



SOLAR PANEL
Collects solar power.



ROOF TOP BOX
Secures wiring between solar panels and the charge controller.



CHARGE CONTROLLER
Regulates the energy from solar panels to charge service batteries.



BATTERIES
Store the power produced by solar panels for later use.



INVERTER CHARGER
Converts DC power from solar panels into AC power for household appliances.



Palomino RV - solar
equipped the way it was meant-
enjoy freedom , no Generators,
no Grid power! *Enjoy your RV*
wherever you want

What's Solar equipped ? 400
Watts solar and 3000 watt
inverter (watch tv for hours,
enjoy A/C ,cpap, coffee maker
and all outlets)

What can I run with solar ?
Standard on your unit Battery Monitor. It
instantly calculates solar in and power
out to let you know how long your
battery will last. Want more time, add
solar or batteries, or just use to manage
what you have.



8hr44minute

| Std or add item to get the hours of usage per appliance desired. Appliance times to the right. | | | | Appliance use estimates with the batteries noted to the left. A/C time shown full sun/night time hours. (time is longer in full sun because of the solar production) these times include 12v items being used also 12v lights, Water pump, displays and vent fans. | | | | | |
|--|----------------------------------|---|----------------|--|-------|-----------|--------------|------------|----|
| | | | | In hours unless noted | | | | | |
| DC toDC and MPPT | Rover 60A MPPT charge controller | 300 watt solar blanket plug into rear wall solar port | 400 AH battery | A/C | C-PAP | Microwave | Coffee Maker | Hair Dryer | TV |
| Standard | Standard | 0 | Standard | 3.5/2.6 | 8 | 10 min | 1 pot | 10 min | 3 |
| Standard | Standard | 1 | Standard | 4.5/2.6 | 8 | 10 min | 1 pot | 10 min | 3 |
| Standard | Standard | 2 | Standard | 5.5/2.6 | 8 | 10 min | 1 pot | 10 min | 3 |
| Standard | Standard | 3 | Standard | 6.5/2.6 | 8 | 10 min | 1 pot | 10 min | 3 |
| | 1 more + std | 4 | 1 more + std | 7.5/6 | 8 | 10 min | 1 pot | 10 min | 3 |
| | 1 more + std | 5 | 1 more + std | 8.5/6 | 8 | 10 min | 1 pot | 10 min | 3 |
| | 1 more + std | 6 | 1 more + std | 9.5/6 | 8 | 10 min | 1 pot | 10 min | 3 |

Notes:

*Running the vehicle will add up to 600watts via the anderson connection harness

*Plugging into shore power charges the batteries at 65 amps and an hours via the inverter (always make sure it is set to Lithium Batteries to maximize charging)

*add two more 100 watt solar panels to the roof that use the DC to DC standard on your RV to add charging power.

Introduction to solar



When developing a quality solar solution there are several concepts that should be remembered.

- *Energy* is the capacity for doing work. It essentially tells you how much work can be done. Energy can take different forms, but when dealing with electricity or solar, you will define energy as Watt Hours. $\text{Watt Hours} = \text{Watts} \times \text{Hours}$. Multiplying an appliances wattage, by how long it will run for will give you its energy value. Multiplying a panel's wattage by the peak solar hours will give you its energy value. You can also think of energy in terms your paycheck, if you make \$8/hour and work for 5 hours, you have $\$8 \times 5 \text{ Hours} = \40 .
- *Power* is defined as rate of doing work. It essentially tells you how quickly you can produce energy. Power takes on different forms, but when dealing with electricity or solar, you will define power as a Watt. As stated before, $\text{Watts} = \text{Volts} \times \text{Amps}$. Multiplying the panel's voltage by amperage will give you a wattage value. This is also true for an appliance. You can also think of power in terms of how much money you make hourly at a job, i.e. \$8/hour.

Load Shed Box allow you to utilize and monitor each outlet of power to understand your use and limit the demand your self at a touch of a button.

