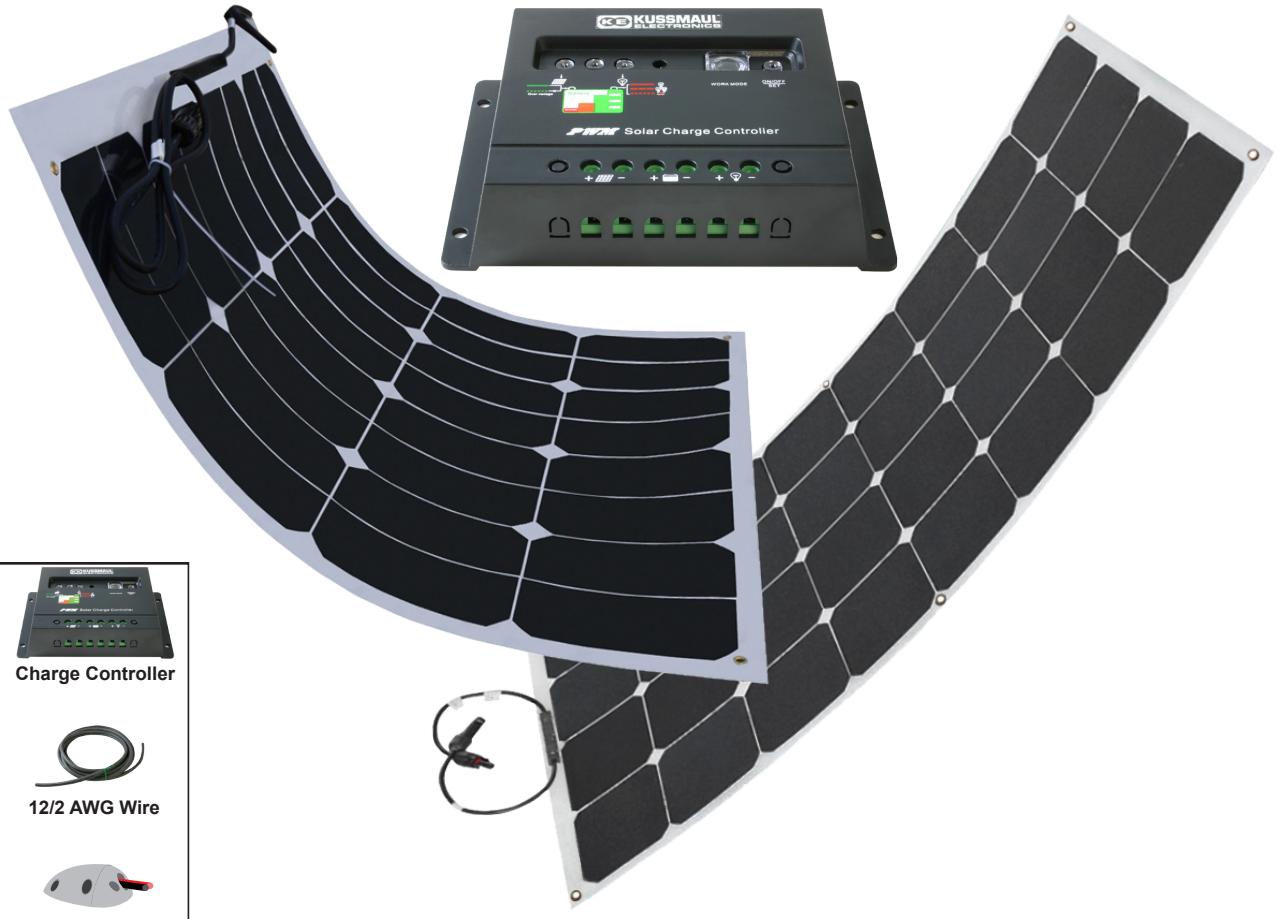
INSTRUCTION MANUAL

DURA-FLEX

FLEXIBLE SOLAR PANEL CHARGING SYSTEM

50W & 100W SOLAR PANELS SERIES



Charge Controller

12/2 AWG Wire

Thru-Dex

MODEL #: 091-241-50W

OUTPUT: 12 VDC, 50 Watt

MODEL #: 091-241-100W

OUTPUT: 12 vDC, 100 Watt

File: IM_091-241_revA.indd
Rev: A
Revised By: JM
Date: 06-26-2015

5 YEAR WARRANTY (Solar Panel)
3 YEAR WARRANTY (Charge Controller)

scan using your mobile device for more information

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www.kussmaul.com

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Ph: 800-346-0857
Fax: 631-567-5826
sales@kussmaul.com

