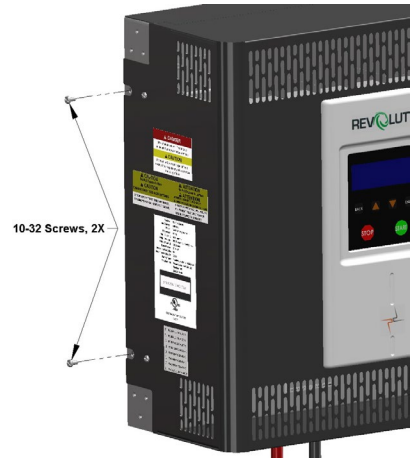


For further information on network setup, see the PowerCharge DataLink User Software, P/N 014-000324-00. (Downloadable from [www.powerdesigners.com](http://www.powerdesigners.com))

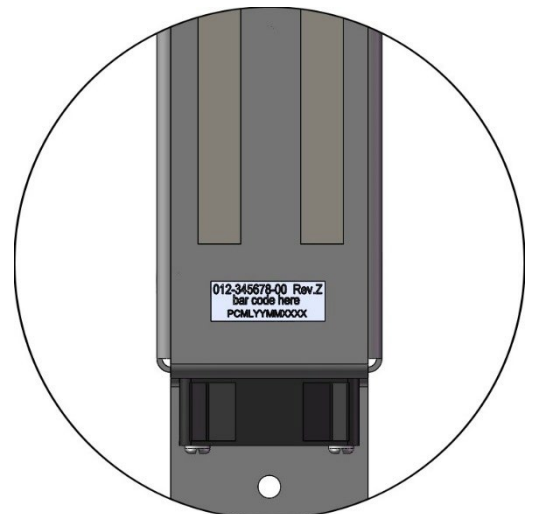
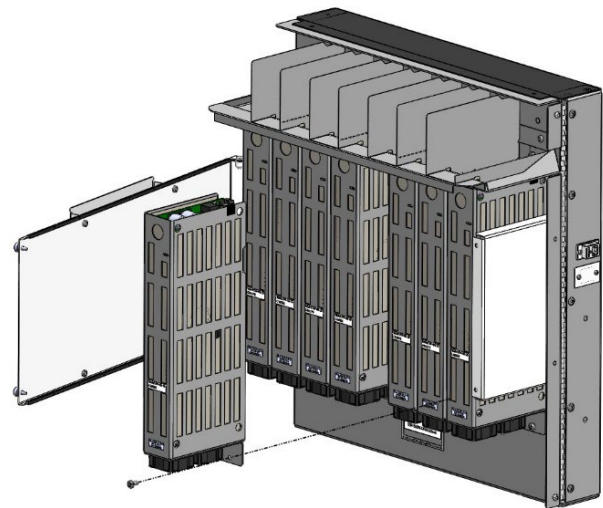
# MODULE REPLACEMENT

In the event a module needs to be replaced follow the instructions below.

1. Note the serial number of the module that needs to be replaced from the Main Screen under the Charge History.
2. De-energize and lock out the incoming AC line from the charger. Follow all local safety procedures and PPE guidelines.
3. Remove the cover of the charger
  - i. Remove the (4) 8-32 screws (2 on each side) securing the upper cover of the Charger. Do not remove the 10-32 screws on the left side of the Charger.
  - ii. Pull the upper cover out and away from the charger.
  - iii. Repeat for lower cover.
  - iv. Loosen the (2) captive screws securing the upper door closed and swing open the door, repeat for lower door.



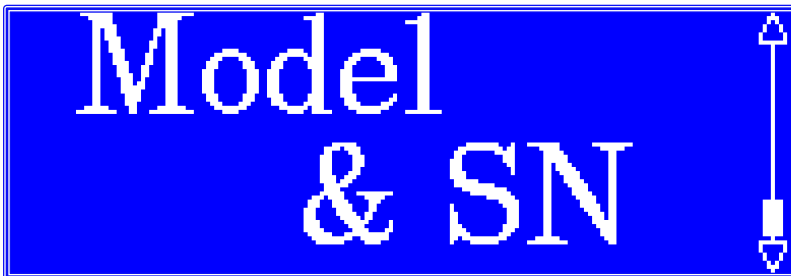
4. Locate the module being removed by the serial number label on the lower front of the module.
5. Remove the (1) 10-32 screw from the bottom tab of the module.
6. Carefully pull the module straight out of the socket. Use your thumb or forefinger to grab the round hole at the top of the module. Grab the fan at the bottom of the module with your other hand.
7. Re-assemble the charger in reverse order. Slide the module in the slot and install the (1) 10-32 screw in the bottom tab of the new module.  
Note: Tighten the captive screws to 10 in-lbs., the (1) 10-32 module screw and (2) 8-32 cover screws to 12 in-lbs.
8. Enumerate the modules to allow the charger to recognize the new module.



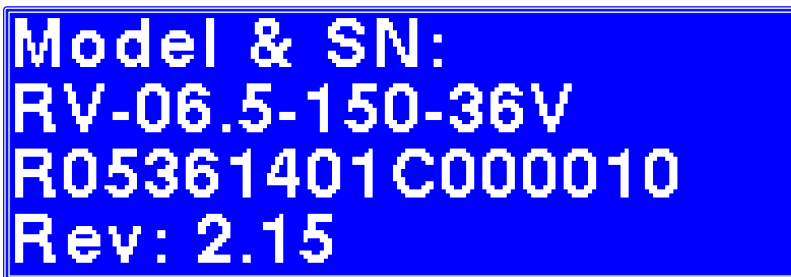
## ENUMERATING INSTALLED MODULES

After a new module is installed into the charger, the charger must be programmed (enumerated) to communicate properly.

