

Ohm Installation & Owner's Manual

The screenshot shows the Ohm web dashboard for a user named 'van Houten Home'. The dashboard includes a navigation sidebar on the left with icons for Summary, Cost Savings, Utility Renewable Balance, Carbon Savings, and Solar Benefit. The main content area is divided into four panels:

- Solar Benefit:** Features a gauge showing 'Solar Hot Water Available' (ranging from 0 to 100) and a pie chart showing 'Solar Fraction today' at 88% (with a 12% segment highlighted in red).
- Energy Graph:** A bar chart showing energy usage over time, with categories for E-Solar, E-Heater, E-Fuse, and E-Load.
- Cost Savings:** Displays a message: 'Saved \$792.21 on utility costs since installation' with a dropdown arrow and an image of coins.
- Temperature Graph:** A line graph showing various temperature metrics (Embathy, Tank_Top, HW_Out, HW_In, Aux) over a 24-hour period.

At the top right of the dashboard, it shows the location 'van Houten Home', address 'Carbondale', and forecast 'Partly Sunny' with a high of 55° and a low of 29°. A 'Log Out' button is also present.



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1. Introduction

Congratulations on the purchase of your Ohm Monitoring System by Sunnovations!

We believe the Ohm is the most easily installed solar thermal (solar hot water) monitoring system available, and can be installed by most homeowners that possess basic plumbing knowledge and tools. Furthermore, it can be installed in nearly any residential solar thermal system, whether as part of a new installation or a retrofit on your existing solar thermal system. This manual will guide you through the short hardware installation process and online dashboard setup, after which you can monitor your solar thermal system's performance from any online location.

The key to the Ohm's simplicity is the fact that it does **not** use a flow meter to monitor how a solar thermal system is running. Instead, it uses the unique in-tank Ohm sensor* to accurately monitor the heat entering and leaving the hot water tank itself (or themselves, if you have a 2-tank system). Thus, the Ohm not only captures your solar system performance, but it can also tell how often your backup heater turns on, your hot water use and even energy lost from the tank on account of cooling (known as "tank loss").

The Ohm sensor "plugs" into the Temperature and Pressure Relief Valve (the "T&P valve") port, a feature that nearly all hot water tanks have in common, via a threaded brass fitting. After installing the Ohm sensor, you will need to properly reinstall the T&P valve.



The Temperature and Pressure Relief Valve is a critical safety feature required by code; be sure to re-install it after putting in the Ohm sensor.

PLEASE READ THE ENTIRE INSTRUCTION MANUAL AND WATCH THE INSTALLATION VIDEO ON OUR WEBSITE PRIOR TO STARTING INSTALLATION! PLEASE ALSO REFER TO THE "FREQUENTLY ASKED QUESTIONS" AND "TROUBLESHOOTING" SECTION OF THIS MANUAL. THIS WILL ENSURE CORRECT INSTALLATION AND THAT YOUR OHM SYSTEM WORKS PROPERLY FROM THE START.

*Patent pending

2. Familiarize Yourself with the Ohm

Parts List

Upon opening the Ohm box, identify the following items:

Number	Item	Qty
1	“Emily” sensor controller	1
2	“Amber” wireless bridge	1
3	Ohm tank sensor	1
4	Digital temperature sensor	2
5	Power adapter for Emily	1
6	Power adapter for Amber	1
7	CAT5 Ethernet cable, 6 ft	1
8	Velcro straps	2
9	Teflon tape	1
10	Velcro backing	1

1



2



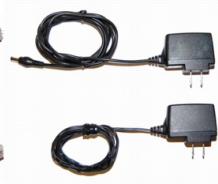
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4