Lights, tv, refrigerator can run for days with out charge



Shore Power

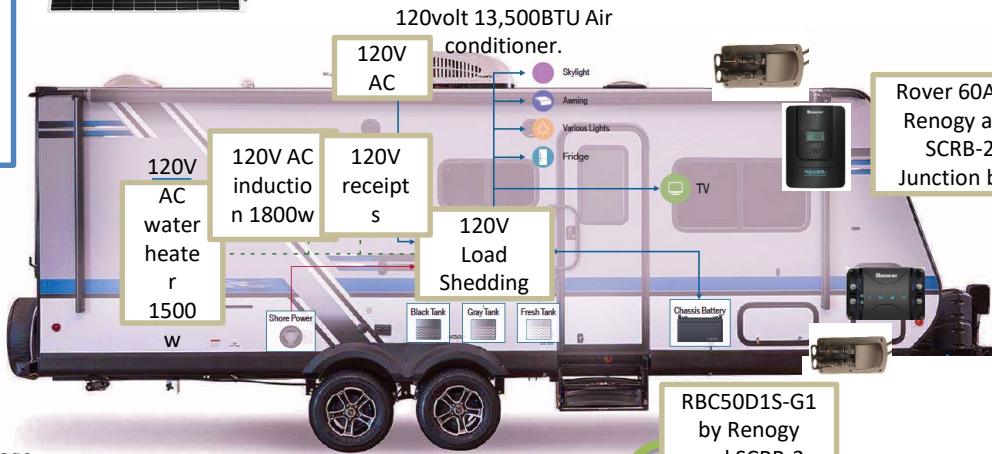
3000-watt inverter with multi-stage battery charger.



Batteries 4 100 ah for 4800 kwh stored =



4 Renogy 100 Watt flex panels



Monitor displays time of battery life left at current load, most intuitive display on the market

8 hr 44 minutes left

Current load on system 10.3 amps at 13.2 volts

Rover 60A by Renogy and SCR-B-2 Junction box

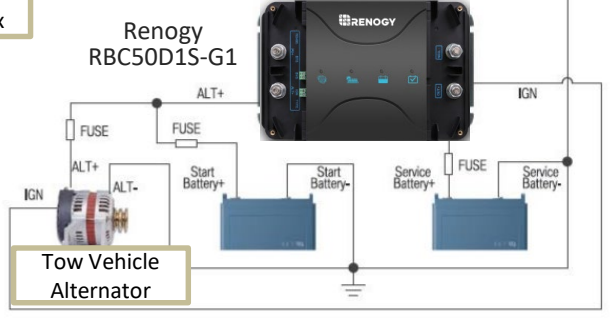
Use the tow vehicle to generate power as needed, use with stock alternator. Up to 600watts an hour. Anderson Cables W-DDX-7 & W-DDX-23



RBC50D1S-G1 by Renogy and SCR-B-2 Junction box



2 Renogy 300 Watt portable panels (optional)



Tow Vehicle Alternator

3000W 12V PURE SINE WAVE INVERTER CHARGER W/ LCD DISPLAY

R-INVT-PCL1-30111S



When using shore power the Inverter charges batteries at 780 watts an hour ,about 7 hours to refill. 65charger is rated 65 amps