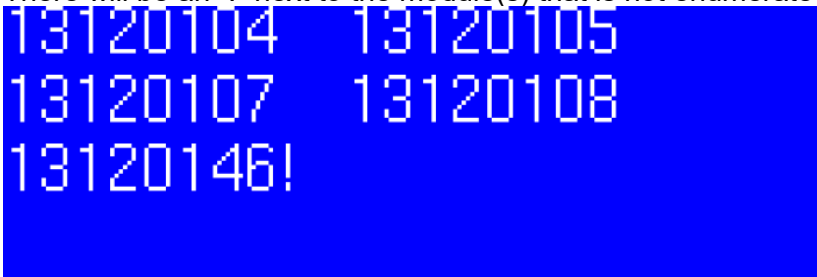
1. From the Idle screen, press the Enter key to enter the menu.
2. While in **Main Menu**, press ▲/▼ until the **Model & SN** screen appears.



3. Pressing the **ENTER** key displays the charger model number, manufacturing ID, and firmware revision.



4. Press the **ENTER** key again. The serial numbers of the installed modules will be displayed. There will be an "!" next to the module(s) that is not enumerated.



5. Press the green **START** button on the keypad. The display will show "Save Installed Modules?" with "NO" as the default selection.

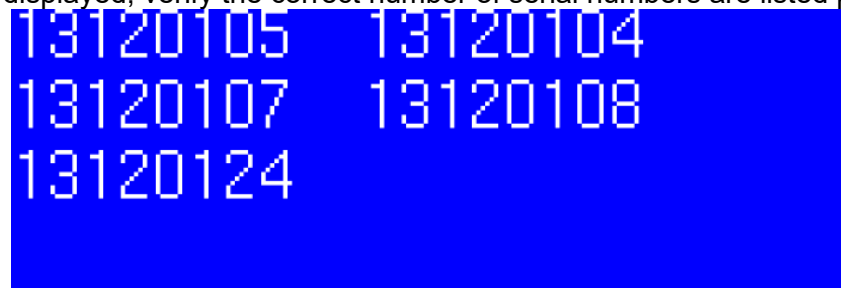




6. Press the Up Arrow to select "Yes".



7. Press the **ENTER** key to enumerate the modules. The serial numbers of the modules will be displayed; verify the correct number of serial numbers are listed per installed modules.



8. Press the **STOP** key to exit the menu.

# TROUBLESHOOTING

Occasional faults may occur in certain conditions. Please follow the suggested steps.

## A. Charger Does Not Power Up

When the charger is first turned on, the LCD should illuminate and display one of the idle mode messages, typically the **CONNECT BATTERY** screen.

If the LCD is not illuminated after power is applied, perform the following checks:

- a. Verify that the service disconnect switch (if provided) and the main panel breaker is in the **ON** position.
- b. Cycle the switch to the **OFF** position, wait 30 seconds, and then return it to the **ON** position.
- c. If the charger display still does not illuminate, carefully verify the source circuit and wiring to the charger and correct any problems. If appropriate, check that all fuses in the service disconnect switch box on the wall are intact, and also that the supply voltage for all three phases (AC mains line-to-line) is  $480\text{ V} \pm 10\%$ , and matches to 10 VAC or better.
- d. If the fault persists, contact the Dealer or Power Designers Sibex.



**DANGEROUS VOLTAGES AND CURRENTS ARE PRESENT IN THE AC MAINS WHEN ENERGIZED. ONLY TRAINED PERSONNEL SHOULD PERFORM THESE CHECKS, USING PROPER EQUIPMENT AND PROCEDURES.**

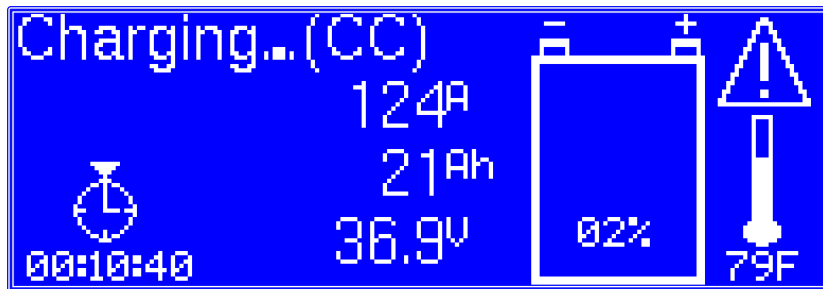


**DO NOT ATTEMPT TO SERVICE THE CHARGER!**

## B. Charger Fault During Operation

The **REVOLUTION** Series features a modular and fault-tolerant design that allows the Charger to continue operation despite the loss of a portion of the modules through temporary or permanent fault conditions. If a module faults during the charging cycle, the fault is recorded, and the charge cycle continues. The Charger will continue to operate, so long as 60% of the installed modules are operational.

If the Serial Numbers of the operating modules do not match the expected numbers, either because they are missing (faulted), or a module has been replaced or added improperly, a Warning Symbol will be displayed on the upper right of the display while the charge cycle is under way.



The Warning Symbol is not displayed once the charge cycle is complete.

The appearance of the Charge History screen under these circumstances may be similar to:



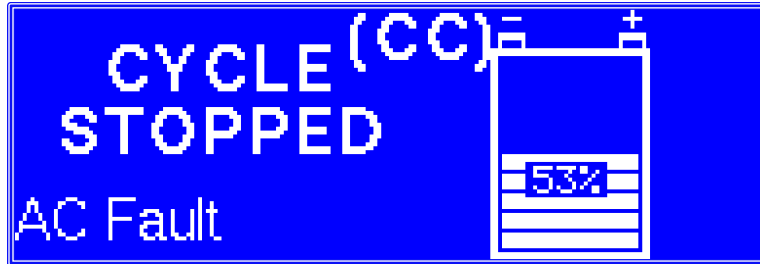
The Serial Number of the faulted module is displayed, along with a fault code.

**When contacting the Dealer or Power Designers Sibex, make sure to note the specific fault message that is displayed. This will aid in quick identification of the cause and the appropriate fix for the fault.**

If the Warning Symbol is displayed while charging, but no faulted modules are listed in the Charge History screen, the problem is that the Serial Numbers of the modules that are found to be available do not match the stored list of "Installed Modules". This may have occurred either through complete loss of power to a module, or by the improper addition of spare or replacement modules. Please contact the Dealer or Power Designers Sibex to arrange repair.