IMPORTANT SAFETY INSTRUCTIONS

- **WARNING: DO NOT REMOVE PROTECTIVE CARDBOARD ON SOLAR PANEL UNTIL THE SOLAR PANEL IS INSTALLED AND WIRED TO THE CONTROLLER.** The solar panel is an energy source. Once cables are attached to it and the panel exposed to a light source the cables become live. Bare or exposed copper conductors can short during wire preparation & routing creating hazardous sparks and possible damage to solar panel. Leave protective cardboard in place until installation is 100% complete.
- Warning: Be very careful when working with batteries. Lead-acid batteries can generate explosive gasses and short circuits can draw thousands of amps from the battery. Read these instructions and those included with the charge controller and battery.
- DO NOT exceed the voltage or current ratings of the controller. Use only with a 12 volt battery.
- DO NOT short circuit the PV array or load while connected to the controller. This will DAMAGE the controller.
- The controller should be protected from direct sunlight. Ensure adequate space for air flow around the controller.
- The negative system conductor should be properly grounded.

INTRODUCTION

The Auto Flex Solar Charger is designed for use in emergency vehicles and other mobile applications. The system includes all necessary components to quickly and easily install and start maintain batteries using solar power. This kit includes a solar panel, charge controller, mounting hardware, and wire. For additional parts and or alternate installation methods, please contact us by phone at (800) 346-0857 or email us at sales@kussmaul.com.

UNPACKING

The Solar Charging System is shipped complete in one carton:
If any items are missing, please contact your distributor or Kussmaul Electronics immediately.

WARNING: WHEN SOLAR PANEL IS TAKEN OUT OF ITS SHIPPING CARTON, DO NOT REMOVE PROTECTIVE CARDBOARD TAPED TO SOLAR PANEL UNTIL THE SOLAR PANEL IS INSTALLED AND WIRED TO THE CONTROLLER. The solar panel is an energy source. Once cables are attached to it and the panel is exposed to a light source the cables become live. Bare or exposed copper conductors can short during wire preparation & routing, creating hazardous sparks and possible damage to solar panel. Leave protective cardboard in place until installation is 100% complete.

TOOLS REQUIRED

- Philips Screwdriver
- Punch or Awl
- Wire Strippers
- Wire Cutters
- Wire Crimpers
- Electric Hand Drill
- 1/8” Drill Bit for thr Thru-Dex roof cable feed-thru mounting screws (pilot hole)
- 15/32” Drill Bit for the cable to pass through roof using RA-7 Right Angle Thru-Dex fitting
- 3/8” Drill Bit for Well Nuts
- 13/16” Drill Bit if using optional cord grip
- 1/8” Drill Bit for #8 sheet metal screws (pilot hole - mount solar regulator)
- 5/16” and 7/16” Wrench
- Adjustable Wrench (1-1/16”) if installing NPT cord grip
- Sealant
- Thread Locker (high vibration applications)
- Anti-seize lubricant

FEATURES

I. Solar Panel Features

- Industrial grade panel, components and heavy duty mounts designed for emergency vehicle use
- Numerous size panels match available roof space. Panels can be wired in parallel for higher output.
- Flexible: Can be curved to a maximum 30 degree arc. Versatile installation options: applicable for vehicles, RVs, boats, cabins, tents, yachts or any other irregular surfaces. Ideal for storage in tight spaces or crowded areas that are typically off limits for traditional glass and aluminum models.
- Reliable: The junction box is sealed and waterproof.
- Productivity: Bypass diodes minimizes performance drop due to partial shade and prevent battery discharge at night.
- Temperature Compensated Voltage Controller
- Kits contain all parts needed for vehicle installations
- Keep up with radio load without running engine or plugging in
- Helps comply with anti-idle laws
- Saves fuel cost and engine maintenance
- Eliminate the need to jump start reserve vehicles
- Ideal for vehicles with mobile computers and radios
- Top Ranked PTC Rating
- High Module Conversion Efficiency
- Fast and Inexpensive Mounting
- Maximizes System output by reducing mismatch loss
- 5 Year Warranty