CHARGER SPECIFICATIONS

Output Current: 5-75A configurable, 5A intervals

Nominal Input Voltage: 120 VAC

Input Frequency Range: 40Hz - 70Hz

Surge Power (1 second): 9000W

Output Frequency (Nominal): 50/60 Hz

Output Waveform: Pure Sine Wave

No Load Power Consumption: Normal: <30W; Power Saving: <15W

GENERAL SPECIFICATIONS

Battery Types: GEL, AGM, SLA, FLD, CAL, LI, USER

Operating Temperature: 0 ~ 40°C / 0 ~ 104°F

Storage Temperature: -30 ~ 70°C / -22 ~ 158°F

Humidity: 0% ~ 95%

Noise: <50dB

Dimensions: 20.1 x 9.7 x 7.6 in / 510 x 248 x 193 mm

Weight: 63.5 lbs / 28.8 Kg

INVERTER SPECIFICATIONS

Continuous Power: 3000W

AC Output Voltage Range: 100~120VAC configurable, 5V interval

DC Input Voltage Range: 10~16 VDC

Nominal Efficiency: > 90% Peak

Surge Power (1 second): 9000W

Output Frequency (Nominal): 50/60 Hz

Output Waveform: Pure Sine Wave

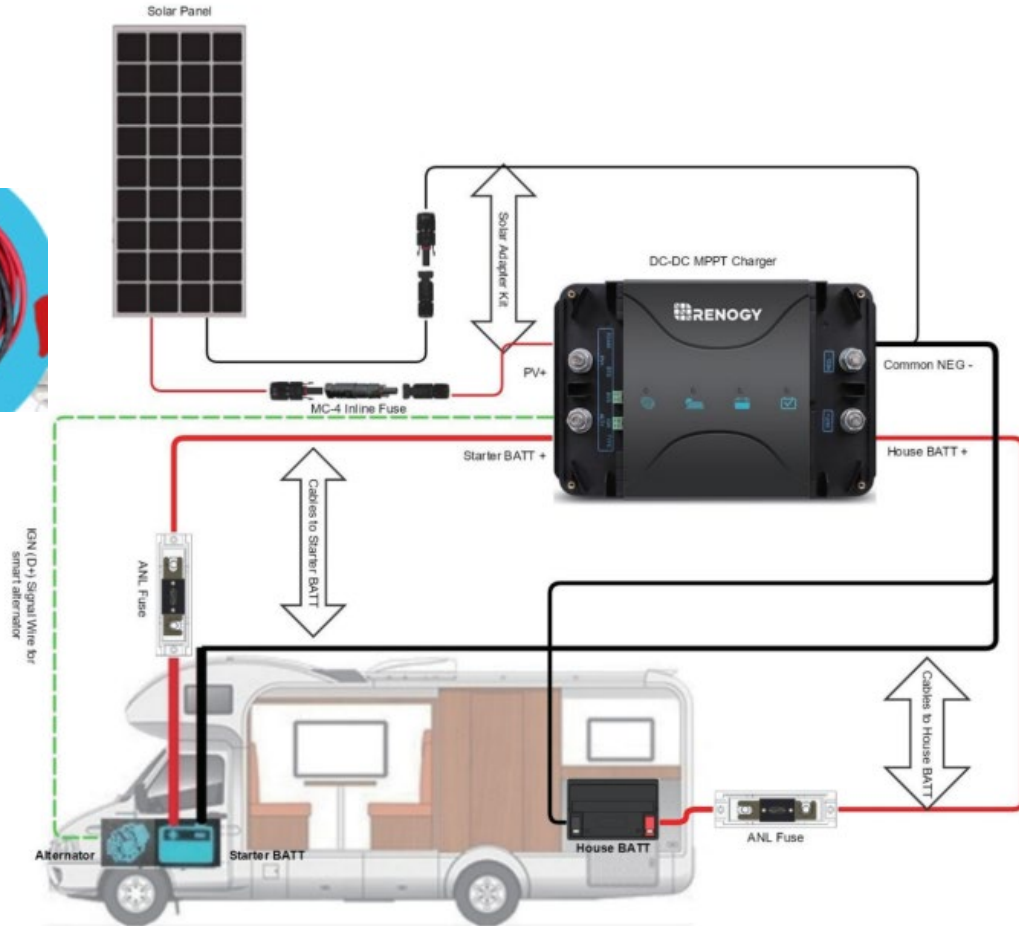
No Load Power Consumption: Normal: <30W; Power Saving: <15W



DCC50S 12V 50A DC-DC ON-BOARD BATTERY CHARGER WITH MPPT

RBC50D1S-G1

Via the Anderson connector on the A-Frame of your trailer you can charge 600watts of power into your Trailer batteries as you drive from the tow vehicle. Currently the 7 way plug only allow 5-7 amps or 60-84 watts an hour.





100 WATT 12 VOLT FLEXIBLE MONOCRYSTALLINE SOLAR PANEL

RNG-100DB-H (you have 4 of these on your roof)

MECHANICAL DATA

Solar Cells: 36 Monocrystalline cells

Panel Dimensions: 48x21.5x0.08 In

Cables: 12 AWG, 17.7In(Negative Cable), 5.9In(Positive Cable)

Junction Box: IP 68

Weight: 4 lbs

Connectors: MC4 Connectors

SPECIFICATIONS

Maximum Power at STC*: 100 W

Optimum Operating Voltage (Vmp): 18.9 V

Open-Circuit voltage (Voc): 22.5V

Maximum System Voltage: 600 VDC

Cell Efficiency: 21%

Optimum Operating Current (Imp): 5.29A

Short-Circuit Current (Isc): 5.75A

Maximum Series Fuse Rating: 15 A



ROVER LI 60 AMP MPPT SOLAR CHARGE CONTROLLER

RNG-CTRL-RV60 this is the charge controller that your rear wall solar junction box is connected to. Just add any solar panel to start harvesting green power.