If the number of faulted modules results in the Charger having less than 60% of the “Installed Modules” operational, the charge cycle will be interrupted, and a fault message is displayed. Examples of possible faults follow:

## 1. AC Fault



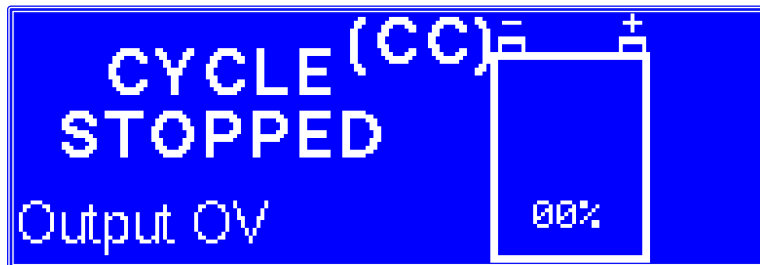
### Possible Causes

- AC line voltage outside of allowable limits. (432VAC-528VAC, AC phases matched within 10V)
- Fuse blown in AC service.

### Troubleshooting

- a. Select **STOP** to revert to the **Connect Battery** or **Push START** screens.
- b. Remove power, disconnect the battery, and verify the AC supply and connections to the charger.
- c. Restart the charge cycle by connecting the battery and selecting **START**.
- d. If the fault persists, contact your dealer or Power Designers Sibex.

## 2. Output Over-Voltage Fault



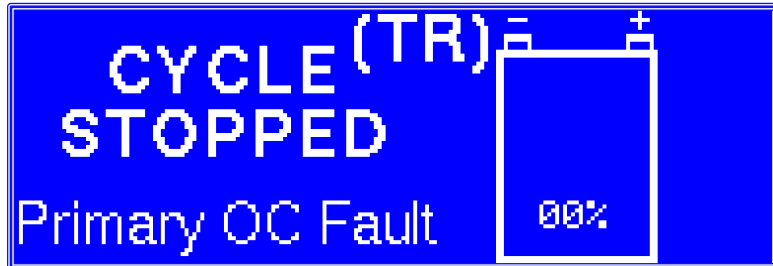
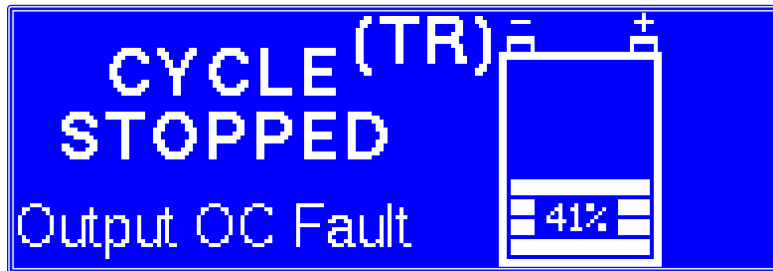
### Possible Causes

- Battery disconnected while charging.

### Troubleshooting

- a. The **CYCLE STOPPED** screen automatically reverts to the **Connect Battery** or **Push START** screens in 30 seconds.
- b. Select **STOP** to revert to the **Connect Battery** or **Push START** screens.
- c. Restart the charge cycle by selecting **START**.
- d. If the fault persists, contact the Dealer or Power Designers Sibex.

### 3. Over-Current / Primary Over-Current Fault



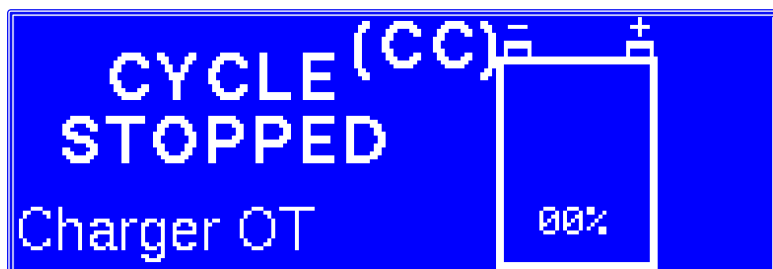
#### Possible Causes

- Damaged DC (output) cables. (open or short)

#### Troubleshooting

- a. Select **STOP** to revert to the **Connect Battery** or **Push START** screens.
- b. Verify that the output cables are in good working condition and are properly connected to the battery.
- c. Restart the charge cycle by selecting **START**.
- d. If the fault persists, contact the Dealer or Power Designers Sibex.

### 4. Charger Over-Temperature



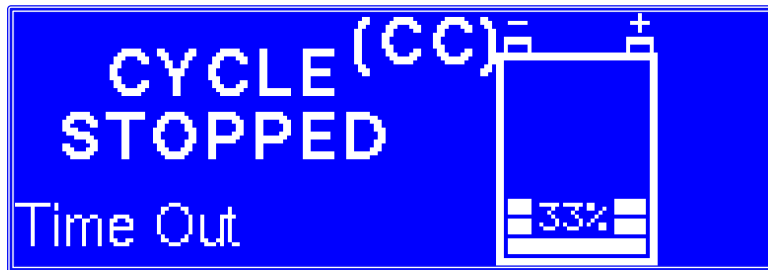
#### Possible Causes

- Blocked air flow to the charger.
- Failed cooling fan.
- Room temperature above 104°F.

### Troubleshooting

- a. Select **STOP** to revert to the **Connect Battery** or **Push START** screens.
- b. Allow the charger to cool down.
- c. Make sure there are no airflow restrictions to the intake or exhaust of the charger.
- d. Restart the charge cycle by selecting **START**.
- e. If the fault persists, contact the Dealer or Power Designers Sibex.

### 5. Charger Timeout Faults



The screen indicates which timer has caused the problem: **TRICKLE CHARGE**, **CC CHARGE**, or **CV CHARGE**.

#### Possible Causes

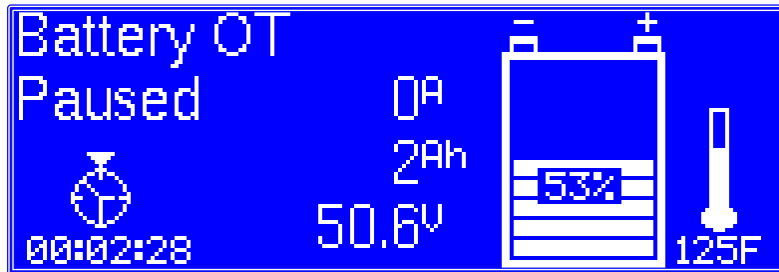
- Programmed charge timers are set incorrectly.
- Programmed charge parameters are set incorrectly.
- Battery has shorted cell(s).

