Operational Guidelines for the Solar Road Panel System

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FCC Notes:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

- Consult the dealer or an experienced radio/TV technician for help.

This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Operational Guidelines

These guidelines are intended for the operator of the system.

Initial Setup

Software Installation

Create a directory which will be dedicated to the Solar Roadways software system. Copy the following files into this directory:

config.ini contains the configuration parameters

<location>.exe location will be the name of the installation.

Coordinator Dongle

Figure 1. Photo. Coordinator dongle.

Each Solar Road Panel contains a microprocessor and an antenna section. This allows the panels to communication wirelessly. For a user to be able to communicate with the panels, a similar microprocessor and antenna section must be available. The Coordinator dongle provides this functionality. It is plugged into a USB port on a Windows-compatible computer. The dongle must be plugged into the computer prior to launching the software. If it is removed, then the software must be relaunched after the dongle is reinserted.

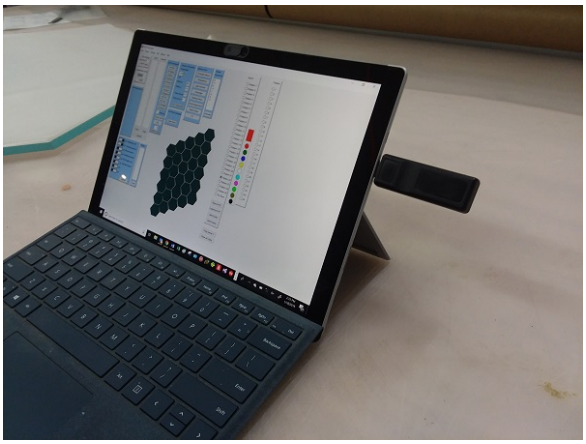

Figure 2. Photo. Microsoft Surface Pro with Coordinator dongle in the USB port.

A driver for the Coordinator dongle must be installed before the dongle will work. The driver is the *Silicon Labs CP210x USB to UART Bridge*. The driver can be downloaded from the following link: https://www.silabs.com/products/development-tools/software/usb-to-uart-bridge-vcp-drivers

The driver should be installed the WINDOWS\system32\DRIVERS directory.

Each Coordinator dongle is unique to its installation. For instance, if two neighboring driveways are made of Solar Road Panels, each homeowner will have a unique dongle. Their dongle will only be able to communicate with the panels on his/her driveway. The neighbor's driveway will be unaffected.

Operating the Software

Once the Coordinator dongle is plugged into the computer, launch the software.