ROVER 60 AMP MPPT SOLAR CHARGE CONTROLLER

| | |
|---|--|
| Nominal Voltage: 12V/24V/36V/48V Auto Recognition | Rated Charge Current: 60A |
| Rated Load Current: 20A | Max. PV Input Power: 800W/12V; 1600W/24V; 2400W/36V; 3200W/48V |
| Max. PV Input Voltage: 150 VDC (25°C), 140VDC (-25°C) | Self-Consumption: 0.7W-1.2W |
| Operating Temperature: -31 °C to 113 °C | Temperature Compensation: -3mV/°C/2V (default) |
| Dimensions: 285 x 205 x 102mm (11.22 x 8.07 x 4.00in) | Weight: 7.9lbs |
| Enclosure: IP32 | Terminals: 25mm ² 4AWG |

OPTIONS: BT-1 BLUETOOTH MODULE

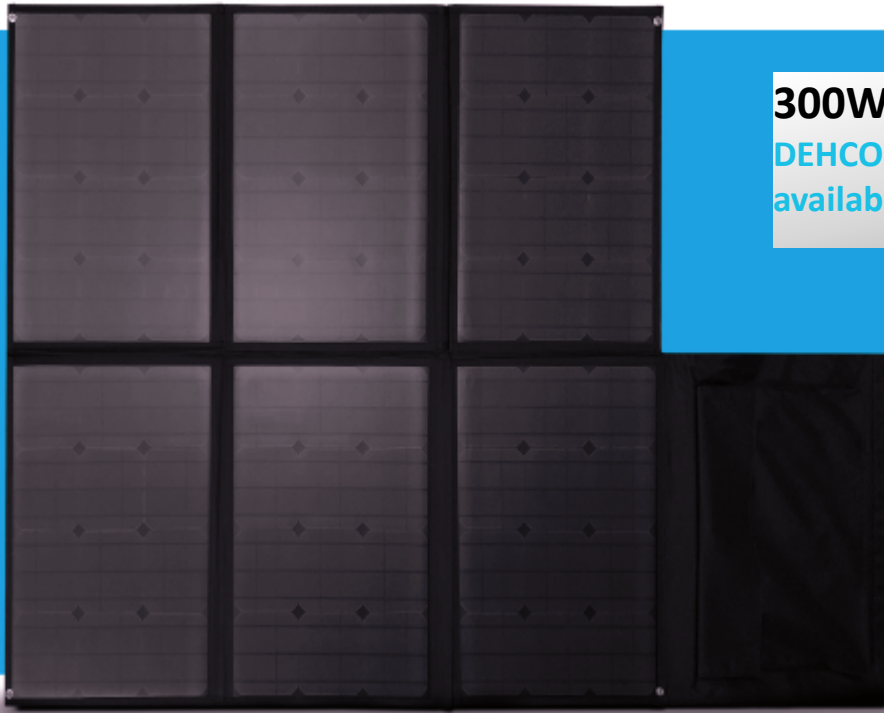
| | |
|--|---|
| Communication Protocol: RS232 | Port Type: RJ12 |
| Input Voltage: 5V | Protection Grade: IP54 |
| Standby Power Consumption: 0.04W | Operating Power Consumption: 0.05W |
| Communication Range: ≤82ft | Serial Baud Rate: Fixed Baud Rate 9600bps |
| Cable Length: 5.00 m (16.4 ft) | Dimensions: 2.65 X 1.38 X 0.55 in (67.3 X 35 X 14 mm) |
| Installation Dimensions: 67.3 φ3.5mm ± 0.14in ± 0.01in | Operation Temperature: -20°C ~ 85°C (-4°F to 185°F) |

Charge Controllers



- **WHAT IS A CHARGE CONTROLLER?**
- Solar Charge controllers regulate the power received from solar panels to charge your 12v batteries safely. There are two types of controllers, PWM (Pulse Width Modulation) and MPPT (Maximum Power Point Tracking).
- **WHAT ARE THE DIFFERENCES BETWEEN MPPT AND PWM?**
- The main differences between the two are the charging efficiency and cost. MPPT controllers are more efficient than PWM controllers at battery charging (MPPT: 90%+ efficiency; PWM: 0%-80% efficiency). PWM controllers are more inexpensive than their MPPT counterparts. MPPT units also have the capability of charging higher rated voltage battery banks such as: 24V , 48V , 72V, etc. and have an auto recognition feature.