#### Troubleshooting

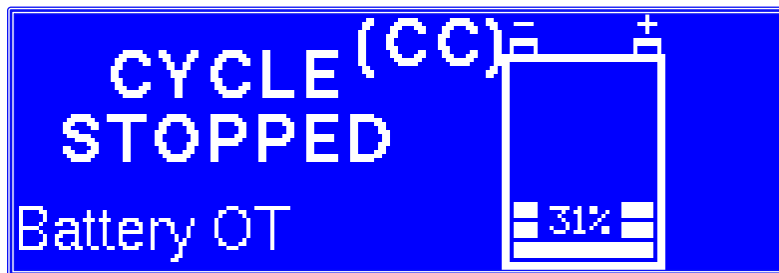
- a. Select **STOP** to revert to the **Connect Battery** or **Push START** screens.
- b. Verify that the battery is in good working condition (i.e., no shorted cells).
- c. If the fault persists, contact the Dealer or Power Designers Sibex.

## 6. Battery Over-Temperature

The following screen will appear the first 5 times the battery over-temperature limit is exceeded during any charge cycle. On the first instance of detecting a battery over-temperature, the Charger will wait until the battery temperature drops approximately 7°C (13°F) and then re-start the charge cycle automatically. If another over-temperature fault is encountered, the charger waits for an 8°C (14°F) drop before re-starting the charge cycle. The Charger increments the delay until an 11°C (20°F) drop is required before restart.



If the battery temperature limit is exceeded once again, the Charger will stop the charge cycle and display the following screen:



### Possible Causes

- Charge and/ or discharge rates too high.
- CV and Finish modes running too often.
- Room temperature excessive.

### Troubleshooting

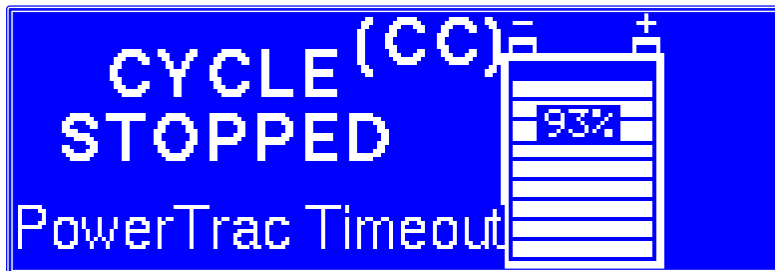
- a. Select **STOP** to revert to the **Connect Battery** or **Push START** screens.
- b. Allow the battery to cool down.
- c. Restart the charge cycle by selecting **START**.
- d. If the fault persists, contact the Dealer or Power Designers Sibex.

## 7. PowerTrac™ Communication Faults

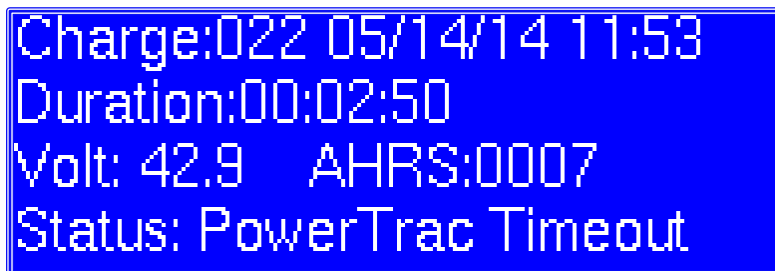
The following screen will appear when the battery is connected and the charger detects the presence of a PowerTrac™, but is unable to establish a link. This may be due to a poor or reversed connection of the auxiliary wires.



If the connection to the PowerTrac™ is lost while a charge cycle is underway, a screen similar to the following will be displayed:



Examining the Charge History will reveal a screen similar to this:



### **Possible Causes**

- Worn or broken auxiliary wires or auxiliary contacts
- Failure of the PowerTrac™

### **Troubleshooting**

- a. Inspect connections on both charger and battery sides of the battery connector. Verify auxiliary Wire #1 is connected on the positive (red) side of the battery connector.
- b. If the fault persists, contact the Dealer or Power Designers Sibex.



## RETURN MATERIAL PROCESS

In the event that the troubleshooting steps included in this manual do not resolve the problem,

- a. Record the charger serial number;
- B. Call Power Designers Sibex with a description of the problem.

Power Designers Sibex will attempt to resolve the problem over the phone. If the issue cannot be resolved in this manner, a Return Material Authorization (RMA) form must be completed and submitted to Power Designers Sibex.

Upon receipt of the completed RMA form, Power Designers Sibex will issue an RMA number for the return. Based on the serial number of the specific charger(s) and the particular problem encountered, Power Designers Sibex will either repair or replace the defective components under warranty.

For chargers out of warranty, Power Designers Sibex, upon receipt of the charger and in consideration of a diagnostic fee, will provide a repair estimate.

### **Power Designers Sibex**

#### **RMA Return #**

430 N. Suncoast Blvd  
Crystal River, FL 34429

Phone: 352.795.0101

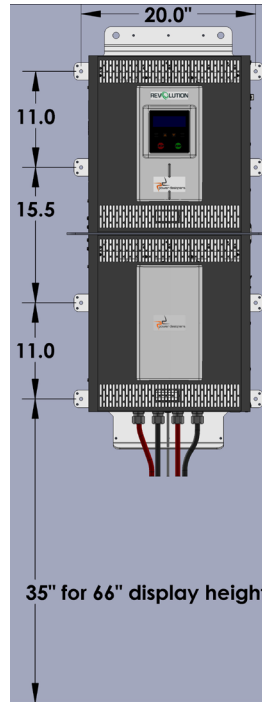
Fax: 352.564.0772

Email: [service@powerdesigners.com](mailto:service@powerdesigners.com)