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5 & 6

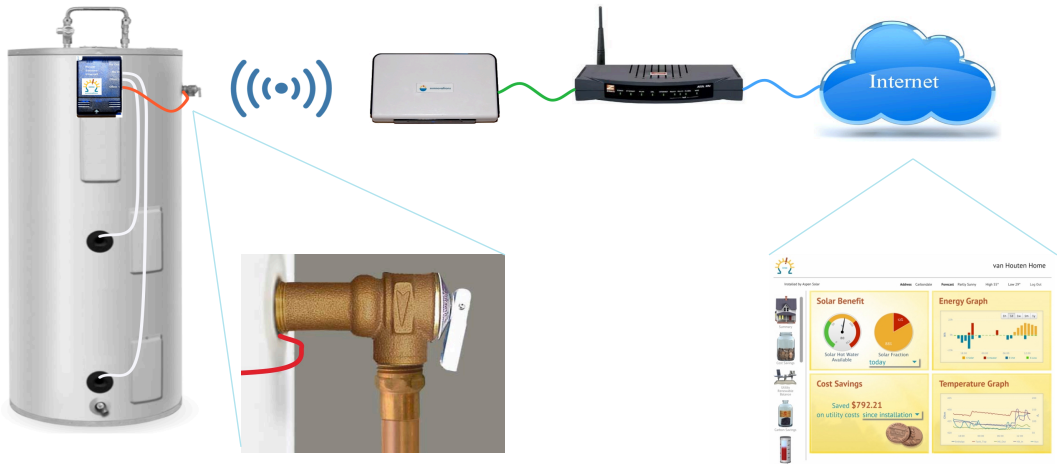
Overall System Configuration

The below diagram is an overall system view of the Ohm monitoring system. As shown, the Ohm tank sensor accesses the tank through the T&P valve port. The “Emily” sensor controller gathers data from the Ohm sensor and temperature sensors. Data are then passed wirelessly to the “Amber” wireless bridge, which is plugged into your home internet router via the supplied CAT5 Ethernet cable. From there, data are sent to the Ohm Dashboard where it can be viewed from the web.

The following chapters describe the installation procedure, which with proper preparation should takes less than 30 minutes. We highly recommend watching the installation video AND read this installation guide.



The installation video can be viewed via this link:
<http://vimeo.com/62665897>



3. Tools Needed



- Pipe wrench or pliers, large enough to remove Temperature and Pressure Relief (“T&P”) Valve
- Bucket for emptying tank water
- Short hose (e.g. washing machine hose; you can use a garden hose in a pinch)
- Wire brush and/or rag for cleaning tank ports
- Flat head screwdriver
- Ballpoint pen or similar thin, straight and rigid utensil



If your home does not have high speed internet (i.e. pretty much anything other than dial-up) with a router having a free LAN port, Ohm will not be able to connect to the Internet and provide usable information.

4. Amber Installation

1. Connect one end of supplied CAT5 Ethernet cable into **Amber** and the other into a free LAN port on your home router.
2. Plug in **Amber’s** power adapter.
LEDs should light up:
 - a. **Red** LED: Power OK
 - b. **Green** LED: Amber OK
 - c. **Blue** LED: Connectivity to Internet



It is important that the Amber is plugged in to your home internet router and a power source prior to installing the Emily. Amber provides a receiver for signals from the Emily, which expects Amber to already be online to pick its signals up.

5. Sensor Installation

Installation Preparation

1. Shut off the main home water supply.¹
2. As an added precaution, turn off the gas feed or switch off the electric breaker for tank depending on the kind of backup heating source it has.
3. Connect the hose to the drain port of the tank and feed it to a drain or into the bucket.
4. Open drain valve at bottom of tank, catching water in the bucket or down a drain. Opening the valve may require the screwdriver.
5. Flip up the lever on the T&P valve (which should be a clearly marked port on the side or at the top of the tank), letting air into tank; notice a “glugging” sound as water exits tank. Be mindful of the hot water coming out.
6. When “glugging” stops (which will be after few minutes and 3 to 8 gallons of water have drained), wait an additional minute to be sure the water level has dropped beneath the T&P valve, after which time close drain valve to stop the water draining from tank. The water level should now be just under the T&P valve port.
7. Remove hose from drain port.
8. With wrench, remove drain pipe connected to outlet of T&P valve.
9. With wrench, remove T&P valve.
10. Clean threads with brush or rag, both on the valve and in the tank.
11. Wrap the supplied Teflon tape clockwise around threads on T&P valve, preparing it for re-installation; 3 layers are enough.
12. Wrap Teflon tape clockwise around the male threads on the brass Ohm sensor fitting; 3 layers are enough.