300W PORTABLE SOLAR PANEL

DEHCO part FSP300D Optional portable panel available via your dealership or ebay

- High performing PET-laminated monocrystalline cells, 19% efficiency
- Foldable and portable design with carrying handle
- Expandable design with industry standard MC4 connector

300W FOLDABLE MONOCRYSTALLINE SOLAR PANEL

| | |
|---------------------------------|----------------------|
| Optimum Operating Voltage (Vmp) | 39.5V |
| Optimum Operating Current (Imp) | 7.6A |
| Cables | 3 ft |
| Weight | 27.5 lb |
| Folded Dimensions | 27.0 x 19.5 x 2.0 in |
| Unfolded Dimensions | 81.0 x 55.5 x 0.5 in |

Option 300 watt panel be helpful for charging while parked in the shade or to help rapid charge your batteries or extend your appliance use during the day.

Combine in series or in parallel to add 300 or 600 watts to your batteries. two of these 600 watts plus your roofs 400 will charge your batteries to full in 5.5 hours of full direct sun in summer southern states.

How much energy can a solar panel generate over a period of time?

The power generated by the panel is given in Watts. In theory, to calculate energy production you must multiply the number of hours the panels are exposed to the sun, by the rated watts on the panel.

Location of the panels will influence how much PV power can be produced. 400 watts will produce 1.6 kw on a sunny day. 4-5.5 times the panel size, on a summer day.

Average Peak Sun Hours by State

| State | Peak Sun Hours | State | Peak Sun Hours |
|---------------|----------------|----------------|----------------|
| Alabama | 3.5-4 | Montana | 4-5 |
| Alaska | 2-3 | Nebraska | 4.5-5 |
| Arizona | 7-8 | Nevada | 6-7.5 |
| Arkansas | 3.5-4 | New Hampshire | 3-3.5 |
| California | 5-7.5 | New Jersey | 3.5-4 |
| Colorado | 5-6.5 | New Mexico | 6-7 |
| Connecticut | 3 | New York | 3-3.5 |
| Delaware | 4 | North Carolina | 4-4.5 |
| Florida | 4-4.5 | North Dakota | 4-4.5 |
| Georgia | 4-4.5 | Ohio | 2.5-3.5 |
| Hawaii | 4-5 | Oklahoma | 4.5-5.5 |
| Idaho | 4-5 | Oregon | 3-5 |
| Illinois | 3-4 | Pennsylvania | 3 |
| Indiana | 2.5-4 | Rhode Island | 3.5 |
| Iowa | 4 | South Carolina | 4-4.5 |
| Kansas | 4-5.5 | South Dakota | 4.5-5 |
| Kentucky | 3-4 | Tennessee | 4 |
| Louisiana | 4-4.5 | Texas | 4.5-6 |
| Maine | 3-3.5 | Utah | 6-7 |
| Maryland | 3-4 | Vermont | 3-3.5 |
| Massachusetts | 3 | Virginia | 3.5-4 |
| Michigan | 2.5-3.5 | Washington | 2.5-5 |
| Minnesota | 4 | West Virginia | 3 |
| Mississippi | 4-4.5 | Wisconsin | 3.5 |
| Missouri | 4-4.5 | Wyoming | 5.5-6 |

* This is just an approximation; hours vary by region within each state.





LITHIUM-IRON PHOSPHATE BATTERY 12 VOLT 100AH

RBT100LFP12S-G1 (You have 4 of these for 400AH)

- Next-level BMS w/ communication ports for auto-balance and auto-storage mode
- Powerful and compact at only 29 lb
- Superior 4000+ cycles at 80% depth of discharge

100AH 12V LITHIUM IRON PHOSPHATE BATTERY

| | |
|-----------------------|------------------------|
| Operating Temperature | -20~50°C |
| Cycle Life | 4000 cycles at 80% DOD |
| Communication Port | RS485 |
| Weight | 28.6 lb |
| Dimensions | 11.4 × 6.8 × 7.4 in |