II. Charge Controller Features

- Temperature Compensated
- Protects battery from overcharge and discharge
- Compatible with both 12 volt and 24 volt solar panels and batteries
- Handles up to 30 amps of array current
- Handles up to 400 watts of solar power on 12V or 800 watts on 24V
- Maintenance free protection of your solar panel and batteries
- Maintains 12 volt batteries in a fully charged state
- LED indicator shows when solar is charging the battery
- LED indicator shows when the system is over voltage
- The EPIP30I solar Controller is designed with a microcontroller for automatic lighting control functions
- Suitable for all 12/24 V DC lamps
- 1-year warranty

The main advantage of Pulse Width Modulation (PWM) is that power loss in the switching devices is very low. When a switch is off, there is practically no current. When the device is on, there is almost no voltage drop across the switch. Power loss, being the product of voltage and current, is thus in both cases close to zero. PWM also works well with digital controls, which, because of their on/off nature, can easily set to the needed duty cycle.

This solar power system controller adopts the most advanced digital techniques and operates fully automatically. The PWM battery charging can greatly increase the lifetime of your battery and has various unique functions and quite easy to use features.

WARNING: The 'LOAD' terminals are NOT to be used in this application.

INSTALLATION

Reference Installation Wiring Diagram 1 for a simplified visual overview of the installation.

I. Mounting the Solar Panel
II. Cable Feed-Thru Installation
III. Installing and Wiring the Charge Controller
IV. Battery Wiring

WARNING: DO NOT REMOVE THE CARDBOARD COVERING THE PVC SIDE OF PANEL UNITL THE INSTALLATION IS COMPLETED. ONCE CABLES ARE CONNECTED TO THE PANEL'S JUNCTION BOX THE CABLES WILL BECOME LIVE IF THE PANEL IS EXPOSED TO A LIGHT SOURCE.

I. Mounting the Solar Panel

Reference Installation Wiring Diagram 2

Note: It is recommended that the roof does not exceed 3/16” when using supplied well nut.

When mounting a panel, a well-nut (also known as “expansion nut”) is often used on a pre-drilled hole. This procedure safely secures the panel on thin vehicle roofs. Using the provided well-nuts is recommended, as the rubber expansion prevents water leakage.

Locate the mounting holes on the solar panel. The 50 Watt panel has 4 mounting holes, and the 100 Watt panel has 6 mounting holes. Lay the panel on the mounting surface, and make a mark where the mounting holes will be with a felt-tip marker. Once the holes are properly marked, use the appropriate size bit to drill the holes. The well-nuts supplied have a body diameter of 3/8”, therefore, we use a 3/8” drill bit. Carefully drill the holes, and make sure the well-nut fits properly.

Gently insert the well-nut into the drill hole. Be careful not to push the well-nut flange completely into the holes. The rubber flange on the well-nut must be flush with the roofline. Before attaching the panel to the roof, a film of caulk can be laid between the vehicle roof and the solar panel backing. Even though the well-nut provides a watertight bond, this provides additional sealant.

Once the caulking sealant bead has been laid, align the panel’s mounting holes with the well-nut holes. Insert the #10 lock washer into the #10-32x3/4” machine screw followed by the #10 flat washer. Apply anti-seize fluid to the screw, as this will prevent galling, locking, or seizing with the well-nut brass insert.

Insert the screw into the well-nut hole, and begin to tighten it with a Philips screwdriver. As the screw is tightened, the well-nut compresses and expands, creating a secure hold that is free from air and water leakage.

WARNING: Do not over-tighten the screw.
DO NOT exceed 5 in-lbs of torque.

Once you have tightened all the screws, ensure that the panel is secured before driving the vehicle. To finalize the vehicle mounting installation, cover the head screws with sufficient sealant; this will completely seal the base.

The well-nut does not only work for thin vehicle roofs, but also works in blind holes. Tightening a well-nut in a blind hole will cause the body to expand and apply pressure against the walls of the hole. This also creates a secure hold of the solar module.

II. Cable Feed-Thru Installation

Reference Installation Wiring Diagram 3

1. Roof top, dual cable feed thru- A model RA-7 Right Angle Thru-dex fitting is provided for routing the solar panel's lead cable through the roof and to the charge controller. Use butt connectors and 12/2 wire, provided to extend wires to controller. Carefully choose a location that can be accessed from inside the vehicle and mark the location on roof for the RA-7 location and follow the install instructions provided with the RA-7.

