

# Solar Power

Model 8145-SO, 8145-CS,  
8145-CSEU



Operation and Maintenance Manual

P/N 6016614 Rev. A  
June 2022



# Start Seeing the Benefits of Registering Today!

Thank you for your TSI® instrument purchase. Occasionally, TSI® releases information on software updates, product enhancements and new products. By registering your instrument, TSI® will be able to send this important information to you.

<http://register.tsi.com>

As part of the registration process, you will be asked for your comments on TSI products and services. TSI's customer feedback program gives customers like you a way to tell us how we are doing.

**Copyright©**

TSI Incorporated / 2022 / All rights reserved.

**Part Number**

6016614 / Revision A / June 2022

**Address**

TSI Incorporated / 500 Cardigan Road / Shoreview, MN 55126 / USA

**Fax No.**

(651) 490-3824

**LIMITATION OF WARRANTY AND LIABILITY** (effective May 2022)

(For country-specific terms and conditions outside of the USA, please visit [www.tsi.com](http://www.tsi.com).)

Seller warrants the goods, excluding software, sold hereunder, under normal use and service as described in the operator's manual, to be free from defects in workmanship and material for **12 months**, or if less, the length of time specified in the operator's manual, from the date of shipment to the customer. This warranty period is inclusive of any statutory warranty. This limited warranty is subject to the following exclusions and exceptions:

- a. Parts repaired or replaced as a result of repair services are warranted to be free from defects in workmanship and material, under normal use, for 90 days from the date of shipment;
- b. Seller does not provide any warranty on finished goods manufactured by others or on any fuses, batteries or other consumable materials. Only the original manufacturer's warranty applies;
- c. This warranty does not cover calibration requirements, and seller warrants only that the instrument or product is properly calibrated at the time of its manufacture. Instruments returned for calibration are not covered by this warranty;
- d. This warranty is **VOID** if the instrument is opened by anyone other than a factory authorized service center with the one exception where requirements set forth in the manual allow an operator to replace consumables or perform recommended cleaning;
- e. This warranty is **VOID** if the product has been misused, neglected, subjected to accidental or intentional damage, or is not properly installed, maintained, or cleaned according to the requirements of the manual. Unless specifically authorized in a separate writing by Seller, Seller makes no warranty with respect to, and shall have no liability in connection with, goods which are incorporated into other products or equipment, or which are modified by any person other than Seller.

The foregoing is **IN LIEU OF** all other warranties and is subject to the **LIMITATIONS** stated herein. **NO OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS FOR PARTICULAR PURPOSE OR MERCHANTABILITY IS MADE. WITH RESPECT TO SELLER'S BREACH OF THE IMPLIED WARRANTY AGAINST INFRINGEMENT, SAID WARRANTY IS LIMITED TO CLAIMS OF DIRECT INFRINGEMENT AND EXCLUDES CLAIMS OF CONTRIBUTORY OR INDUCED INFRINGEMENTS. BUYER'S EXCLUSIVE REMEDY SHALL BE THE RETURN OF THE PURCHASE PRICE DISCOUNTED FOR REASONABLE WEAR AND TEAR OR AT SELLER'S OPTION REPLACEMENT OF THE GOODS WITH NON-INFRINGEMENTS.**

TO THE EXTENT PERMITTED BY LAW, THE EXCLUSIVE REMEDY OF THE USER OR BUYER, AND THE LIMIT OF SELLER'S LIABILITY FOR ANY AND ALL LOSSES, INJURIES, OR DAMAGES CONCERNING THE GOODS (INCLUDING CLAIMS BASED ON CONTRACT, NEGLIGENCE, TORT, STRICT LIABILITY OR OTHERWISE) SHALL BE THE RETURN OF GOODS TO SELLER AND THE REFUND OF THE PURCHASE PRICE, OR, AT THE OPTION OF SELLER, THE REPAIR OR REPLACEMENT OF THE GOODS. IN THE CASE OF SOFTWARE, SELLER WILL

REPAIR OR REPLACE DEFECTIVE SOFTWARE OR IF UNABLE TO DO SO, WILL REFUND THE PURCHASE PRICE OF THE SOFTWARE. **IN NO EVENT SHALL SELLER BE LIABLE FOR LOST PROFITS, BUSINESS INTERRUPTION, OR ANY SPECIAL, INDIRECT, CONSEQUENTIAL OR INCIDENTAL DAMAGES.** SELLER SHALL NOT BE RESPONSIBLE FOR INSTALLATION, DISMANTLING OR REINSTALLATION COSTS OR CHARGES. No Action, regardless of form, may be brought against Seller more than 12 months after a cause of action has accrued. The goods returned under warranty to Seller's factory shall be at Buyer's risk of loss, and will be returned, if at all, at Seller's risk of loss.