IF YOU HAVE A 2-TANK SOLAR THERMAL SYSTEM, REPEAT THE ABOVE STEPS WITH YOUR SECONDARY TANK AND 2ND OHM SENSOR WHILE LEAVING THE WATER MAIN OFF.

¹ Just shutting the valve to the hot water tank is usually not enough; it can be hard to empty the tank without having done so as cold water finds its way back to the tank via shower/mixing faucets.

Ohm Sensor Installation



IMPORTANT: Float should be positioned inside brass fitting as shown, prior to insertion in tank. This prevents the sensor wire from twisting which can jeopardize the sensor's accuracy.



1. Feed flexible tube portion of Ohm sensor into tank, starting with weighted end; be careful not to cut sensor tube on the sharp threads of the brass fitting.
2. Thread in and hand-tighten the brass fitting of Ohm sensor until tight; do NOT use wrench for this step as too much force may damage the sensor.
3. Using a ballpoint pen or similar thin, straight and rigid utensil, push float into interior of tank and feed in the remaining sensor wire by hand until port is free from the folded sensor wire.
4. Thread T&P valve into back side of Ohm sensor.
5. Grasping the T&P valve with wrench, turn until fittings are tight; this will simultaneously tighten the Ohm sensor into the tank as well. Keep in mind the direction where you would like the T&P valve to end (typically down).
6. Reattach T&P valve drain pipe.
7. Open water main valve.
8. If turned off, turn back on the gas or electricity to the tank.

IF YOU HAVE A 2-TANK SOLAR THERMAL SYSTEM, REPEAT THE ABOVE STEPS WITH YOUR SECONDARY TANK AND 2ND OHM SENSOR PRIOR TO STEP #7 (OPENING WATER MAIN).



The Temperature and Pressure Relief Valve is a critical safety feature required by code; be sure to re-install it after putting in the Ohm sensor.

6. Emily Installation

1. Remove the adhesive backing and affix **Emily** to tank. When positioning Emily, keep in mind that the Ohm sensor cord must reach and must plug in to it, and its power cord must reach an outlet (if not, you will need an extension cord).
2. Plug the Ohm sensor wire into **Emily's** port #1.
3. Using supplied Velcro straps, attach temperature sensors to the heat exchanger pipe inlet (the upper port) and heat exchanger pipe outlet (the lower port). There must be good thermal contact between sensor and pipe, and insulation must cover the sensor after it is installed.
4. Plug in the digital temperature sensors to labeled ports on **Emily**.
5. Plug in **Emily's** power adapter. LEDs should light up:
 - a. **Red** LED: Power OK
 - b. **Green** LED: Sensors OK
 - c. **Blue** LED: Connectivity to Internet



IF YOU HAVE A 2-TANK SOLAR THERMAL SYSTEM, REPEAT STEP 4 WITH 2ND OHM SENSOR IN YOUR SECONDARY TANK IN **EMILY** PORT #2.

Sensor Errors

# of Green Led Blinks	Sensor Status
1	Ohm Sensor Failure
2	HX-in Sensor Failure
3	HX-out Sensor Failure

7. Online Dashboard Setup

Go to <http://www.sunninnovations.com/ohm/setup> and use the 6 digit code on the back of the included manual or on the Amber unit and complete the set up wizard. After completion click “save” and you will see the Dashboard.

