CHARGESYS

The engineering authority in mobile solar power

# ARMORCELL

## Solar kit user & installation guide

Engineered to perform in demanding applications. Trusted by emergency services, commercial fleets, marine, and outdoor adventure enthusiasts

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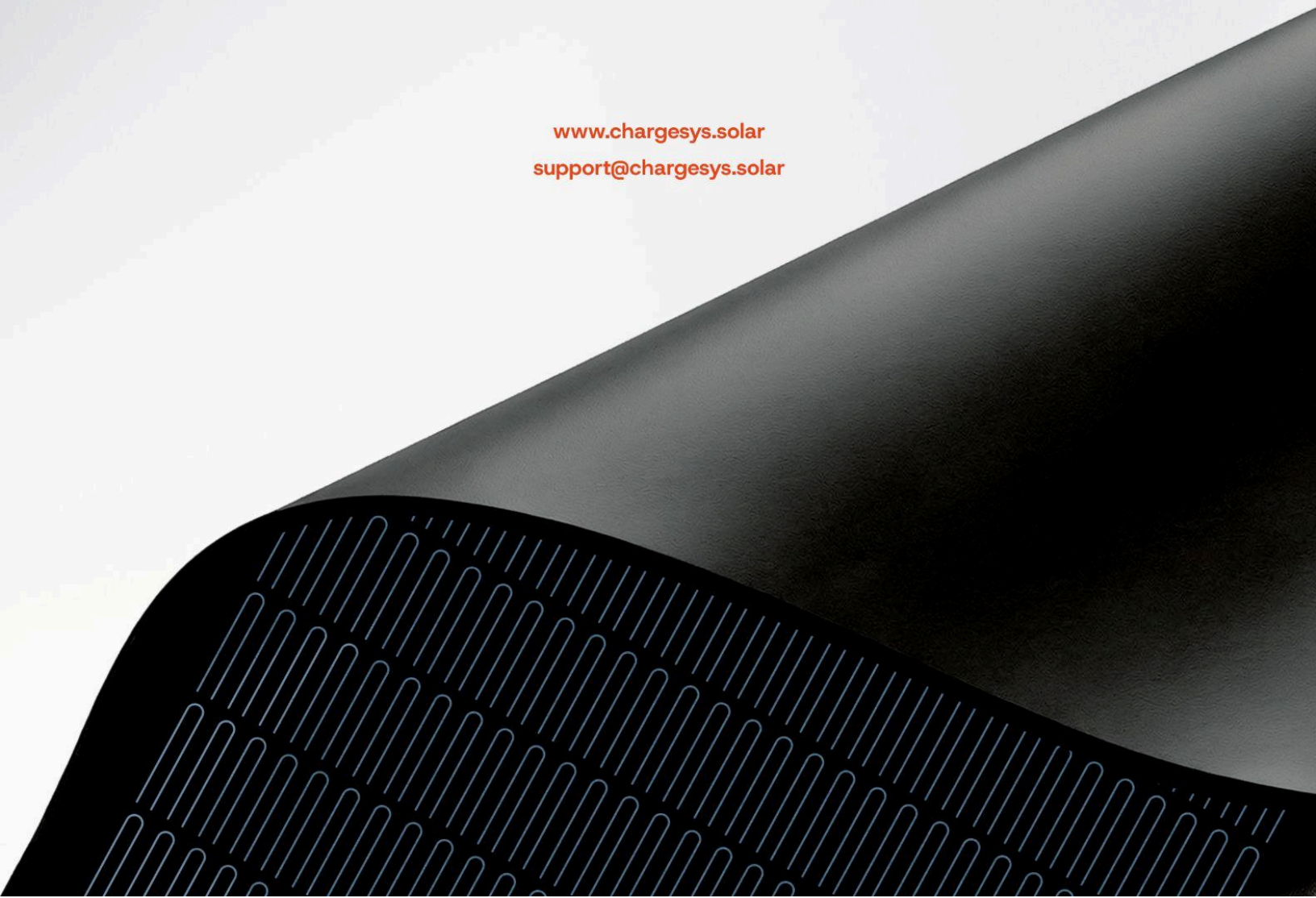
support@chargesys.solar



# ⚠ WARNING

## Read before installation

Disconnect all battery connections before beginning installation. Solar panels generate electricity when exposed to light — cover the panel face during wiring. All electrical work should be performed by qualified personnel in accordance with local codes. Failure to follow these instructions may result in electric shock, fire, or equipment damage.