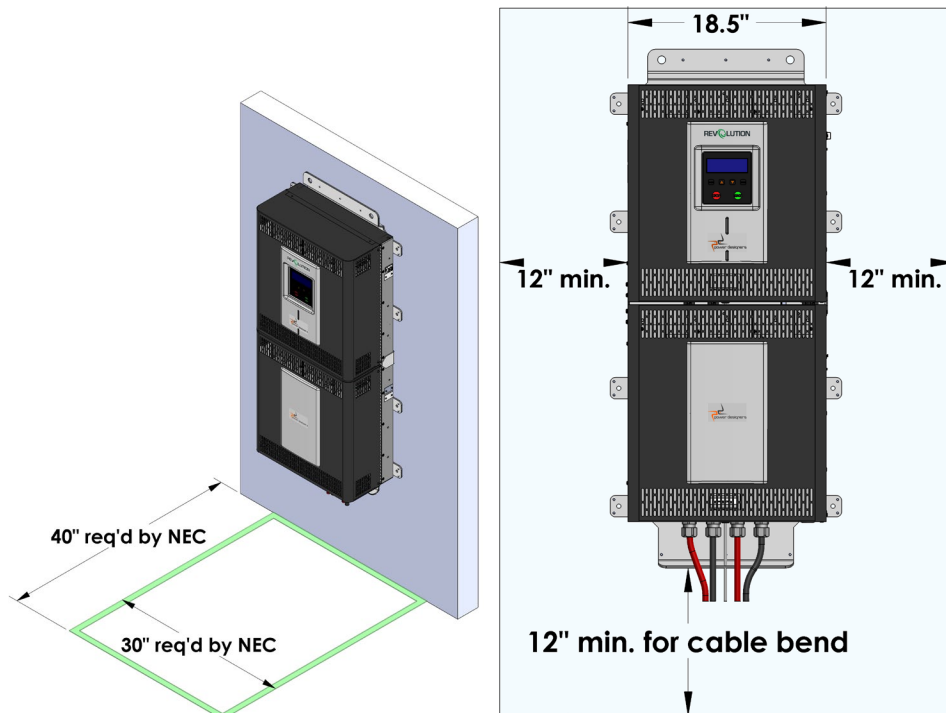
[www.powerdesigners.com](http://www.powerdesigners.com)

# Appendix A – Wall Mount Dimensions & Clearances

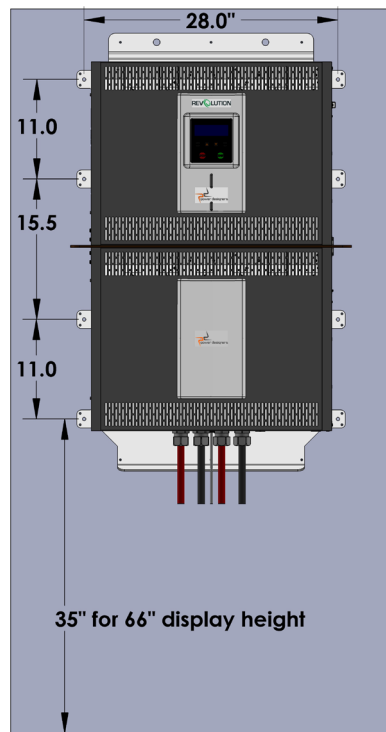
## RV16 Models



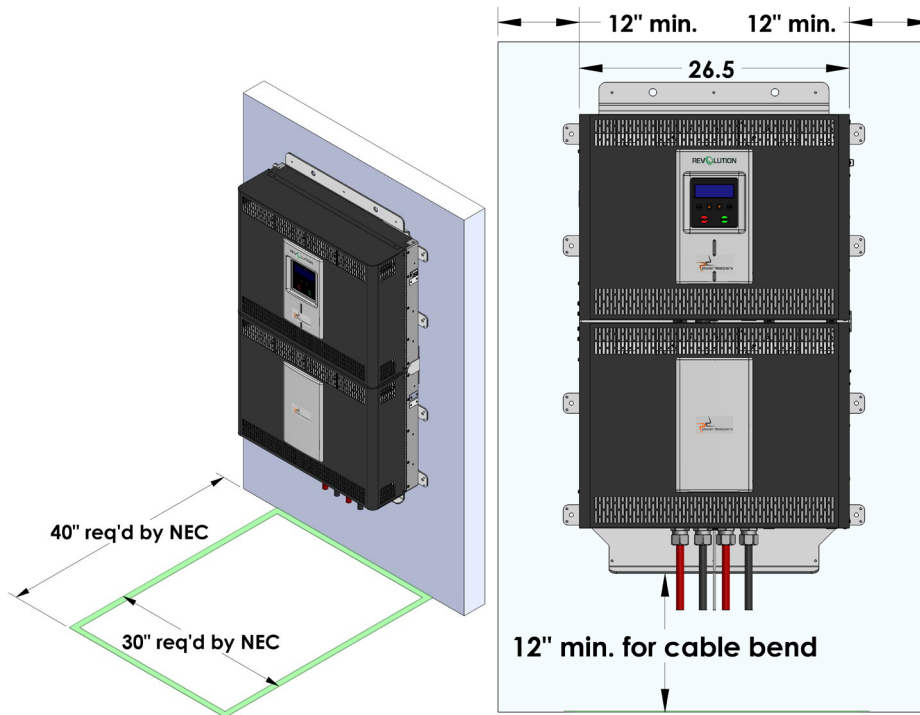
Recommended mounting hardware: 5/16".