2. A drill size of 15/32" is recommended for the wire routing hole and a 1/8" drill for creating pilot holes for the fitting's three self tapping screws.

3. Additional cable feed thru for bulk heads- A ½" NPT Liquid tight cord grip is provided to allow the cable to pass through a bulkhead or fire wall. To install this cord grip drill a 13/16" hole.

III. Installing and Wiring the Charge Controller

Reference Installation Wiring Diagram 4

1. Select a suitable location for the installation of the charge controller. A location inside the vehicle such as the cab or other protected compartment is recommended (operating temperature range: -35 to +55° C). The charge controller should be mounted to a vertical surface and have free space around it for cooling. Use the four #8, ½" sheet metal screws provided. Use a 1/8" drill bit for the pilot hole.

WARNING: The 'LOAD' terminals are NOT to be used in this application.

2. Wire the battery to controller:

a) Connect to the charge controller Battery screw terminals using cable provided:

Red wire to Battery Positive (+)
Black wire to Battery Negative (-)

Note: Do not install fuse until ready for step IV. Powering Up The Solar Charging System.

b) Route this cable either directly to the battery or if more convenient, to the line side of a power distribution bus. Before connecting to vehicle battery system install the ATC in-line fuse holder provided on the red/positive (+) wire on the battery end (as close to + battery/+ bus as practical) – do not install the ATC-15 fuse at this time. Use butt connectors and 12/2 wire provided. Connect the black/negative (-) wire to the battery negative (-) terminal or a convenient ground bus point.

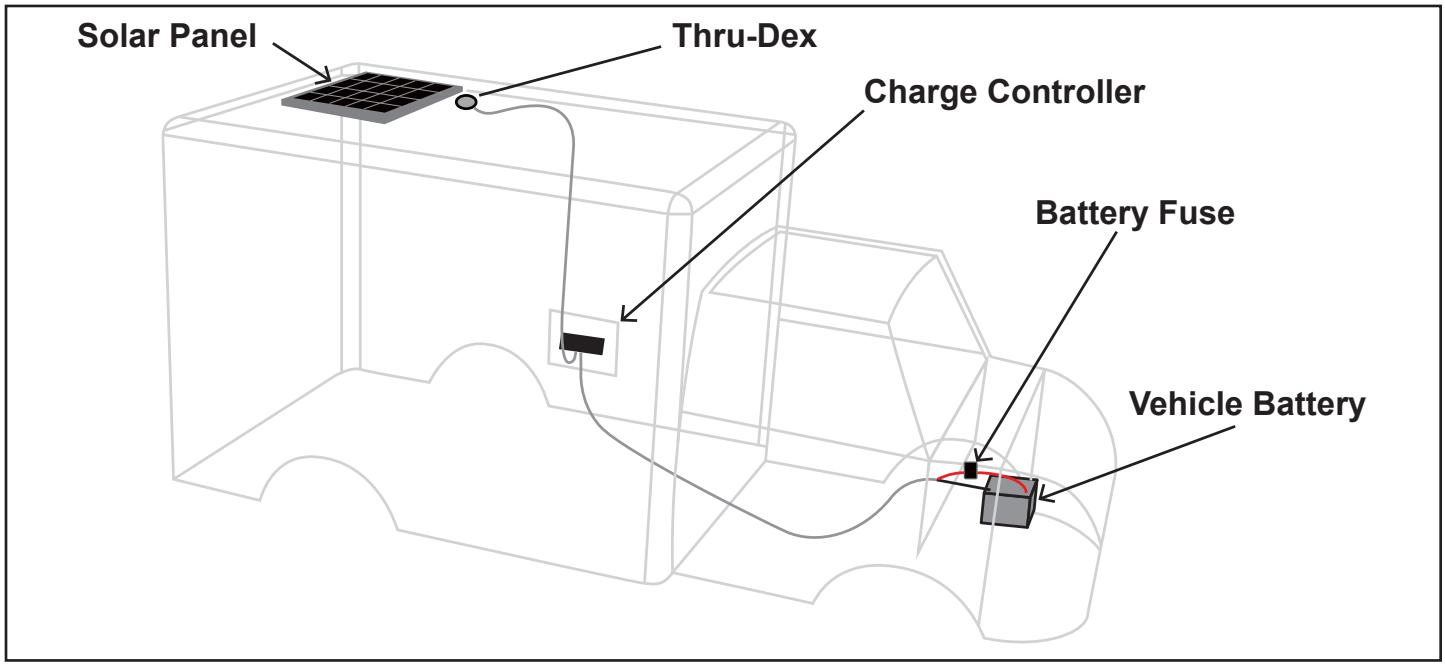
IV. Powering Up The Solar Charging System