Buyer and all users are deemed to have accepted this LIMITATION OF WARRANTY AND LIABILITY, which contains the complete and exclusive limited warranty of Seller. This LIMITATION OF WARRANTY AND LIABILITY may not be amended, modified or its terms waived, except by writing signed by an Officer of Seller.

Buyer further agrees that purchase of TSI's cellular modem accessories Buyer agrees to the Terms and Conditions of Use and the Privacy Policy located at [www.tsilink.com](http://www.tsilink.com).

### **Service Policy**

Knowing that inoperative or defective instruments are as detrimental to TSI as they are to our customers, our service policy is designed to give prompt attention to any problems. If any malfunction is discovered, please contact your nearest sales office or representative, or call TSI's Customer Service department at (800) 680-1220 (USA) or (001 651) 490-2860 (International) or visit [www.tsi.com](http://www.tsi.com).

### **Trademarks**

TSI and TSI logo are registered trademarks of TSI Incorporated in the United States and may be protected under other country's trademark registrations. BlueSky, TSI Link, and DustTrak are trademarks of TSI Incorporated. Wi-Fi is a registered trademark of the Wi-Fi Alliance.

### **Cloud Software End User Licensing Agreement and Privacy Policy**

Go to [tsilink.com/terms-of-use](http://tsilink.com/terms-of-use) and click on **TERMS OF USE & PRIVACY POLICY** link.

# Contents

---

<b>Contents</b> .....	<b>i</b>
<b>Figures</b> .....	<b>ii</b>
<b>Safety Information</b> .....	<b>iii</b>
Description of Caution/Warning Symbols .....	iii
Caution .....	iii
Warning .....	iii
Caution and Warning Symbols .....	iii
Labels .....	v
Reusing and Recycling .....	v
<b>Chapter 1 Product Overview</b> .....	<b>1</b>
Unpacking .....	1
Replacement Parts .....	2
<b>Chapter 2 Setting Up</b> .....	<b>3</b>
Solar Power System Assembly.....	3
Mount the Solar Panel .....	3
Mount the Enclosure.....	5
Electrical Connections .....	5
Cellular Modem Setup (if equipped) .....	8
Installing the SIM Card .....	8
Determining Cellular Modem Status .....	10
<b>Chapter 3 Troubleshooting</b> .....	<b>13</b>
<b>Appendix A Specifications*</b> .....	<b>15</b>

# Figures

---

1: Solar panel bracket .....	3
2: Solar panel bracket angle adjustment (solar panel not shown) .....	4
3: Mounted enclosure .....	5
4: Battery connection .....	5
5: Solar panel connection .....	6
6: All connections .....	6
7: Solar power controller .....	7
8: Micro USB port .....	7
9: Solar controller and cellular modem .....	8
10: Installation of SIM card .....	9
11: SIM card sizes .....	9
12: Power LED .....	10
13: Connection status LEDs .....	10
14: Signal strength LEDs .....	11

# Safety Information

## Description of Caution/Warning Symbols

Appropriate caution/warning statements are used throughout the manual and on the instrument that requires you to take cautionary measures when working with the instrument.

### Caution



#### CAUTION

Failure to follow the procedures prescribed in this manual might result in irreparable equipment damage. Important information about the operation and maintenance of this instrument is included in this manual.

### Warning



#### WARNING

Warning means that unsafe use of the instrument could result in serious injury to you or cause damage to the instrument. Follow the procedures prescribed.

## Caution and Warning Symbols

The following symbols may accompany cautions and warnings to indicate the nature and consequences of hazards:

	Warns that the instrument contains a laser and that important information about its safe operation and maintenance is included in the manual.
	Warns that the instrument is susceptible to electrostatic discharge (ESD) and ESD protection should be followed to avoid damage.
	Indicates the connector is connected to earth ground and cabinet ground.



## WARNINGS

- Use of components other than those specified by TSI® Incorporated (TSI®) may impair the safety features provided by the equipment.
- The instrument has been design to be used with batteries supplied by TSI®. **DO NOT** use a substitute.
- Old batteries must be properly recycled in accordance with the local environmental regulations.
- **DO NOT** use non-rechargeable batteries in this instrument. Fire, explosions, or other hazards may result.
- If the solar power kit is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- When using outdoors, the power adapters should be connected to a weatherproof “in use” rated outdoor receptacle enclosure.