## RV24 Models

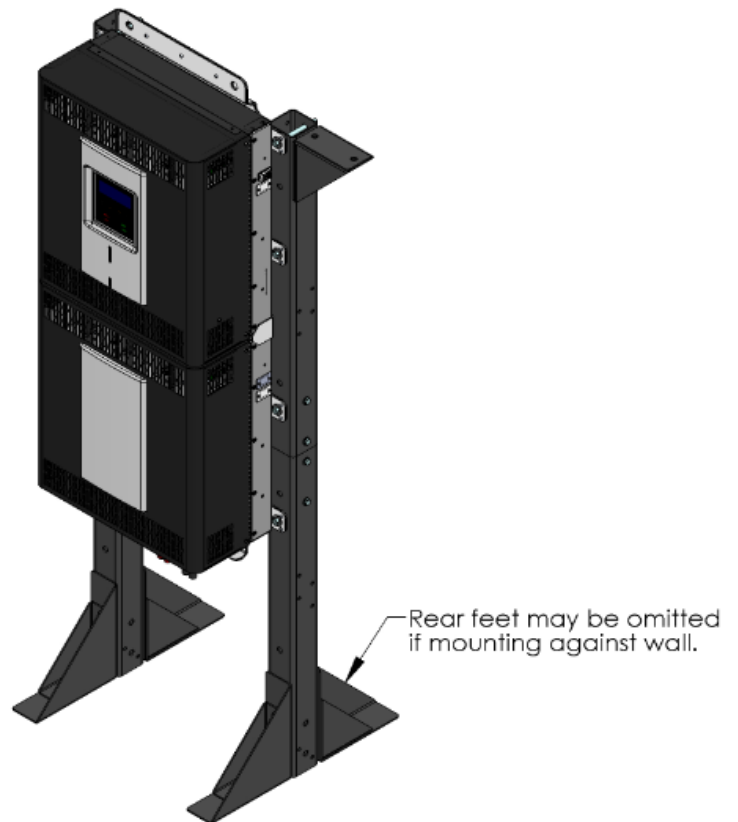
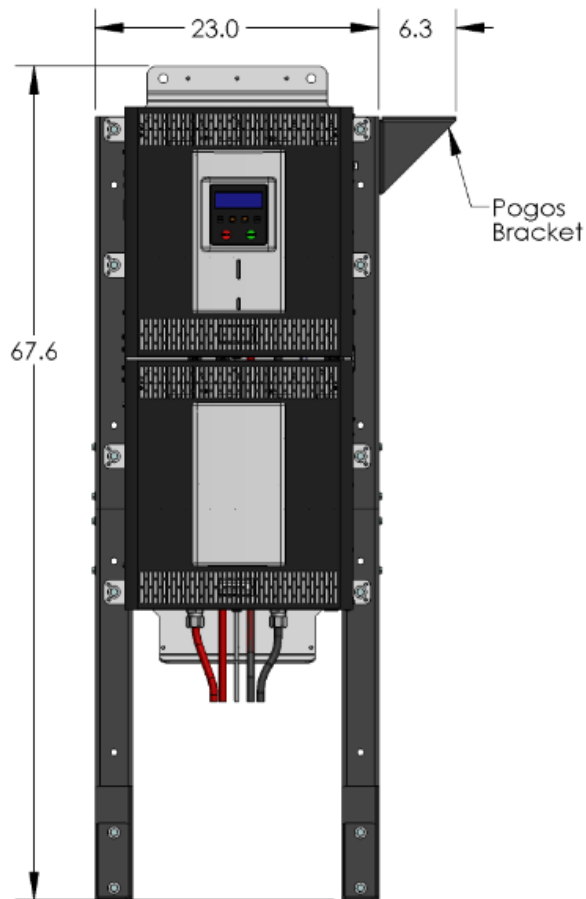
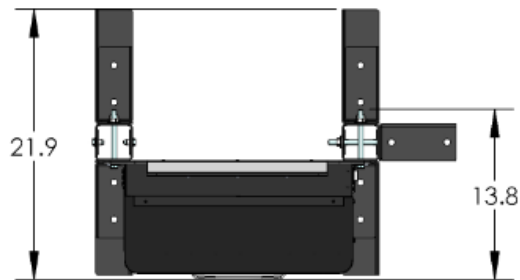


Recommended mounting hardware: 5/16".

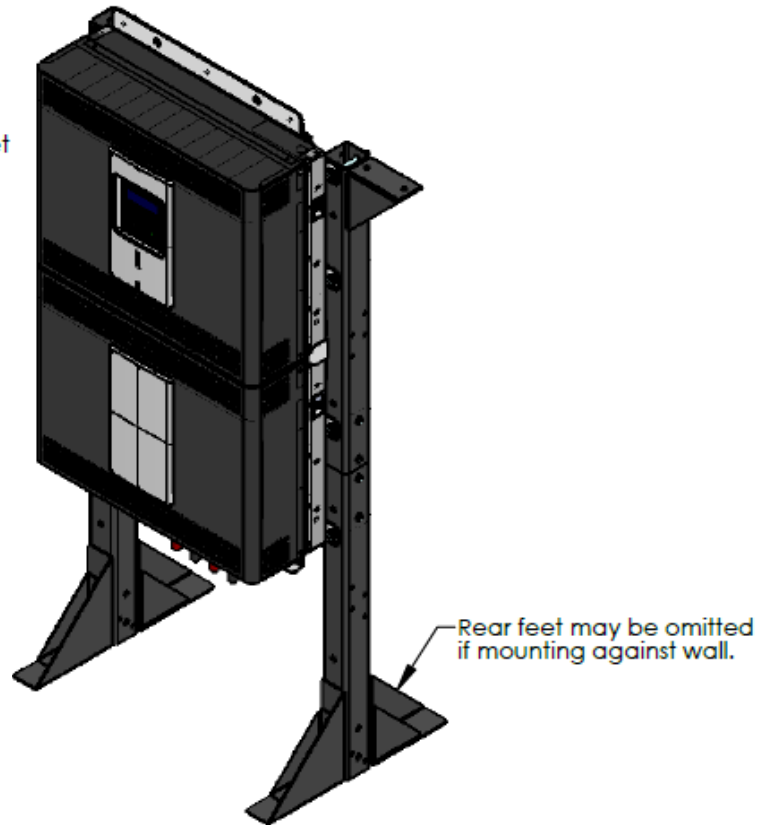
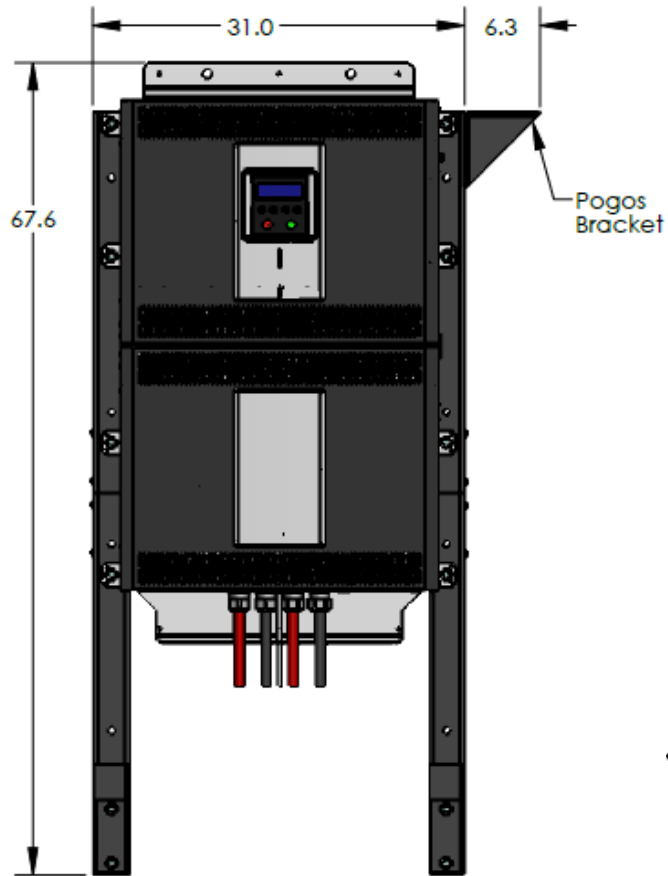
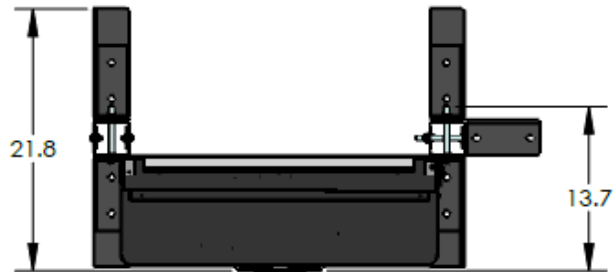