Reference Installation Wiring Diagram 4

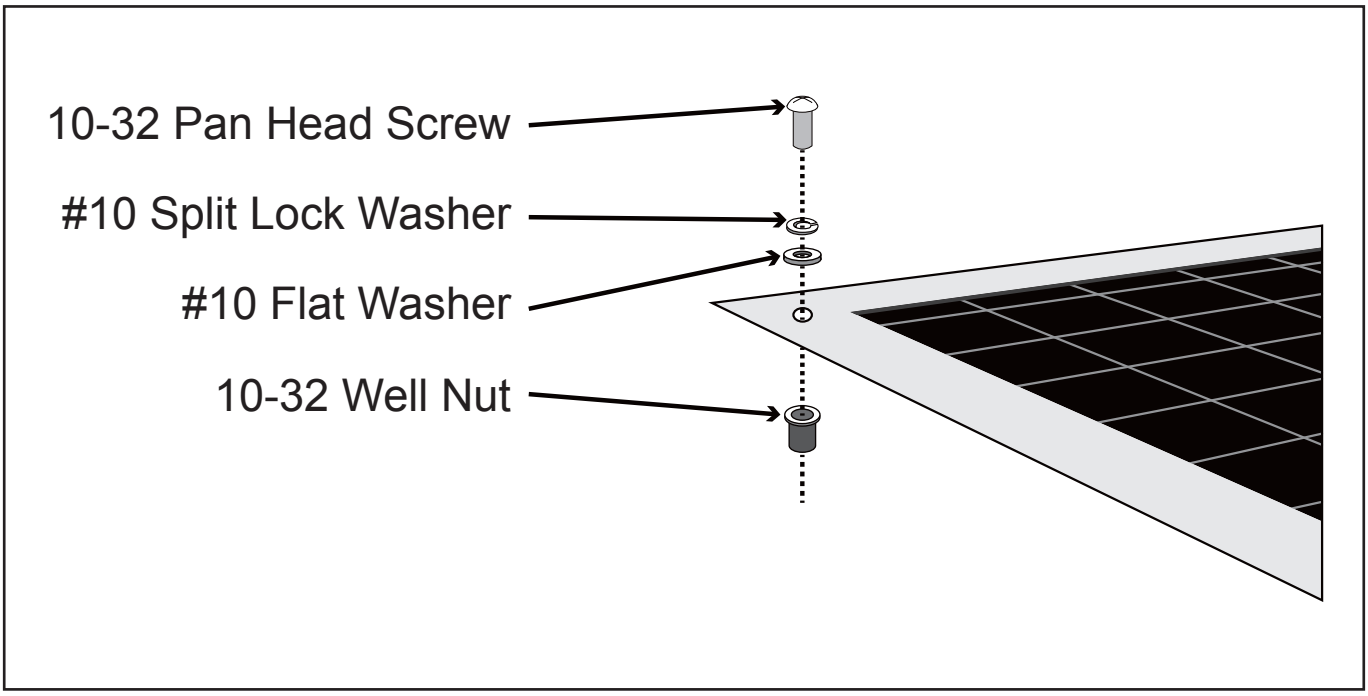
1. Double check polarity of wire connectors.
2. Install the ATC/ATO-15 fuse into the battery fuse holder.
3. Remove protective cardboard from the solar panel.
4. Verify the green LED indicator on the charge controller is illuminating whenever sunlight is available.
5. Using a digital multi-meter, place the probes across the vehicle battery with the solar panel exposed to sunlight and no other charging sources operating (alternator and vehicle battery charger off). Verify battery voltage is rising. See Charge Controller manual.