## CAUTION

The solar power enclosure is designed to be resistant to rain or water spray. It is not designed to be waterproof when immersed. Setting it in a pool of water will result in flooding the inner compartment with water. This will severely damage the battery pack. **DO NOT** set the Battery Enclosure in **water!**



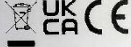
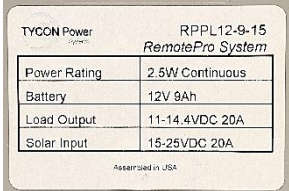
## NOTICE

Installation videos can be found on our website [www.tsi.com](http://www.tsi.com).



# Labels


Advisory labels and identification labels are attached to the instrument.

1. Serial Number Label (Inside)	 <p>Solar System/Système Solaire PN: 8145 – S0 SN: 8145ACC2220013</p>  <p>TSI Incorporated www.tsi.com</p> 								
2. Specifications Label	 <p>TYCON Power RPPL12-9-15 <i>RemotePro System</i></p> <table border="1"><tr><td>Power Rating</td><td>2.5W Continuous</td></tr><tr><td>Battery</td><td>12V 9Ah</td></tr><tr><td>Load Output</td><td>11-14.4VDC 20A</td></tr><tr><td>Solar Input</td><td>15-25VDC 20A</td></tr></table> <p>Assembled in USA</p>	Power Rating	2.5W Continuous	Battery	12V 9Ah	Load Output	11-14.4VDC 20A	Solar Input	15-25VDC 20A
Power Rating	2.5W Continuous								
Battery	12V 9Ah								
Load Output	11-14.4VDC 20A								
Solar Input	15-25VDC 20A								

## Reusing and Recycling



As part of TSI® Incorporated’s effort to have a minimal negative impact on the communities in which its products are manufactured and used:

-  If instrument becomes obsolete, return to TSI® for disassembly and recycling.

*(This page intentionally left blank)*

# Chapter 1

## Product Overview


TSI® Incorporated's 12 VDC power solar systems are designed for use with the BlueSky™ Air Quality Monitor which enables real-time outdoor air quality monitoring in remote locations.

### NOTICE

Customer must purchase a SIM card from a cellular provider to use with Models 8145-CS and 8145-CSEU.

## Unpacking

Compare all the components you received with those listed in the table below.

Item	Part Number	Description
	8145-SO	Solar system, includes 1 12 VDC (8.5) A-Hr battery, 1 charge controller, 1 panel, 1 outdoor enclosure and mounting hardware
	8145-CS	Solar system + cellular modem – NA version, includes solar system plus FCC certified cellular modem
	8145-CSEU	Solar system + cellular modem – EU version, includes solar system plus CE certified cellular modem

## Replacement Parts

Item	Part Number	Description
	8145-BATT	12 VDC (8.5) A-Hr battery
	8145-PL1	15 watt solar panel
	8145-BK	Solar panel bracket
	8145-CONT	Solar power controller
	8145-CK	Cables
	8145-HC	Hose clamps
	8145-LOCK	Padlock

## Chapter 2

### Setting Up

---

#### Solar Power System Assembly

TSI® solar power systems are delivered partially assembled. Start by unpacking the device and its contents from the shipping package.



#### WARNING

The solar panel, solar panel bracket and hose clamps may have sharp corners and edges. Handle with care.

#### Suggested tools:

- (2) 1/2" (13 mm) wrenches
- 5/16" (8 mm) socket, wrench or nut driver
- Flat blade screwdriver

#### Mount the Solar Panel

1. Select the hose clamps appropriate for the pole size to which the solar panel will be mounted. Two sets of different size hose clamps are provided for use with the solar panel bracket.
2. Open the hose clamps and feed the open ends through the slots in the solar panel bracket.



Figure 1: Solar panel bracket

- Place the solar panel at the desired location on the pole and tighten the hose clamps using the 5/16" (8 mm) socket or nut driver (or use a flat blade screwdriver). If necessary, use the 1/2" (13 mm) wrenches to loosen the bolts shown in Figure 2 to adjust the angle of the solar panel based on your location's latitude.

### NOTICES

- In the northern hemisphere, the solar panel should be facing south. The bracket comes preset to 45 degrees. For maximum efficiency, set the angle to (your latitude) \* 0.9 + 30. There are also angle calculators on the internet that can help you with the best angle for your location.
- Mounting the BlueSky™ monitor so it is shaded by the solar panel will reduce the effect of the sun on temperature measurements (see images in the table above for reference).



**Figure 2:** Solar panel bracket angle adjustment (solar panel not shown)

## Mount the Enclosure

1. Using the included hose clamps, mount the enclosure on the pole with the cable entry grommets facing down.
2. Securely tighten the hose clamps.