Setup Wizard

Serial Number: DWN#

Next

Installer: Please Select

Installation Type: Commercial Pool Residential Other

Date of commissioning: equipment placed in service: 04/09/2013

Total installed cost without rebate: \$ 9500

Total rebates: \$ 3500

Net total installed cost: \$ 6000

Next

Collector Manufacturer: AET

Collector Model: A32

Tank Volume: 75

Pump Manufacturer: Sunwin

Cost per kWh: \$ 0.1044 Cents per kWh

Cost per Therm: \$ 0.0958 Cents per CCF

Carbon Factor of the Utility: 0.3546 lb per kWh

Next

Energy Dashboard Title: Green Home

Ownership Type: 3rd party owner

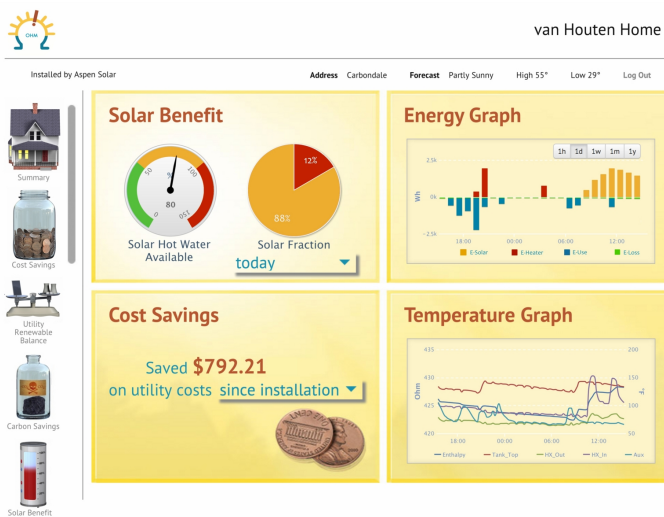
Median household or business income: Please Select

Year of Building Construction: 1980

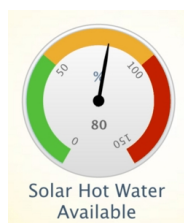
Display Temperatures In: Fahrenheit Centigrade

Save

8. The Ohm Dashboard



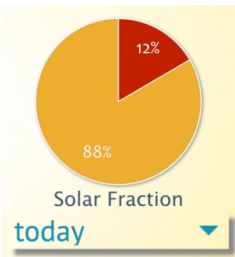
Solar Benefits



The **Solar Hot Water Available** gauge gives an indication if and how much solar heated water is available in the tank. This can help optimize your hot water usage: if there is a lot of “free” solar heated water, it is best to use it before it is lost due to tank losses. Alternatively – if there is no solar hot water available, it is best to use as little as hot water to prevent the external heater from kicking in and using electricity or gas (and money).

The gauge starts showing green if a little bit of solar heated water is produced. The 100% mark roughly indicates that the bottom of the tank (i.e. the solar heated section of the tank) has reached a usable temperature – so no back-up heating is needed to post-heat it to shower-ready temperatures.

The red section of the gauge will show if the tank is heated to even higher temperatures (up to 185°F) above the typical set-point of the tank-thermostat. This means a lot of hot water is available and the back-up heater should not kick in at all to post-heat the hot water. The anti-scalding mixing valve (mandatory for every solar thermal system) will mix the output temperature to avoid scalding hot water at the faucet. The gauge will drop when hot water is used – so it can help inform hot water consumption.

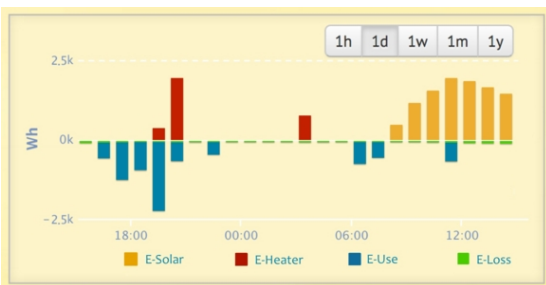


The **Solar Fraction** gauge provides insight into the ratio of solar heated water versus hot water consumption. [Solar Fraction](#) is a computer modeled measure of system thermal performance used by the Solar Rating and Certification Corporation to rate solar thermal systems. The Ohm system is the first to measure in real time all of the parameters to needed calculate the Solar Fraction. The formula used is: $\text{Solar Fraction} = \text{Solar Energy} / (\text{Energy of hot water usage} + \text{Energy of tank loss})$.

If the solar energy (for the selected period) exceeds the energy usage, it will show 100% (all orange).