This system is designed for 12V DC battery systems. Do not connect to 24V or 48V battery banks without consulting ChargeSys technical support. Ensure all components are rated for your specific application before installation.

# Kit contents

Verify all components are present before beginning installation. Contact ChargeSys immediately if any items are missing or damaged.

| Qty | Component | Part Type | Check |
|---|---|---|---|
| 1 | CIGS Solar Panel with Self-Adhesive Backing | Solar | ☐ |
| 1 | Victron SmartSolar MPPT Charge Controller | Controller | ☐ |
| 1 | Roof Wire Gland with Integrated MC4 Bulkhead Connectors & 15 ft Pre-Installed Interior Wires (6mm² Solar PV Wire) | Wiring | ☐ |
| 1 | 10A Inline MC4 Fuse | Protection | ☐ |
| 1 | 25A Marine-Style Circuit Breaker | Protection | ☐ |
| 1 | Installation Hardware (screws, grommet, pad) | Mounting | ☐ |

# About ARMORCELL solar technology

Your ChargeSys ARMORCELL solar panel uses **Copper Indium Gallium Selenide (CIGS)** thin-film technology — the most advanced flexible solar technology available for mobile applications. Unlike rigid crystalline silicon panels, ARMORCELL panels are engineered for the unique demands of vehicles and marine environments.

## Why ARMORCELL for mobile applications?

- **Lightweight & low-profile**: Thin-film construction adds minimal weight and virtually no aerodynamic drag. The self-adhesive backing bonds directly to the roof surface with no raised mounting brackets.
- **Superior heat performance**: ARMORCELL panels have a lower temperature coefficient than crystalline silicon, meaning they lose less power output in hot conditions — critical for vehicles parked in direct sun.
- **Shade tolerance**: CIGS technology handles partial shading better than rigid panels. Light bars, antennas, and other rooftop equipment cast shadows that would significantly reduce output from crystalline panels.
- **Durability**: No glass to crack, no rigid frame to loosen. ARMORCELL panels flex with the vehicle body and withstand the vibration and impacts of daily operations.

# Tools & materials required

The following tools are needed for a complete installation (not included in kit):

| Tools | Materials |
|---|---|
| Wire strippers / cutters<br>Crimping tool (for ring terminals)<br>Drill with appropriate bits<br>Phillips & Flathead screwdrivers<br>Multimeter (for voltage verification)<br>Isopropyl alcohol & clean cloth | 10 AWG wire (red & black), ~6 ft each<br>Ring terminals (for battery connections)<br>Cable ties / wire loom<br>Silicone sealant (marine-grade preferred)<br>Heat shrink tubing (assorted)<br>Dielectric grease (for connections) |

# Installation procedure

### Step 1 — Plan the Installation

Choose a mounting location on the vehicle roof that is relatively flat, receives maximum sun exposure, and avoids obstructions such as light bars, antennas, A/C units, and roof hatches. The panel should be oriented lengthwise along the vehicle when possible to minimize shading from equipment at either end.

Plan your wire routing path from the panel location to the charge controller mounting point inside the vehicle. Identify the roof penetration point for the wire gland — choose a location near the panel that allows easy access to the interior. Avoid routing wires near heat sources or areas that may be pinched.

**Wire Lead Routing:** The solar panel wire leads must be neatly routed along the roof surface to ensure they do not get snagged by trees, brush, or other obstacles. If mounting the roof wire gland and solar panel in a straight line, verify that the wires will lay straight (not bowed) when the installation is complete.

**Spacing Between Panel and Gland:** Carefully measure the distance between the planned panel position and the roof cover (wire gland) location. The solar panel's MC4 connectors must reach the MC4 bulkhead connectors on the exterior face of the roof cover. The system will not work if the panel wire leads are too short to reach the roof cover. Do not leave excessive space between the cover and the panel — slack wire on the roof is vulnerable to snagging and looks unprofessional. A helpful technique is to temporarily connect the solar panel's MC4 connectors to the gland's exterior bulkhead connectors before permanently mounting either component to verify the layout spacing is correct.