**Figure 3:** Mounted enclosure

### NOTICE

The solar panel and enclosure can also be mounted on a wall or post using screws.

## Electrical Connections

1. Inside the enclosure, remove and discard the packing material. Remove the white protective cap from the positive battery terminal and attach the red wire to the red terminal.



**Figure 4:** Battery connection

2. Take the end of the cable from the solar panel and feed it through the far-left grommet into the enclosure. Connect it to its mating connector from the charge controller and twist the knurled nut (circled below) until it clicks.




**Figure 5:** Solar panel connection

3. Feed the USB cable through the far-left grommet into the enclosure and connect it to the power controller as shown above.



**Figure 6:** All connections



4. Press the  button on the solar controller to turn on the power to the BlueSky™ monitor and cellular modem (if equipped). See [Chapter 5](#) for troubleshooting power issues.



**Figure 7:** Solar power controller

5. Make sure the lid gasket is clean and free from any debris. Then carefully close the cover, making sure that wires are clear of the seam and hinge area. The cover snaps into place. There is one center security bolt that can be used to secure the cover. The included padlock can also be used to lock the enclosure.
6. Connect the USB cable that is connected to the solar power controller to the micro USB port on the bottom of the BlueSky™ monitor.



**Figure 8:** Micro USB port

## Cellular Modem Setup (if equipped)



Figure 9: Solar controller and cellular modem

### Installing the SIM Card

1. Remove the cellular modem from the solar power enclosure by grasping the modem and pulling it straight off. The cellular modem is secured with hook-and-loop (Velcro®) strips.
2. Detach the power cable from the cellular modem by depressing the tab on the power cable connector.
3. Access the SIM card tray by using the SIM needle tool **1** provided with the system. Push the needle tool into the access hole next to the SIM card port and push until SIM card tray comes out **2**.
4. Place the SIM card in the SIM card tray **3** with an included adapter if needed and insert the tray into the cellular modem **4**. Note the orientation and the angled corner of the SIM card in the SIM card tray.

---

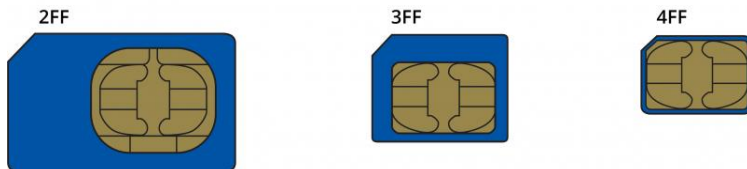
®Velcro is a registered trademark of Velcro IP Holdings.



**Figure 10:** Installation of SIM card

## NOTICE

The cellular modem is compatible with mini-SIM (2FF) size cards. But since different types of SIM cards have the same contact arrangement, smaller SIM cards can also be used with the router, provided they are inserted into a 2FF SIM card adapter (included). A size perspective of the most popular SIM card types can be seen in the figure below:



**Figure 11:** SIM card sizes

5. Place the cellular modem back into the solar enclosure by aligning the hook-and-loop strips in the enclosure and the back of the cellular modem. Then apply pressure to the cellular modem to ensure it is secure.
6. Connect the power cable back into the cellular modem.

## Determining Cellular Modem Status

### Power LED:

The power LED is located on the bottom left corner of the front panel, just under the power connector:



Figure 12: Power LED

Action	Description
LED turned ON	Router is powered up
LED turned OFF	Router is not powered up

### Connection Status LEDs:

The connection status LEDs are located between the power connector and the signal strength indication LEDs:



Figure 13: Connection status LEDs

The LED displays the router's current connection state and network type among a few other things:

Action	Description
2G, 3G and 4G LEDs blinking every 1 second	No SIM or bad PIN
Blinking from 2G LED to 4G LED repeatedly	SIM holder is not inserted or access to network is denied

Action	Description
2G/3G/4G LED blinking every 1 sec	Connected to 2G/3G/4G, no data session established
2G/3G/4G LED turned on	Connected to 2G/3G/4G with data session
2G/3G/4G LED blinking rapidly	Connected to 2G/3G/4G with data session and data is being transferred

### Signal Strength LEDs:

The signal strength LEDs are located in the center of the front panel, to the right of the connection status LEDs:



**Figure 14:** Signal strength LEDs

Each lit up LED represents a different value of the router's current signal strength in RSSI:

No. of Lit-up LEDs	Signal Strength Value
0	$\leq -111$ dBm
1	-110 dBm to -97 dBm
2	-96 dBm to -82 dBm
3	-81 dBm to -67 dBm
4	-66 dBm to -52 dBm
5	$\geq -51$ dBm

### NOTICE

After the cellular modem gets powered up, all signal strength LEDs will turn ON and stay ON for about 40 seconds or until the router's modem registers on a network—after this, the LEDs will start displaying the router's current signal strength.