* AVAILABLE PREWIRED IN 200-400AH BATTERY BOX



DEHCO ELECTRONICS

Storage



- **Things to consider when choosing a battery:**
- Important fact: Lead batteries can only discharge and recharge to limited percentage before being damaged. Lithium will maintain 13.1 volts up to the final few percent of storage and can be recharged to 100 percent.
- Average Lithium battery weighs 43% less than lead.
- Battery capacity is measured in Amp Hours. Amp hours need to be converted into watt hours.
- Formula: X (Battery size in AH) x Y (Battery voltage) = Z Power available in watt hours.
- Example: A 12-volt, 20 AH battery would produce 240 watt hours. This means the battery could supply 240 watts for 1 hour.

$$20\text{AH (X)} \times 12\text{V (Y)} = 240\text{ WH (Z)}$$

Weight Comparison:

RNG-AGM12-100Ah=**66**lbs

RNG-GEL 100Ah=**60**lbs

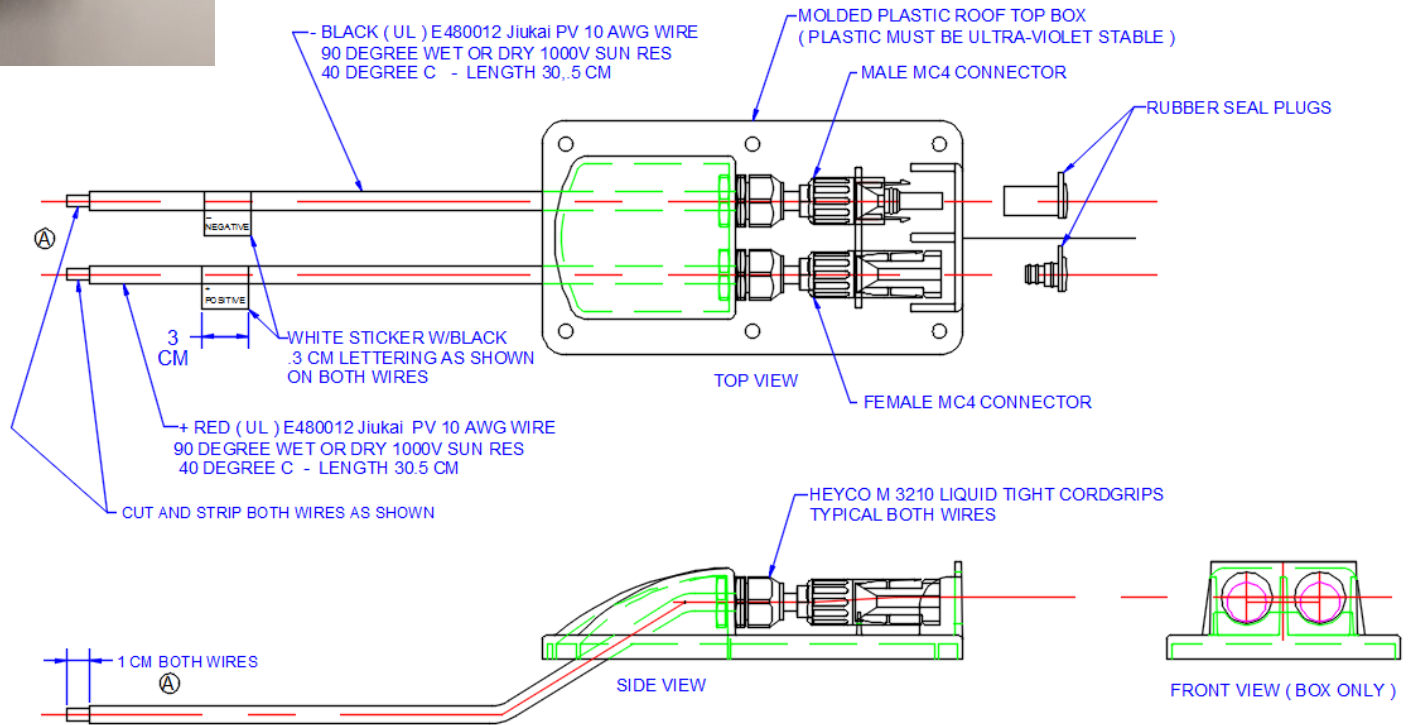
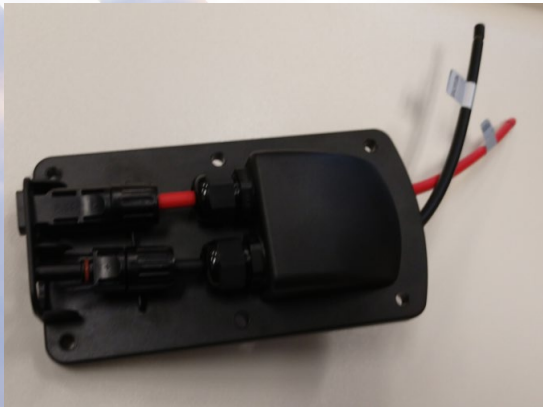
RNG-Lithium Iron 100Ah=**28.1**lbs