## Step 2 — Prepare the Mounting Surface

Clean the roof surface thoroughly with isopropyl alcohol to remove all dirt, oil, wax, and debris. Allow the surface to dry completely. The adhesive bond is only as strong as the surface preparation — this step is critical.

Ambient temperature must be above 50°F (10°C) for proper adhesive curing. If installing in cold weather, warm the mounting surface and adhesive backing with a heat gun set to low before application.

## Step 3 — Mount the Solar Panel

**IMPORTANT:** Use caution when handling the panel. The panel generates voltage on the terminals when exposed to light.

1. Dry-fit the panel in the planned location without removing the adhesive backing. Verify clearances and wire routing. Mark the panel position with painter's tape if needed.

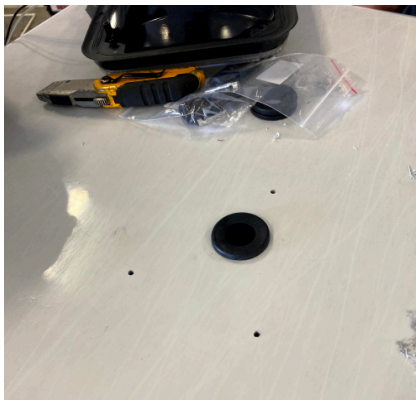
2. Peel back approximately 6 inches of adhesive backing from one end. Align the panel to the marked position and press firmly to tack the starting edge.

3. Slowly peel the remaining backing while pressing the panel firmly onto the surface, working from the tacked edge to the opposite end. Use a soft towel with moderate hand pressure on the face of the panel to ensure it is firmly adhered to the surface.

4. Apply firm, even pressure across the entire panel surface. Vehicle operation can start immediately after installation, however maximum bond strength will be achieved after approximately 24 hours.

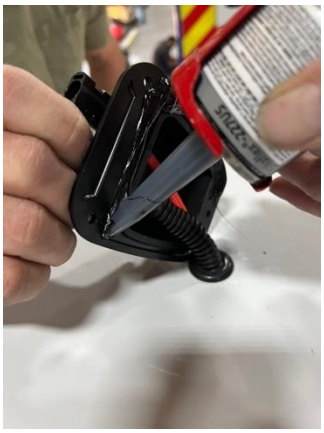
## Step 4 — Install the roof cover wire gland

1. Drill the roof penetration hole at the planned location using a step drill bit. Size the hole to match the inner raceway diameter of the rubber grommet to ensure the grommet fits securely in the hole. Deburr the hole edges and clean any metal shavings. Measure twice! Be sure not to oversize the hole to ensure a secure grommet fit.



2. Install the rubber grommet into the drilled hole. The grommet protects the wires from being cut or chafed by the sharp metal edges of the hole. Seat the grommet fully so it is flush and secure.

3. Feed the roof gland's 15-foot pre-installed wires down through the grommet and into the vehicle interior.



4. Apply a generous bead of marine-grade silicone sealant to the bottom of the roof cover wire gland housing flange. Position the cover over the hole and secure it to the roof using the included self-drilling screws. The sealant between the gland housing and the roof surface creates the weatherproof seal. The roof cover gland's integrated MC4 bulkhead connectors should be aligned and ready to accept the solar panel's MC4 connectors.

5. Connect the 10A inline MC4 fuse to the solar panel's positive (+) MC4 connector. Then connect the fuse's output MC4 to the positive MC4 bulkhead connector on the exterior face of the roof cover gland. Connect the panel's negative (–) MC4 connector directly to the negative bulkhead connector on the gland. Ensure all MC4 connections click securely into place.

6. Allow sealant to cure per manufacturer's instructions before exposing to water.

## Step 5 — Wire the System

**CAUTION:** Always wire from the battery side first, then connect to the solar panel last. This prevents the charge controller from receiving solar input before battery voltage is established. Reversing this order could potentially damage the controller.

**Follow this wiring sequence exactly:**

1. Mount the Victron SmartSolar charge controller in a dry, ventilated location inside the vehicle. Allow at least 4 inches of clearance above and below for heat dissipation. The controller should be mounted vertically with terminals at the bottom.