INSTALLATION WIRING DIAGRAM

1. Installation Overview



2. Mounting Solar Panel



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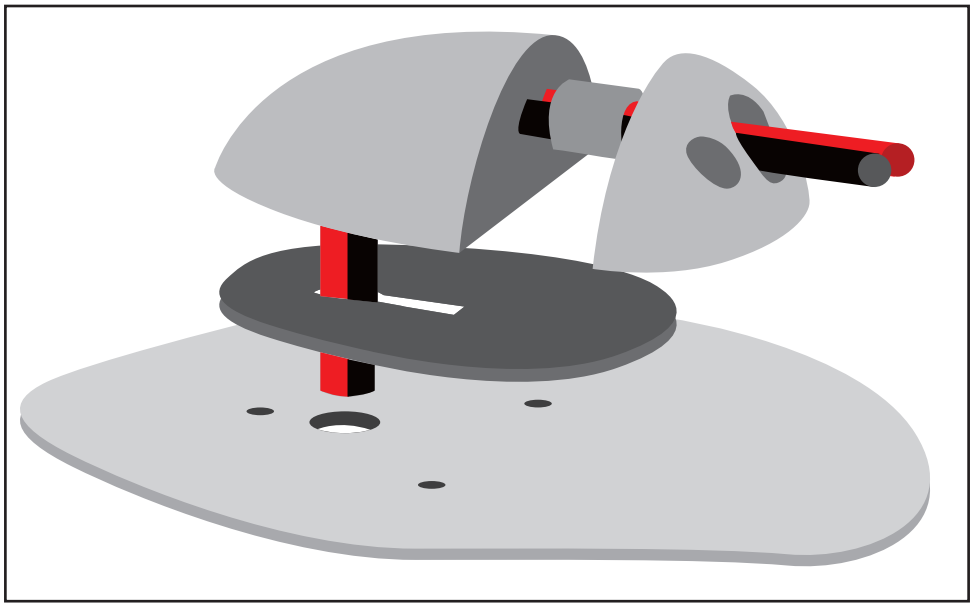
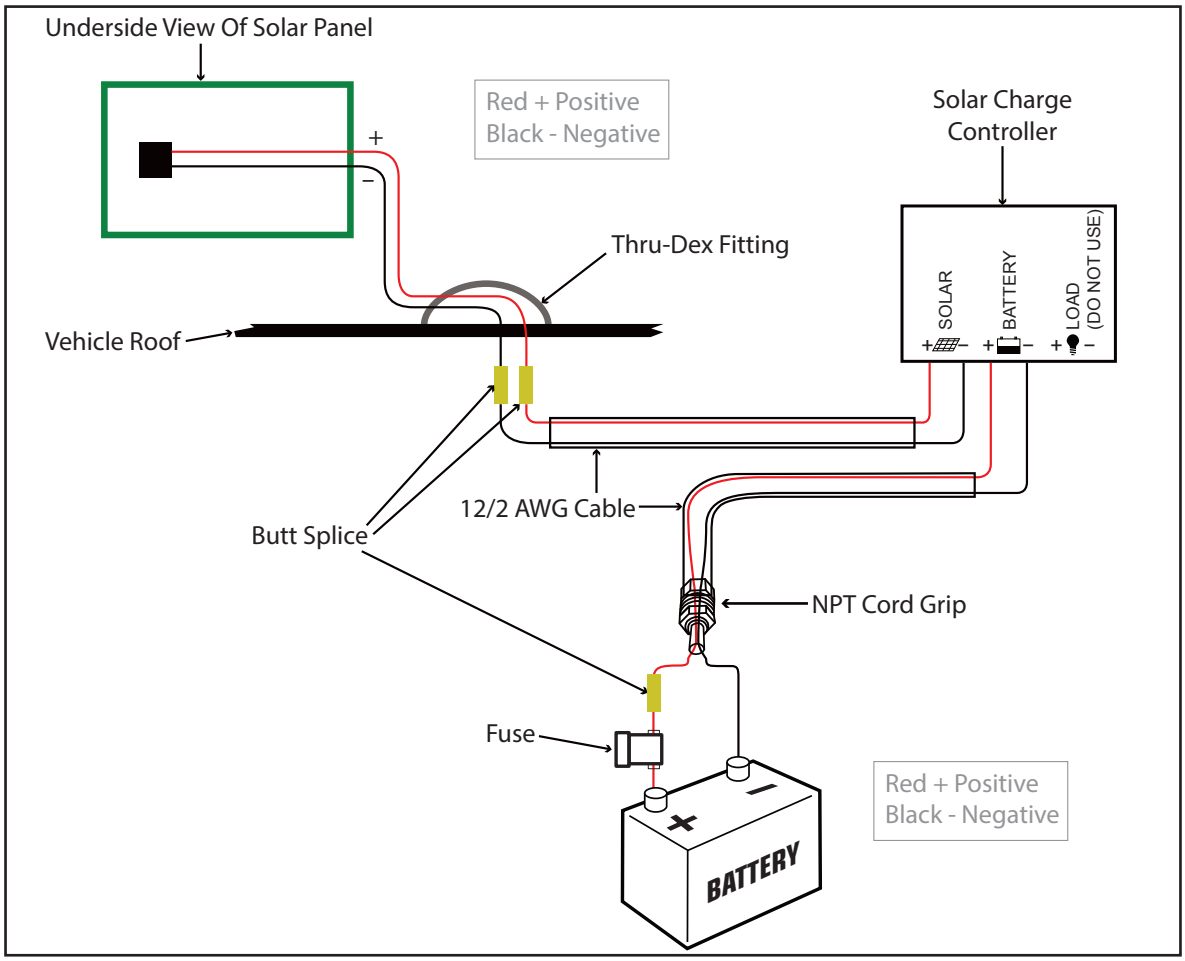
3. RA-7 Right Angle Feed-Thru