Typically at the end of a sunny day the Solar Fraction will be high, and when hot water is used the Solar Fraction will drop again. Notice that the energy used by the back-up heater has no impact on the solar fraction. This could be considered illogical, but the SRCC standardized formula is followed here.

Energy Graph



The Ohm **Energy Graph** offers a new and unique insight in your hot water energy usage. It shows the energy production of:

- Your solar hot water system (orange bars)
- Back up heating system (red bars)

and also the energy consumed by:

- Hot water usage (blue bars)
- Tank losses (green bars)

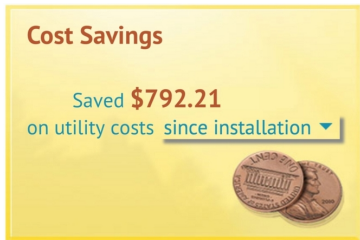
The energy is represented in watt-hours (Wh) as this is the energy unit that is most familiar. 1000 Wh equals 1 kWh; if a 100 watt light bulb is on for 10 hours, it consumed 1 kWh. Other commonly used energy units are Joule: $1\text{kWh} = 3600000\text{ J} = 3600\text{ kJ} = 3.6\text{ MJ}$; or BTU (British Thermal Unit): $1\text{kWh} = 3412\text{ BTU}$.

The default view is the day view, which shows the last 24 hours as 1 hour columns. Views can be changed to 1 hour view (twenty 5 minute columns), week view, month view and year view.

You can also hover the mouse pointer above a column to see energy details for that column. Energy sources can be turned on and off by clicking on the legend under the graph. This can be useful to examine the any of the energy components in more detail.

The scale of the graph has an auto-scaling feature to always provide an optimal view. For a close up view, the graph can be clicked to zoom in to full screen view. Clicking the X in the top right corner will close the zoomed screen. The total energy for each energy source for the selected view is displayed in the legend between parentheses.

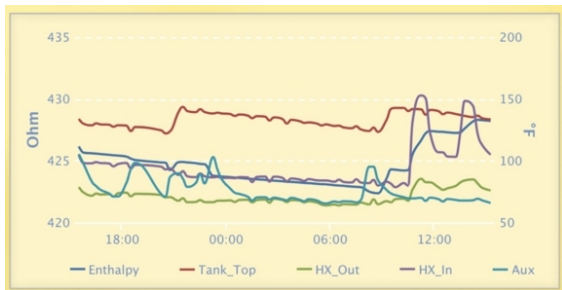
Cost Savings



The **Cost Savings** widget shows the savings in dollars from your solar hot water system. It is calculated as follows:
 Energy produced by the solar hot water system (in kWh) for the selected time period multiplied by the kWh price or equivalent gas price per kWh as set up in during system setup.
 The default time period is “since installation,” but can be modified using the pull down menu.

The Cost Savings widget provides a direct indication of your return on investment on your solar hot water system.

Temperature Graph



The **Temperature Graph** shows:

- Solar feed into the heat exchanger (“Hx In”)
- Solar return from the heat exchanger (“Hx Out”)
- Top tank temperature integrated with the Ohm enthalpy sensor (“Tank Top”)
- Output from Ohm Enthalpy sensor(s), measured in ohms (“Enthalpy”) – see Y-axis on the left side.
- Optional: an additional temperature sensor.

The time period of the temperature graph will change if the time-period selection buttons are clicked in the Energy Graph. The default unit for temperature is in Fahrenheit (°F), but can be changed to Celsius (°C) via the “Edit settings” menu in the Passport widget.

If the mouse pointer is hovered over the line graphs a text bubble shows numerical details. Hovering over the legend highlights the individual graphs. A click on the legend items can turn individual graph items on and off for clarity. A click on the graph will zoom the graph to full screen. Clicking the X in the top right corner will close the zoomed screen.

9. FAQ, Troubleshooting and Support



Please refer to www.sunnovations.com/ohm/support for the most up to date frequently asked questions (FAQ) and and support information.

FAQ - General

1. Why the name Ohm?

It is a reference to how our proprietary sensor works: it measures the resistance to a small current running through the sensor, and that measurement is translated into the energy readings you see on the Dashboard. The unit of measure for electrical resistance is Ohm!