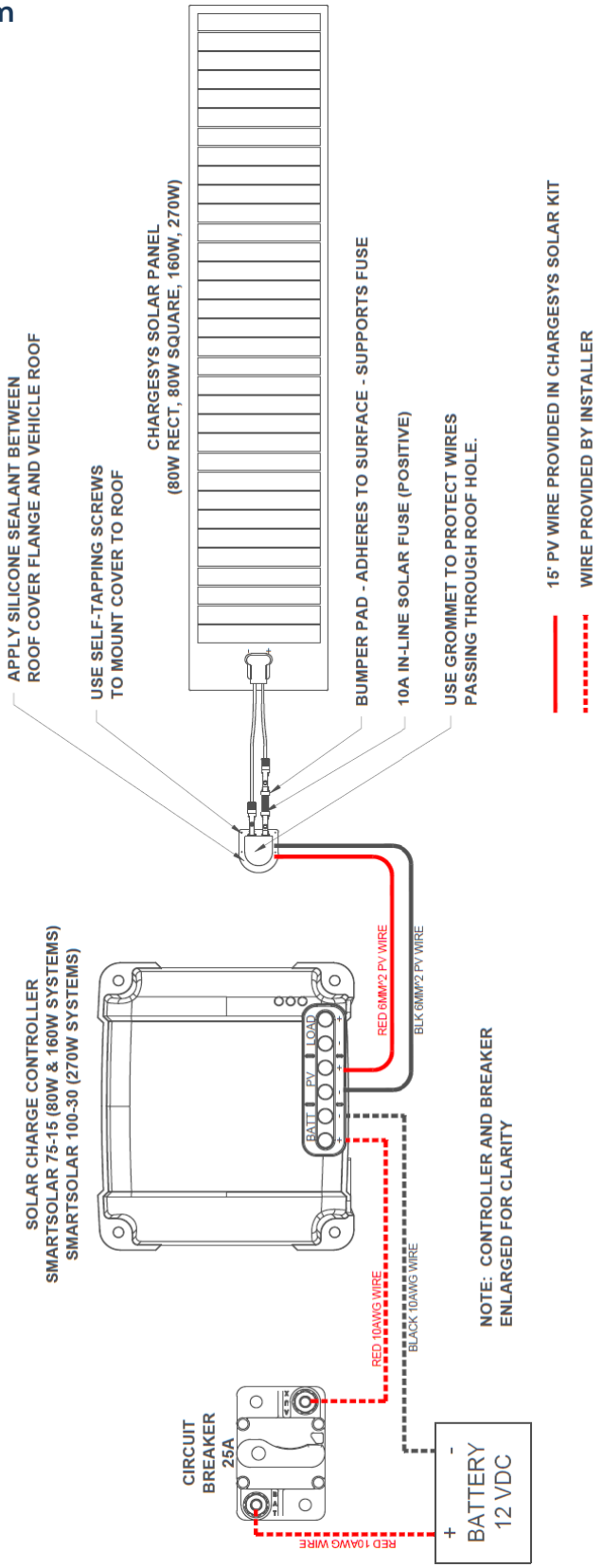
2. Install the 25A marine circuit breaker on the positive battery cable between the charge controller and the battery. This serves as both overcurrent protection and a convenient disconnect switch.

3. Connect battery cables: Run 10 AWG wire from the charge controller's battery terminals to the battery. Connect positive (red) through the circuit breaker to the battery positive terminal. Connect negative (black) directly to the battery negative terminal. Use properly crimped ring terminals at the battery.

4. Verify battery connection: Close the circuit breaker and confirm the charge controller powers on and displays battery voltage on the VictronConnect app or device LED indicators. The controller should show battery voltage (typically 12.0–13.0V).

5. Connect solar input wires: Connect the roof cover gland's PV wires to the charge controller's PV input terminals. Positive to positive (RED - PV+), negative to negative (BLACK - PV–). With the panel exposed to sunlight, the controller should begin charging.

## System Wiring Diagram



# Charge controller setup

## Victron SmartSolar MPPT Configuration

Your Victron SmartSolar MPPT charge controller is a premium, Bluetooth-enabled controller that optimizes solar energy harvest. It can be monitored and configured via the free VictronConnect app on your smartphone.