SOLAR ROOFTOP JUNCTION BOX W/ MC4 CONNECTORS

SRCB-2 (this is on the roof and the rear wall of your RV used for hooking up solar panel to your charge controller)

 DEHCO ELECTRONICS



A 04/03/19 REMOVED BUTT CONNECTORS ADDED WIRE STRIP DIMENSION


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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES:
FRACTIONAL: +1/16
ANGULAR: +5 DEGREE
TWO PLACE DECIMAL: +.05
THREE PLACE DECIMAL: +.005

MATERIAL: BLACK UV STABLE ABS PLASTIC
FINISH: BLACK - GLOSS SMOOTH

| | | |
|-------------|------|----------|
| DESIGNED BY | NAME | DATE |
| DRAWN BY | DL | 04/28/19 |
| CHECKED | | |
| APPROVED | | |
| COMMENTS | | |


DEHCO, INC.

DESCRIPTION
LARGE SOLAR ROOF TOP BOX ASSY WITH CONNECTORS

| | | |
|------|--------------|------|
| SIZE | PART NUMBER | REV. |
| | PT 0219 1133 | A |

POWER PROTECTION MANAGEMENT SYSTEM

LOAD SHED AND BREAKER PANEL ALL IN ONE

CH001

Features

- Combines a breaker panel and energy management system into an all-inclusive unit
- Power management for different available sources including 50 Amp & 30 Amp Service
- Easy configuration by setting circuit priority and max current allowance
- Automatically sheds and re-engages loads to avoid tripping the breaker
- 6 AC relays
- Monitors AC loads independently in real time



Intellitronix Energy Management System

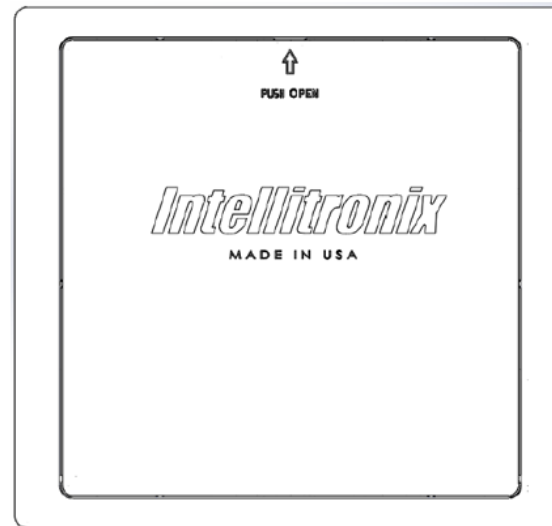
The Intellitronix Energy Management System combines a standard breaker box with automatic power management for use in a recreational vehicle. It automatically senses and shifts AC loads to best utilize the available power. It decides what AC circuits get power based on user priority settings.

For example, if someone is using a hair dryer and running a microwave oven and toaster, and the refrigerator starts running, that may temporarily be more power than is available, potentially causing a main circuit breaker to trip, or overloading a generator. The Intellitronix Energy Management System can temporarily shut down the refrigerator power. When enough appliances are turned off, and sufficient power is available, refrigerator power is automatically restored. It also functions as a standard breaker box using standard breakers and wiring.



12 VDC control power in

Generator or Shore
Power in, 50A 2-phase
30A single phase
breaker 120VAC



The Power Module looks almost identical to a standard breaker box and is wired the same way. It adds a 12V input to drive the Energy Management System. Inside, the eight led lights indicate which circuits are using power. (Two center ones are input power)

Up to six 120VAC Circuits out, each with standard breakers, 15A or 20A.