# Appendix B – Post Stand Dimensions and Assembly instructions

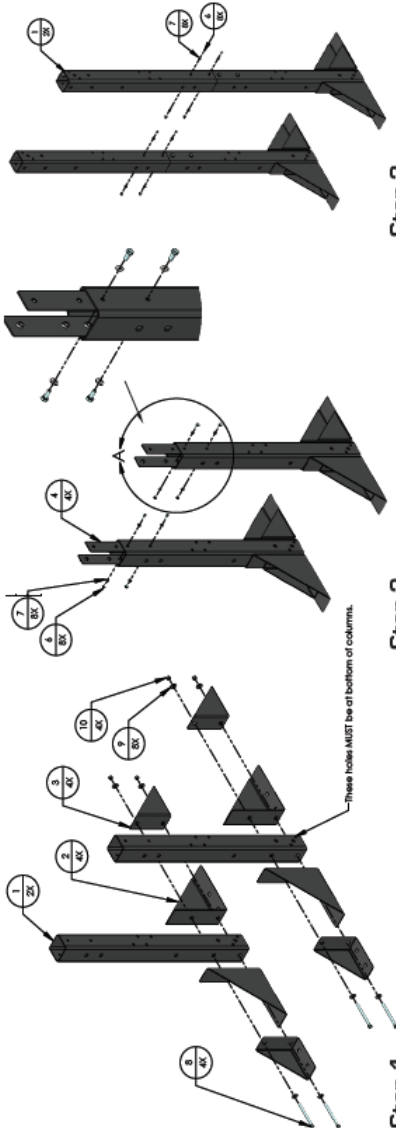
## RV16 Models



## RV24 Models

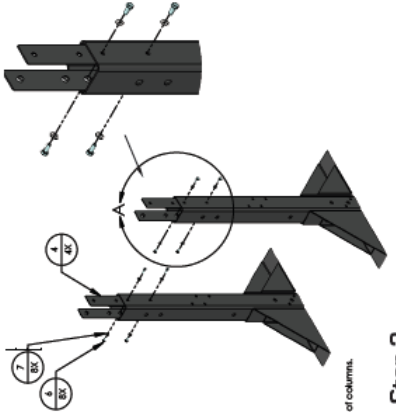


# 16X & 24X Floor Stand Assembly Instructions



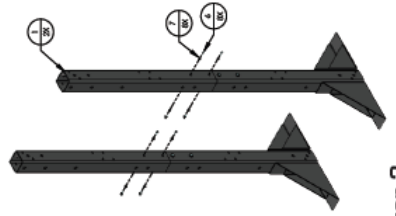
### Step 1

On a flat surface, assemble the left and right stand columns and the feet as shown. Tighten the bolts to 30 ft-lbs +/- 3 ft-lbs.



### Step 2

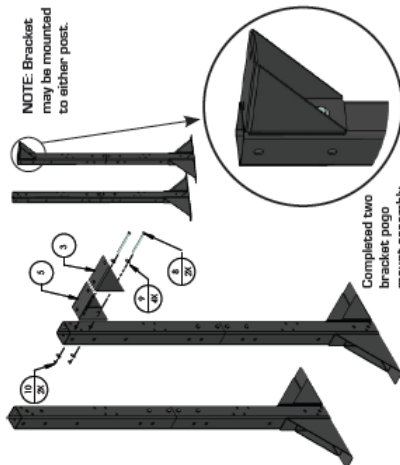
Assemble the connector plates onto the left and right column & feet assemblies. Tighten the bolts to 17 ft-lbs +/- 2 ft-lbs.



### Step 3

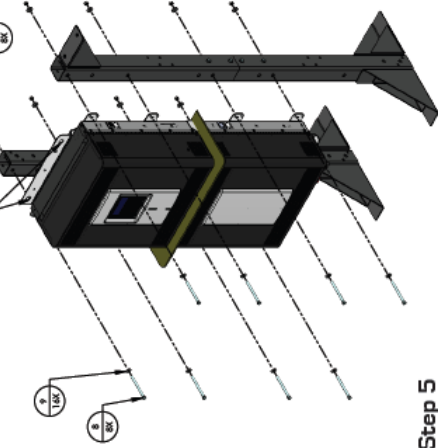
Assemble the upper columns onto the lower column and feet assemblies. Tighten the bolts to 17 ft-lbs +/- 2 ft-lbs.