2. Is my solar hot water system a fit for Ohm?

Ohm is designed to work with most solar domestic water heating system types, either as part of a new installation or a retrofit on your existing solar thermal system. Basic system requirements are:

- ✓ *Functioning domestic solar water heating system (not for use in monitoring solar pool heating or PV).*
- ✓ *Indoor solar storage tank ([here is an example](#)) of 60-120 gallons in capacity.*
- ✓ *High speed internet with home router (cable, wi-fi or otherwise).*

3. How does Ohm work?

Caution... techno-geek alert! The Ohm sensor calculates the enthalpy in a thermal mass – in this case your water heater – by measuring resistance to a small current running through it. Ohm's software is able to distinguish between different types of energy going into and out of the thermal mass, which are presented as the energy readings you see on the Dashboard. The components communicate with one another via the 6lowpan wireless protocol, enabling the zero-configuration attribute of Ohm.

4. Will Ohm work on pool heating systems?

No. It is designed to work in solar domestic water heating systems only.

5. Will Ohm affect my internet access?

No, although accessing the Dashboard will use up some of your bandwidth like any other application. Ohm uses a different wavelength than any wireless router you may have and so won't interfere with its operation.

6. Is it OK to have the Ohm sensor in contact with my potable hot water?

Yes. The components that are in contact with potable hot water are NSF compliant.

FAQ - Installation

1. I have a 2 tank solar hot water system design (one solar storage, the other backup heating); will Ohm work?

Yes! You should have ordered a second Ohm sensor with your kit when purchasing Ohm; if not, contact us and we'll get you one. Just follow the installation directions to install it.

2. I have an unusual tank design; will Ohm work?

Please contact us if is not readily apparent where and how to install your Ohm on your solar tank. Ohm is not designed to work on "low-boy" solar tanks or thermosiphon systems.

3. Will the sensor affect the operation of my hot water tank?

No, it will not. The Ohm sensor is designed to be installed in a tank's Temperature and Pressure Relief valve port, which is an important safety feature found in nearly every water heater. Properly installed, the sensor will not interfere with the operation of the T&P valve.


4. Where is the T&P Valve?

It can typically be found labeled prominently on the side or top of your tank.

Troubleshooting

1. The T&P valve is dripping after installation.

- a. While opening up the valve during installation, you may have introduced some debris into the valve's seal. Tanks that have calcification due to hard water (seen as a white build-up inside the tank and T&P valve) are especially susceptible to this. Try opening up the valve slightly by pulling the small metal lever- this will let water run through the valve and help clean out the seal. Do this several times to be sure it is clean. Make sure you have a bucket to catch the water, and be careful - the water let out can be very hot.
- b. T&P valves have a limited lifetime in any water tank, and a leaky valve is a common plumbing problem. If it continues to drip, it is possible that your valve has gone bad and it is time to replace it. They can be found at any hardware store and are relatively inexpensive. Make sure to replace with the same temperature and pressure ratings – typically 210°F and 150 psi.

- 
2. I am trying to remove my T&P valve, but it seems stuck.
 - a. All T&P valves must be removable for replacement in case of a valve failure. Be sure you are turning it in the correct direction - counter clockwise. A pipe wrench is the easiest tool to use when removing or installing a T&P valve.

 3. I see a drip coming from one of the threaded connections on the Ohm fitting.
 - a. To make a water tight connection, make sure you have at least 3 wraps of Teflon tape on each of the male threaded connections (one on Ohm, one on the T&P valve), and it should be tightened very snug with a pipe wrench or large pliers.
 - b. One common problem is wrapping the Teflon tape in the wrong direction, which causes it to unravel as the fitting is screwed in. Watch the installation video to verify you are wrapping the Teflon in the correct direction.

 4. A temperature sensor reads 32 degrees F.
 - a. This is the default temperature reading if the temperature sensors are not connected. Check to make sure the temperature sensors are securely connected in the correct port.