Power Module Specifications

Max input power breaker 50 Amps 2-phase, or 30 Amps single phase 120 VAC

Digital Control System power input 12 VDC, (0.2 amps normally, to 1 Amp max for all circuits opened)

Six, normally on, relay operated 20 Amp circuits

Two positions for input breaker(s), 50 Amp 2-phase, or 30A single phase

Six 15 Amp or 20 Amp standard circuit breakers

Breaker box style enclosure with rear wire entry strain reliefs, H 10" x W 10" x D 4.75, including ¼" mounting flange.

Power Module Specifications

Max input power breaker 50 Amps 2-phase, or 30 Amps single phase 120 VAC

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Six, normally on, relay operated 20 Amp circuits

Two positions for input breaker(s), 50 Amp 2-phase, or 30A single phase

Six 15 Amp or 20 Amp standard circuit breakers

Breaker box style enclosure with rear wire entry strain reliefs, H 10" x W 10" x D 4.75, including ¼" mounting flange.

Control Module Specifications

Three button control, "Up", "Down", "Enter"

Six yellow led power indicators, one for each circuit under control

An OLED graphics display 0.95"

Uses common ethernet cable (up to 300 feet) to connect to the Power Module for data and power

Flush mount circular enclosure 2 1/16" diameter, 1 ¼" deep.

Control Module Display

The top yellow numbers indicate which circuits are on. Circuits temporarily disconnected are indicated by a square block around the number.

There are six main menus/displays, accessed by pressing the "Up" or "Down" buttons:

1) Total Power Display
Load 53% 0.0A
Enter for Reset

2) History Menu
Enter to show
Watts History

3) Max Power Setting Display (use this to set what your shore power cord is plugged into 15,20,30 amp service for example or 25 amp while inverting)
Max Gen Amps
30.0A

4) Circuit Priority Display

1 2 3 4 5 6

Circuit Priority

5) Present Wattage Display (use this to help manage your power consumption the example below is using 221 watts of 115v or AC power)

W 123 57 13

W 0 23 5

6) Present Amperage Display (same as 5 however in amps ,,,, amps x volt = watts)

2.0A 1.0A 4.1A

5.3A 0.3A 1.7A

Pressing Enter at the History Menu shows past power consumption in Watt hours per circuit, first showing circuits 123, then 456, then previous hours as you press the “Down” button. Pressing the enter button again returns you to the History Menu screen.

0hr ago 123

0.00 0.00 12.0

0hr ago 456

1.20 10.0 0.50

...

23hr ago 123

1.03 2.56 0.00

23hr ago 456

0.00 3.22 1.01

Pressing Enter at the Max Power Setting Display allows editing of the maximum amps allowed by the system. Press Up/Down to set, Enter to save.

Pressing Enter at the Circuit Priority Display allow editing of circuit priorities. An arrow appears below each priority number as you continue to press the Enter button. Pressing the Up or Down buttons changes the priority pointed to by the arrow. A circuit at priority level “1” will be turned off last. Priority level “6” is turned off first when too much power is being used. The default setting is “1 2 3 4 5 6”. This indicates the first circuit (leftmost in display) has the most priority and the sixth circuit has the least priority. A setting of “6 2 3 4 5 1” indicates the first circuit (in first position, far left), has the least priority and the sixth circuit (far right) has the most priority.

Pressing Enter at the Total Power display, (“Enter for Reset”) asks “Reset? Y/N N” press Up/Down buttons until “Reset? Y/N Y” appears. Then press the Enter button. It will show “Resetting... for a few seconds. Any lines that were powered off are all powered on. This is like resetting a breaker. It assumes you have reduced the load that had previously turned off some lines.

How Much Energy Does My RV Need?

The power consumption of most appliances is given in Watts. To determine how much energy my appliances will use, simply multiply the power consumption, by the hours of *intended* use. For example, if I want to run my air conditioner for two hours I will need approximately 2880 watts of energy (w) 1440×2 (H). A typical person will use approximately 1.2Kw of power a day (without air conditioning).

Examples:

| | |
|---------------------|------------|
| iPhone | 6 watts |
| Air Conditioner | 1440 watts |
| LED Television | 200 watts |
| Keurig coffee maker | 300 watts |
| LED lighting/16' TT | 90 watts |
| Water pump | 45 watts |