### Initial Setup

1. Download the VictronConnect app (available on iOS and Android) from your device's app store.

2. Enable Bluetooth on your phone and open the VictronConnect app. The controller will appear as a discoverable device when powered on.

3. The default PIN is 000000. You will be prompted to change this on first connection. If the default PIN does not work, use the PIN code listed on the charge controller label.

4. Navigate to Settings and select the correct battery type for your installation (e.g., Flooded, AGM, Gel, or Lithium).

5. For lithium batteries, verify the absorption and float voltages match your battery manufacturer's specifications. Incorrect charge profiles can damage batteries or reduce lifespan.

## Recommended Battery Charge Settings

| Battery Type | Absorption | Float | Equalize | Temp Comp |
|---|---|---|---|---|
| **Flooded Lead-Acid** | 14.4V | 13.8V | 15.0V | -24mV/°C |
| **AGM** | 14.4V | 13.8V | N/A | -24mV/°C |
| **Gel** | 14.2V | 13.8V | N/A | -24mV/°C |
| **LiFePO4 (Lithium)** | 14.2V* | 13.5V* | N/A | 0mV/°C |

**Lithium voltages vary by manufacturer. Always verify with your battery's documentation.*

# Operation & Monitoring

Once installed, your ChargeSys solar system operates automatically with no user intervention required. The Victron SmartSolar controller manages all charging stages (Bulk, Absorption, Float) and protects the battery from overcharging.

## LED Status Indicators

The charge controller has LED indicators that show system status at a glance:

| LED | State | Meaning |
|---|---|---|
| Green LED | ON - SOLID | Battery fully charged (Float stage) |
| Yellow LED | ON - SOLID | Absorption Charge State |
| Blue LED | ON - SOLID | Bulk Charge State |
| Blue LED | ON – SLOW BLINK | Not Charging – Insufficient Power |
| | | |
| Other Flash Patterns | | See Victron Controller Manual for fault codes |

## Using the VictronConnect App

The VictronConnect app provides detailed real-time and historical data including current solar input power (watts), battery voltage and charge current, daily energy harvest (kWh), 30-day charge history, and error/warning notifications. Check the app periodically to verify the system is performing as expected and to monitor long-term energy production trends.

# Maintenance

Your ARMORCELL solar system requires minimal maintenance. Follow these guidelines to ensure long-term performance:

- **Panel Cleaning:** Clean the panel surface as needed with water and a soft cloth or sponge. Avoid abrasive cleaners, brushes, or pressure washers. Dirt, bird droppings, and road grime reduce output — regular cleaning maintains peak performance.

- **Connection Inspection:** Check all electrical connections twice per year for corrosion, looseness, or damage. Pay special attention to MC4 connectors and battery terminals. Re-apply dielectric grease to exposed connections as needed.

- **Sealant Inspection:** Inspect the roof wire gland sealant and panel adhesive edges annually. Re-seal any areas showing cracking, separation, or wear to prevent water intrusion. The MC4 connectors on the roof cover have internal nuts that hold it in place. Simply twisting the mc4 connector clockwise tightens the connector and nut. Do not overtighten, but do not leave the connector loose/dangling from the roof cover.

- **Circuit Breaker:** Exercise the circuit breaker switch once every few months (open and close) to prevent contact corrosion and ensure reliable operation.

- **Controller Firmware:** Check the VictronConnect app periodically for firmware updates. Victron releases updates that can improve charging algorithms and add features.

# Troubleshooting

| Symptom | Possible Cause | Solution |
|---|---|---|
| **Controller not powering on** | Circuit breaker open or battery disconnected | Close breaker; verify battery connections and voltage with multimeter |
| **No solar input shown** | Panel not exposed to sunlight, MC4 not connected, or fuse blown | Move panel into sunlight; check MC4 connections; inspect 10A fuse |
| **Low power output** | Dirty panel, partial shading, or high temperature | Clean panel; check for sunlight obstructions; output improves as temperatures cool |
| **Controller shows error** | PV overvoltage, battery disconnect, or wiring fault | Check VictronConnect app for specific error code; verify all connections |
| **Battery not holding charge** | Battery age, parasitic loads exceed solar capacity, or incorrect charge profile | Test battery independently; check for unexpected loads; verify charge settings |
| **Water leak at roof cover gland** | Sealant failure or loose fitting | Re-seal with marine-grade silicone; Check MC4 connector gaskets, tighten gland MC4 connectors |