## Supported Frequency Bands:

Different countries and network operators use different frequency bands for communication in their respective mobile networks.

Therefore, in order to communicate within an operator's network, the cellular modem has to support the frequency bands used by that operator. Table below provides the various frequency bands for TSI® cellular modem part numbers.

TSI® P/N	Region (Operator)	Supported Bands
8145-CE 8145-CEOD 8145-CS	North America (AT&T®, Bell*, T-Mobile®)	<b>4G (LTE-FDD):</b> B2 (1900 MHz), B4 (1700 MHz), B12 (700 MHz) <b>3G:</b> B2 (1900 MHz), B4 (1700 MHz), B5 (850 MHz)
8145-CEEU 8145-CEODEU 8145-CSEU	Europe, the Middle East, Africa, Korea, Thailand, Malaysia	<b>4G (LTE-FDD):</b> B1 (2100 MHz), B3 (1800 MHz), B7 (2600 MHz), B8 (900 MHz), B20 (800 MHz), B28A (700 MHz) <b>3G:</b> B1 (2100 MHz), B8 (900MHz) <b>2G:</b> B3 (1800 MHz), B8 (900 MHz)

®AT&A is a registered trademark of AT&T Intellectual Property II, L.P.

\* Copyright © Bell Media Inc., its affiliates and/or licensors.


®T-Mobile is a registered trademark of Deutsche Telekom AG Fed Rep Germany

# Chapter 3

## Troubleshooting

Detailed troubleshooting and frequently asked questions can be found on TSI® website.

The table below lists the symptoms, possible causes and recommended solutions for common problems encountered with the TSI® Solar System and BlueSky™ Air Quality Monitor.

Solar System Troubleshooting	
Possible Cause	Corrective Action
<b>There is no power output from the solar power controller (power controller display is off)</b>	
Bad power connection	Check all power connections. Ensure all connections to the power controller are secure and the battery wire terminals are secure on the battery terminals.
Power controller not turned on	Press the power button  on the solar controller to turn the power on or off.
<b>The BlueSky™ monitor turns off at night and comes back on in the morning or later in the day.</b>	
Not enough sunlight	Contact TSI® for larger capacity options to add more solar panel area and/or battery capacity.

Cellular Modem Troubleshooting	
Possible Cause	Corrective Action
<b>The modem seems to be connected but there is no data available on TSI Link™ solutions.</b>	
Cellular modem is not connected	Check the signal strength and network type (see Figure 13 and Figure 14 above). If the signal is low or there is no data connection, try adjusting the antennas or moving the modem to a location where you know cellular coverage is available and strong.
There is a cellular connection but the BlueSky™ device is not connected to the cellular modem	Check the indicator lights on the BlueSky™ monitor to make sure that it is connected to Wi-Fi® and be sure it is connected to the cellular modem Wi-Fi®.

## Cellular Modem Troubleshooting

Possible Cause	Corrective Action
Data has not been updated yet	The default BlueSky™ monitor reporting period is 15 minutes. It can take up to 30 minutes for data to show up on TSI Link™ the first time.



# Appendix A

## Specifications\*

Power Requirements	
Solar System run-time	Continuous (with adequate sunlight)
Rated maximum cell power	15 watts (per panel)
Nominal voltage	12 volts
Solar system battery	12 VDC, 8.5 Ah
Battery run-time	90 to 120 hours (typical, full-charge to power cutoff, when no sunlight for charging)
Operating temperature	-22 to 140°F (-30 to 60°C)

Physical (Solar Panel)	
Dimensions	12 x 14 in. (31 x 36 cm)

Physical (Battery and Enclosure)	
Dimensions (HWD)	17.5 x 12.5 x 6 in. (45 x 32 x 15 cm)
Weight	15 lbs. (7 kg)

*\*Specifications are subject to change without notice.*

*(This page intentionally left blank)*





**Knowledge Beyond Measure.**

**TSI Incorporated** – Visit our website [www.tsi.com](http://www.tsi.com) for more information.

**USA** Tel: +1 800 680 1220  
**UK** Tel: +44 149 4 459200  
**France** Tel: +33 1 41 19 21 99  
**Germany** Tel: +49 241 523030

**India** Tel: +91 80 67877200  
**China** Tel: +86 10 8219 7688  
**Singapore** Tel: +65 6595 6388

P/N 6016614 Rev. A

©2022 TSI Incorporated

Printed in U.S.A.