 5. My heat exchanger temperature sensors seem swapped.
 - a. Make sure your temperature sensors are measuring the correct locations. The “HX In” sensor should be affixed to the heat exchange inlet pipe, which is typically the top heat exchanger port. The “HX Out” sensor should be on the heat exchanger outlet, usually the bottom heat exchanger port. You can verify which is the heat exchanger inlet and outlet by feeling the pipes when the solar system is working - the inlet port will be hot, the outlet port cold.

 6. My temperature sensors don't seem to be reading accurately.
 - a. Making a good thermal connection between the sensor probe and the pipe is critical. Use the Velcro strap to get a tight and secure connection. Insulate around the outside of the probe - failure to do so will render temperature readings inaccurate.



7. LED Section

a. **Amber:**

- Red; ON indicates Amber has power
- White: On if Amber has connection via the VPN (a secure connection)
- Blue: ON indicates Amber has internet connectivity
- Orange: indicates SD card disk write
- Green: Indicates “heartbeat” of the Amber – i.e. if it is operational.

b. **Emily:**

c. Yellow:

Solid yellow indicates Ohm sensor(s) working properly

One blink: Ohm sensor #1 is malfunctioning or not connected

Two blinks: Ohm sensor #2 is malfunctioning or not connected

d. Red: ON indicates Emily has power

e. Green:

Solid green indicates all temperature sensors are functioning

One blink: top tank sensor #1 (integrated Ohm sensor #1) is malfunctioning or not connected.

Two blinks: HX out sensor is malfunctioning or not connected

Three blinks: HX in sensor is malfunctioning or not connected

Four blinks: top tank sensor #2 (integrated Ohm sensor #2) is malfunctioning or not connected.

f. Blue: ON indicates Emily is connected to Amber

8. Removal Procedure of Ohm Sensor.

- a. In case the Ohm sensor needs to be removed, it is best to use a combination of two wrenches or pliers. One wrench is placed on the HEX section protruding on the Ohm sensor fitting and the other wrench is placed on the T&P valve. Turn both at the same time in counter clockwise direction. If the T&P valve is taken out only – it is hard to loosen the Ohm sensor fitting and the fitting can get easily damaged or oveled.

10. Ohm Limited Warranty

Purchaser agrees and acknowledges that the Sunnovations Ohm Solar Hot Monitoring System (hereinafter referred to as “Product”) is subject in all respects to the warranties and limitations set forth herein.

Limited Warranty.

a. **Limited Warranty.** Sunnovations Inc. (“Sunnovations”) warrants only to Purchaser that for two (2) years from the date of delivery of the Product to Purchaser, the Product shall be substantially free of defects of materials and workmanship.

b. **Exclusions.** Notwithstanding the foregoing, this limited warranty shall not apply to: (a) any Product that has been customized, altered or repaired by any person or entity other than personnel of Sunnovations and/or any distributor of the Product licensed by Sunnovations (“Seller”); (b) any Product that has been subjected to abuse, misuse, damage, neglect, or accident beyond Sunnovations’ published limitations for the Product (including, without limitation, environmental conditions and power requirements); (c) any use or operation of the Product other than in accordance with Sunnovations’ then-current published specifications and instructions for the Product; or (d) any non-conformities or defects notified by Purchaser to Seller after the expiration of the applicable warranty period for such Product.

c. **Warranty Disclaimers.** THIS LIMITED WARRANTY IS IN LIEU OF ANY OTHER WARRANTY, WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL (INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT) WITH RESPECT TO THE PRODUCT, THE MANUFACTURE, SALE, SUPPLYING OR FAILURE OR DELAY IN SUPPLYING OF THE PRODUCT OR THE USE, RESULTS OR DISPOSITION OF THE PRODUCT. YOU EXPRESSLY ACKNOWLEDGE AND AGREE THAT THE PRODUCT PROVIDES NO GUARANTEE, IMPLIED OR OTHERWISE, OF THE PERFORMANCE OF OR WARRANTY COVERING YOUR SOLAR THERMAL SYSTEM, AND SUNNOVATIONS AND ITS LICENSORS ARE IN NO WAY RESPONSIBLE FOR ITS OPERATION OR PERFORMANCE.

d. **Remedies.** Purchaser’s sole and exclusive remedy and Sunnovations’ and/or Seller’s (and their suppliers’ and licensors’) sole and exclusive liability for a breach of this limited warranty shall be, at Sunnovations’ and/or Seller’s sole discretion, commercially reasonable efforts to repair or replace the non-conforming Product or a refund of the purchase price for that Product.