4. Wiring



MAINTENANCE

For optimum performance, clean the solar panel glass at least once a month with window cleaner or mild soap, or when vehicle is washed.

Periodically verify charge controller is operating:

1) Disconnect the vehicle battery charger if equipped.
2) Place the vehicle so the solar panel is exposed to full sunlight.
3) Turn vehicle engine off.
4) Turn on a small 12 volt load such as a radio and using a digital voltmeter, verify battery voltage does not drop below 12.8 VDC. Depending upon solar panel wattage, panel output voltage, sun exposure and current draw of load, the battery voltage may measure between 13-14 VDC.

FACTORY CONTACT INFORMATION

If at any point you have a problem with the Solar Charging System, or have any question about the installation and proper operation of the Solar Charging System, please contact Kussmaul Support via email at sales@kussmaul.com or phone at (800) 346-0857.

SPECIFICATIONS

I. Solar Panel

Solar Panel Electrical Characteristics		
Part #	**091-241-50W**	**091-241-100W**
Maximum Power at STC (Pmax)	50W	100W
Optimum Operating Voltage (Vmp)	17.6 V	17.7 V
Optimum Operating Current (Imp)	2.84 A	5.70 A
Open Circuit Voltage (Voc)	21.6 V	21.70 V
Short Circuit Current (Isc)	3.05 A	6.10 A
Maximum System Voltage	600 VDC	600 VDC
Maximum Series Fuse Rating	15 A	10 A
STC	1000W/m², Temp 25, AM=1	1000W/m², Temp 25, AM=1

Solar Panel Mechanical Properties		
Part #	**091-241-50W**	**091-241-100W**
Solar Cell	Monocrystalline (125 x 63 mm)	Monocrystalline (125 x 125 mm)
# of Cells	32 (2 x 4 x 4 mm)	32 (8 x 4 mm)
Dimensions (mm)	555 x 540 x 3	1060 x 540 x 3
Dimensions (in)	21.8 x 21.2 x 0.12	41.33 x 21.3 x 0.12
Weight (lbs)	2.6	4.4
Junction Box	IP65 Rated	IP65 Rated
Output Cables	0.006 in², 10 in	0.006 in², 10 in
Fire Rating	Class C	Class C

Solar Panel Temperature Characteristics		
Part #	**091-241-50W**	**091-241-100W**
Operating Module Temperature	-40°C to +90°C	-40°C to +80°C
Nominal Operating Cell Temperature (NOCT)	47 ± 2°C	47 ± 2°C
Temperature Coefficient of Pmax	-0.44%/°C	-0.38%/°C
Temperature Coefficient of Voc	-0.30%/°C	-0.28%/°C
Temperature Coefficient of Isc	0.04%/°C	0.06%/°C