# Technical specifications

## Solar Kit Configurations

ChargeSys offers six ARMORCELL solar kit configurations. All kits include the same components (panel, charge controller, roof wire gland with 15 ft pre-installed wires, 10A inline MC4 fuse, 25A marine circuit breaker, and installation hardware). The SK270-ACV (270W) kit includes the higher-capacity Victron SmartSolar 100|30 charge controller.

| Specification | ARMORCELL 38<br>SK38-ACV | ARMORCELL 80<br>SK80-ACV | ARMORCELL 80Q<br>SK80Q-ACV | ARMORCELL 160<br>SK160-ACV | ARMORCELL 270<br>SK270-ACV |
|---|---|---|---|---|---|
| **Technology** | CIGS | CIGS | CIGS | CIGS | CIGS |
| **Pmax (STC)** | 38W | 80W | 80W | 160W | 270W |
| **Vmp** | 18.4V | 18.8V | 18.46V | 19.4V | 32.46V |
| **Imp** | 2.09A | 4.26A | 4.33A | 8.31A | 8.31A |
| **Voc** | 22.8V | 23.8V | 22.88V | 24.1V | 40.28V |
| **Isc** | 2.35A | 4.74A | 4.74A | 9.32A | 9.38A |
| **Vmax** | 1000VDC | 1000VDC | 1000VDC | 1000VDC | 1000VDC |
| **NOCT** | 113±35°F | 113±35°F | 113±35°F | 113±35°F | 113±35°F |
| **Temp Range** | -40~+185°F | -40~+185°F | -40~+185°F | -40~+185°F | -40~+185°F |
| **Fuse Rating** | 10A | 10A | 10A | 10A | 10A |
| **Tolerance** | ±5% | ±5% | ±5% | ±5% | ±5% |
| **Class** | Class A | Class A | Class A | Class A | Class A |
| **Weight** | 1.0 KG (2.2 lbs) | 1.8 KG (4.0 lbs) | 1.7 KG (3.7 lbs) | 2.7 KG (6.0 lbs) | 6 KG (13.2 lbs) |
| **Dimensions** | 869 x 348 mm<br>(34.2 x 13.7 in) | 1709 x 348 mm<br>(67.3 x 13.7 in) | 878 x 660 mm<br>(34.6 x 26.0 in) | 1710 x 665 mm<br>(67.3 x 26.2 in) | 2760 x 665 mm<br>(108.7 x 26.2 in) |
| **Connectors** | MC4 | MC4 | MC4 | MC4 | MC4 |
| **Mounting** | Self-Adhesive | Self-Adhesive | Self-Adhesive | Self-Adhesive | Self-Adhesive |

*All technical data at Standard Test Conditions (STC): Irradiance 1000W/m², Cell Temperature 77°F (25°C), Air Mass AM=1.5*

### Charge Controllers by Kit

| Specification | SmartSolar 75|15 (SK38, SK80, SK80Q, SK160) | SmartSolar 100|30 (SK270) |
|---|---|---|
| **Charge Algorithm** | MPPT | MPPT |
| **Max PV Input Voltage** | 75V | 100V |
| **Max Charge Current** | 15A | 30A |
| **Battery Voltage** | 12V / 24V (auto) | 12V / 24V (auto) |
| **Max PV Power (12V)** | 220W | 440W |
| **Bluetooth** | Built-in | Built-in |
| **Warranty** | 5 Years (Victron) | 5 Years (Victron) |

## Warranty & support

ChargeSys stands behind every kit we sell with a 5 year limited warranty. Our systems are engineered, tested, and proven in demanding real-world applications across emergency vehicles, RVs, and marine environments.

If you have questions about your installation, need help configuring the charge controller for your specific battery type, or experience any issues, contact us:

### ChargeSys Technical Support

Email: support@chargesys.solar
Web: www.chargesys.solar
(833)SOL-POWR  (833)765-7697

### Thank you for choosing ChargeSys

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