Limitation of Liability.

a. **No Indirect Damages.** IN NO EVENT SHALL SUNNOVATIONS AND/OR SELLER (OR ANY OF THEIR SUPPLIERS OR LICENSORS) BE LIABLE TO PURCHASER OR ANY THIRD PARTY FOR SPECIAL, INCIDENTAL, CONSEQUENTIAL, EXEMPLARY, PUNITIVE, MULTIPLE OR OTHER INDIRECT DAMAGES, OR FOR LOSS OF PROFITS, LOSS OF DATA OR LOSS OF USE DAMAGES, ARISING OUT OF THE PRODUCT, MANUFACTURE, SALE, SUPPLYING OR FAILURE OR DELAY IN SUPPLYING OF THE PRODUCT, SERVICES RELATED THERETO OR THE USE, RESULTS OR DISPOSITION OF THE PRODUCT, WHETHER BASED UPON WARRANTY, CONTRACT, TORT, STRICT LIABILITY OR OTHERWISE, EVEN IF SUNNOVATIONS AND/OR SELLER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES OR LOSSES.

b. Limited Direct Damages. SUNNOVATIONS AND/OR SELLER'S (AND THEIR SUPPLIERS' AND LICENSORS') LIABILITY ARISING OUT OF PRODUCT, THE MANUFACTURE, SALE, SUPPLYING OR FAILURE OR DELAY IN SUPPLYING OF THE PRODUCT, SERVICES RELATED THERETO OR THE USE, RESULTS OR DISPOSITION OF THE PRODUCT, WHETHER BASED UPON WARRANTY, CONTRACT, TORT, STRICT LIABILITY OR OTHERWISE, SHALL NOT EXCEED THE APPLICABLE PURCHASE PRICE PAID BY PURCHASER FOR THE APPLICABLE PRODUCT.

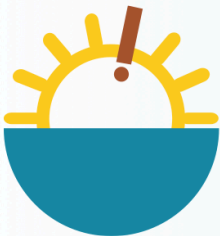
c. Legal Limits. The limitations on liability set forth herein may be restricted by applicable law and may not apply to Purchaser.

Intellectual Property. No sale of any Product, and nothing in this warranty, shall be construed as granting to Purchaser any license or other proprietary or intellectual property right applicable to the Product. Purchaser may not alter or remove, and shall abide by, any patent, trademark, copyright, trade secret, proprietary or other notices contained on or in the Product. Purchaser shall not (a) modify, copy, enhance, make derivative works of the Product, (b) disassemble or otherwise reverse engineer the Product nor (c) remove or obscure any copyright, patent, trademark, trade secret, restricted or limited rights, export restriction or similar notice affixed to any Product.

Sunnovations. Purchaser expressly agrees and acknowledges that this Agreement inures to the benefit of Sunnovations Inc. and its affiliates, and that Sunnovations Inc. or its affiliates may directly enforce the terms of this Agreement.

Miscellaneous. This Limited Warranty shall be governed by and construed in accordance with the laws of the Commonwealth of Virginia, without regard to its conflict of law provisions. Purchaser shall not assign this Limited Warranty without Sunnovations' and/or Seller's prior written consent. If any provision of this Limited Warranty shall be held illegal, unenforceable, or in conflict with any law of any authority having jurisdiction over this Limited Warranty, the validity of the remaining portions or provisions hereof shall remain in full force and affect. Sunnovations and/or Seller shall not be liable for failure to perform any of its obligations hereunder by reasons that are beyond its reasonable control, including, without limitation, fire, flood, earthquake, interruptions in supply, other natural disaster, war, embargo, riot or acts of terrorism.

11. Contact Information



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