Item #	Description	Qty
1	Column	4
2	Foot - 9"	4
3	Foot Brace	5
4	Connector Plate	4
5	Foot - 6"	1
6	Hex Cap Screw 5/16 - 18, 3/4"	16
7	Washer, 5/16"	16
8	Hex Cap Screw 3/8 - 18, 4.5"	14
9	Washer, 3/8"	28
10	Nut, 3/8-16	14



### Step 4 (Optional pogo bracket assembly)

Assemble the pogo bracket onto the column assembly. Verify the top of the bracket is level with the top of the column before tightening. Tighten the bolts to 30 ft-lbs +/- 3 ft-lbs.



### Step 5

Using appropriate equipment and safety precautions, pick up the charger via the lifting eyes. Fasten the charger to the left and right column & feet assemblies as shown. Tighten the bolts to 30 ft-lbs +/- 3 ft-lbs. Anchor the stand to the floor with appropriate hardware.



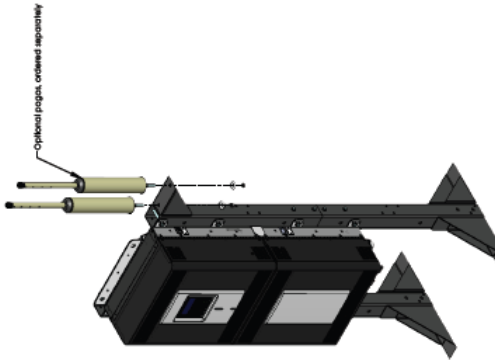
**THE SHIPPING SPACER MUST REMAIN IN PLACE UNTIL THE CHARGER IS PERMANENTLY MOUNTED.**

**LIFTING THE CHARGER WITH THE SPACER REMOVED WILL RESULT IN DAMAGE TO THE CHARGER CHASSIS**



**Once assembled, the entire charger stand assembly may be lifted and moved to the final mounting location.**

**WARNING  
TIP HAZARD!  
DO NOT ATTEMPT TO MOVE THE CHARGER MANUALLY OR WITHOUT PROPER EQUIPMENT!**



### Step 6 (Optional pogo mount)

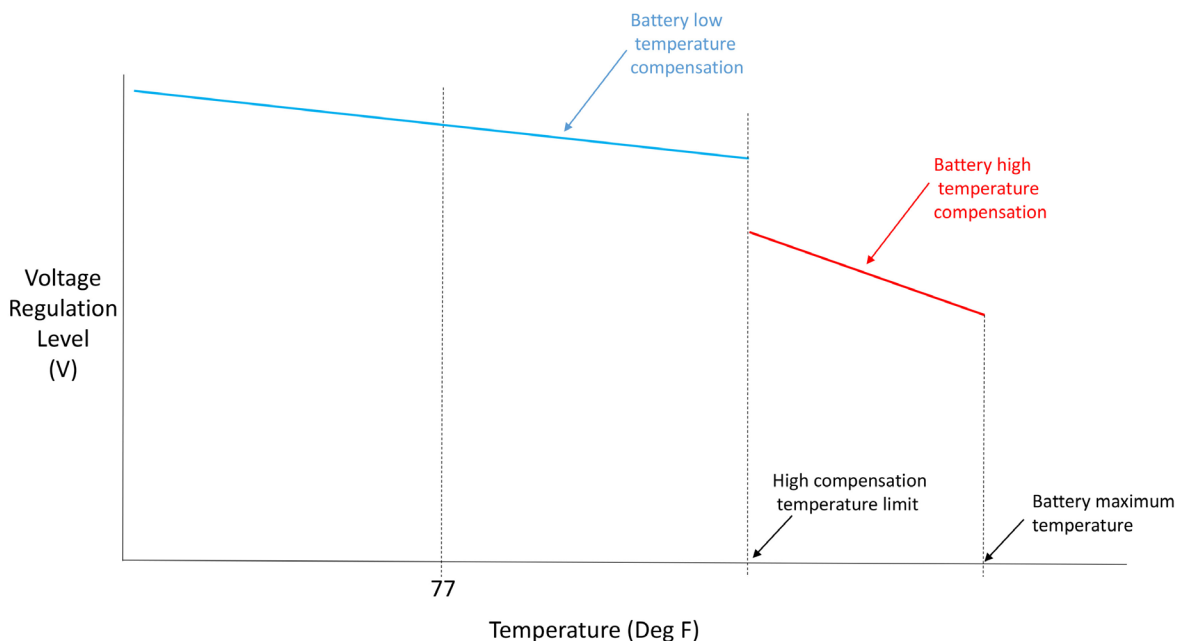
Attach the pogos (ordered separately) as shown. Note the inner pogo must be attached first as clearance to the adjacent hardware is minimal. Tighten the pogo nuts to 20 ft-lbs.

## Appendix C – Note on Temperature Compensation

Temperature compensation is critical to maintaining battery life and performance. If the battery temperature deviates from 77 deg. F during normal operation, the charger voltage regulation levels can be automatically adjusted to compensate for temperature variations.

The REVOLUTION charger (when used with an optional thermistor) implements two temperature compensation factors expressed in mv/ deg C/cell.

1. The Battery Low Compensation factor (Batt Low Temp Comp) is activated when the battery temperature varies from 77 deg F, but is lower than the high compensation temperature limit (High Comp Temp). The default value is 2 mv/deg. C/cell.
2. The Battery High Compensation factor (Batt High Temp Comp) is activated when the battery temperature is higher than the high compensation temperature limit (High Comp Temp). The default value is 4 mv/deg. C/cell.



**Figure C1**

These parameters can be factory or dealer adjusted.

## CONTACT INFORMATION

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Phones are answered between 8 a.m. and 4 p.m., Monday through Friday Eastern Time. After-hours calls are answered by voice mail and returned on the next business day. Questions and comments can also be submitted via fax or email.