II. Charge Controller

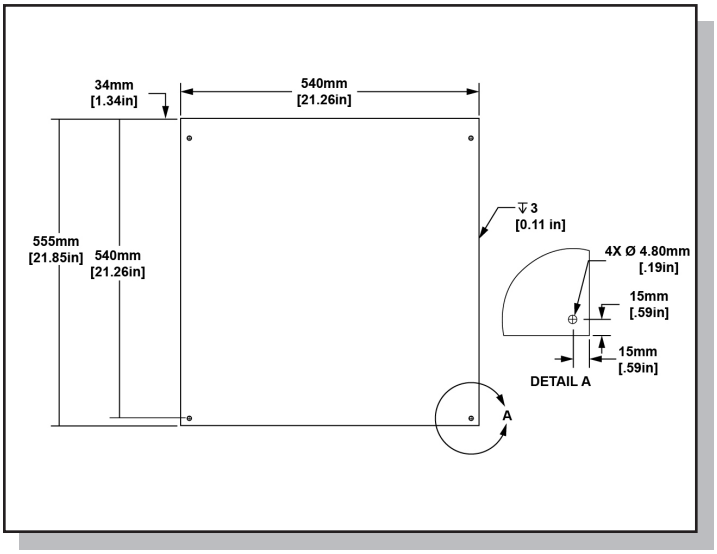
Charge Controller Specifications	
Controller Type	PWM
Rated Solar Input	30 Amps
Rated Load	30 Amps
25% Current Overload	1 minute
Load Disconnect	11.1 V
Load Reconnect	12.6 V
Equalization Voltage (30 minutes)	14.6 V
Boost Voltage (30 minutes)	14.4 V
Float Voltage	13.6 V
Temperature Compensation	-30mV/C
Terminals	For wire sizes up to 6mm²
Temperature	-35°C to +55°C
Battery Type	Lead Acid batteries, including AGM and Flooded

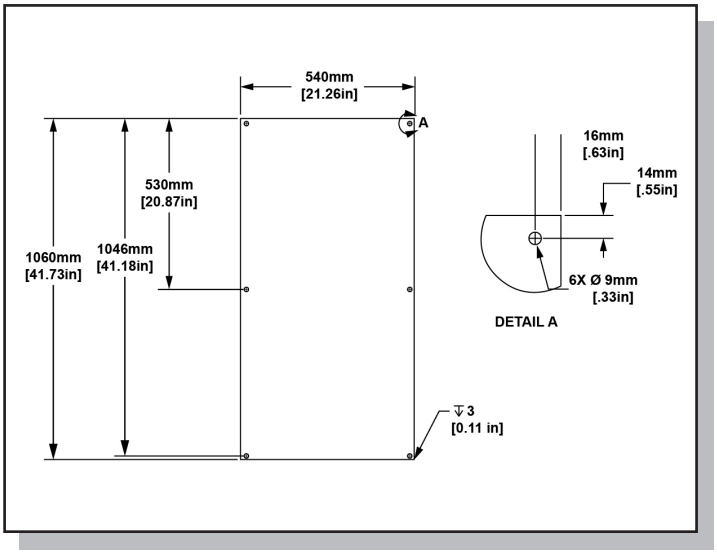
Charge Controller Note: For safety, do not exceed 80% of charge controller current rating. This rating should be based on total short-circuit current of the solar panels.

HARDWARE PROVIDED

1 x Manual-Solar Charging System
1 x Temperature Compensated Charge Controller, 30 Amp
1 x 20’ Cable 12/2 Blk-Red; grey jacket, 105C
1 x RA-7 Right Angle Thru-Dex Fitting (dual cable feed-thru for vehicle roof)
1 x Fuse Auto 15 Amp (battery fuse)
1 x Fuseholder Inline; ATC/ATO, 12 AWG, Red (battery fuse)
1 x Cord Grip; NPT-1/2”, Blk, 11-6 MM (pass cable through roof/firewall)
8 x Machine Screw; Hex Head SS 10-32 x 3/4”
4 x Sheet Metal Screw; Phillips Pan Head, SS #8 (mount controller)
8 x Washer Flat, #10 stainless steel
8 x 10-32 Well Nut
3 x Butt Connector Term. Insul. #1210GA

OUTLINE DRAWING





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INSTALLATION RECORD

DATE INSTALLED _____

INSTALLED BY _____

VEHICLE IDENTIFICATION _____

VEHICLE OWNER _____

WARRANTY POLICY

All products of Kussmaul Electronics are warranted to be free of defects of material or workmanship. Liability is limited to repairing or replacing at our factory, without charge, any material or defects which become apparent in normal use within 5 years from the date the equipment was shipped. Defective products should be returned to Kussmaul Electronics with shipping charges prepaid. Upon repair, products will be returned to customer with shipping charges paid.

Kussmaul Electronics shall have no liability for damages of any kind to associated equipment arising from the installation and/or use of the Kussmaul Electronics products. The purchaser, by the acceptance of the equipment, assumes all liability for any damages which may result from its installation, use or misuse, by the purchaser, his or its employees or others.

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