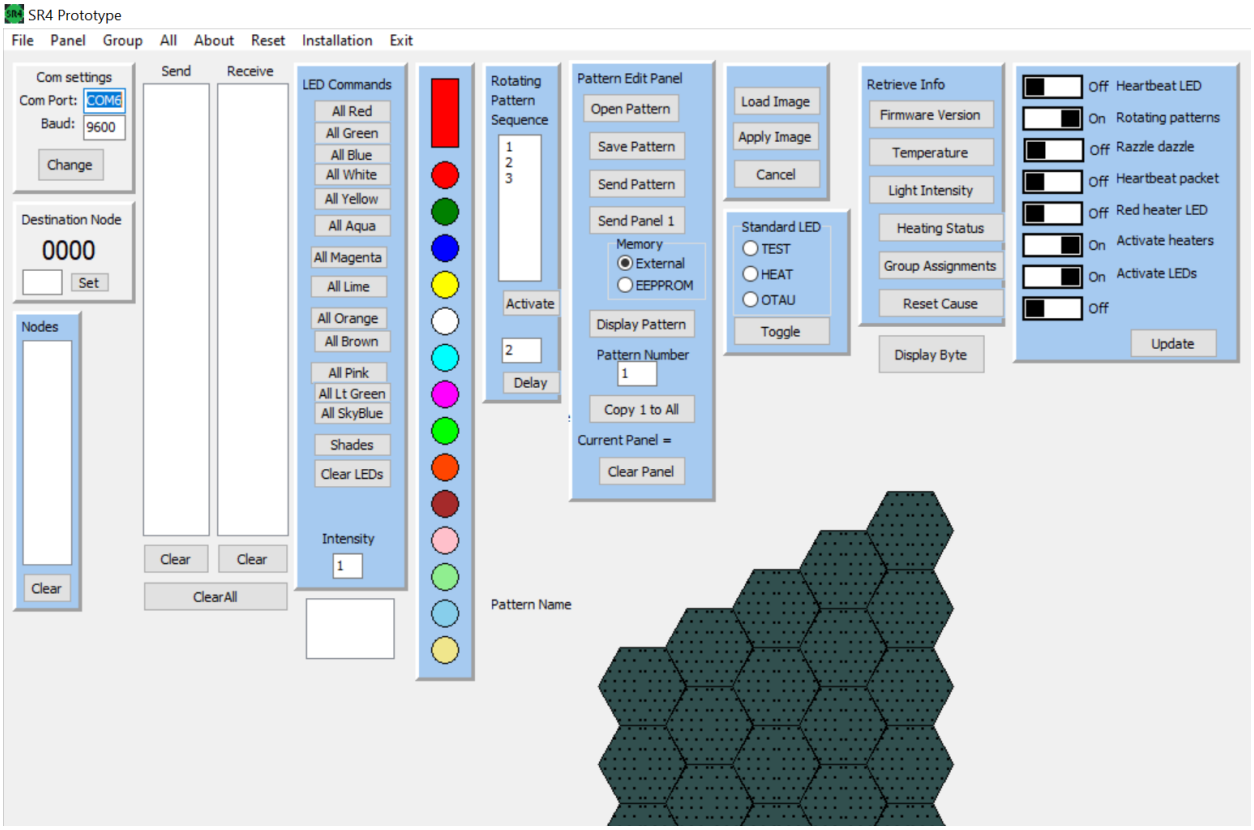

Figure 3. Screenshot. Solar Roadways software for the Sandpoint, Idaho installation.

In the upper left-hand corner of the screen is the Com setting box:

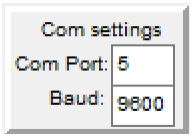

Figure 4. Screenshot. Com port settings.

If these boxes are blank, then the config.ini file is pointing to the wrong USB port. Open Control Panel and go to Device Manager. Scroll down to *Ports (COM & LPT).* You should see the Silicon Labs CP210x driver pointing to a com port – for example, COM5.

Double click on the config.ini file. It can be edited with NotePad. The file should look like the following:

[Init]
BaudRate=9600
ComPort=5
StopBits=1
Parity=3
ToggleSwitches=192

RotationDelayInterval=3
UpperTempRange=135
LowerTempRange=103
PWMHi=90
PWMLo=10
TimerInterval=10
CheckTempInterval=1
TempCheckInterval=1

Change the ComPort= entry to match the Device Manager entry. For instance, COM5 will be entered as ComPort=5

Save the file. Close the software and relaunch. The Com settings should now look similar to figure 3. This procedure should only have to be performed once on a single computer.

Addressing the Solar Road Panels

The software user can address each panel individually or address all the panels at once. This is done through the “Destination Node” box.

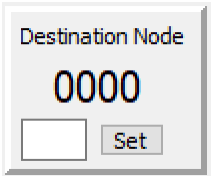

Figure 5. Screenshot. Destination Node box.

The destination node address “FFFF” is used to address all the Solar Road Panels in the system. This is called an “All Call”. This address can be selected by entering FFFF in the destination node box and clicking “Set” or by clicking the “All” menu item at the top of the screen:

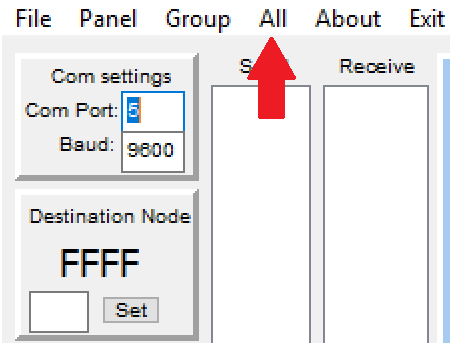

Figure 6. Screenshot. Selecting all panels.

Individual panels can be selected for communications by entering their address into the “Destination Node” box and clicking “Set”. The panels’ addresses can be obtained by selecting the panel. That panel’s address will then be displayed in the Panel box (with the “Clear Panel” button):

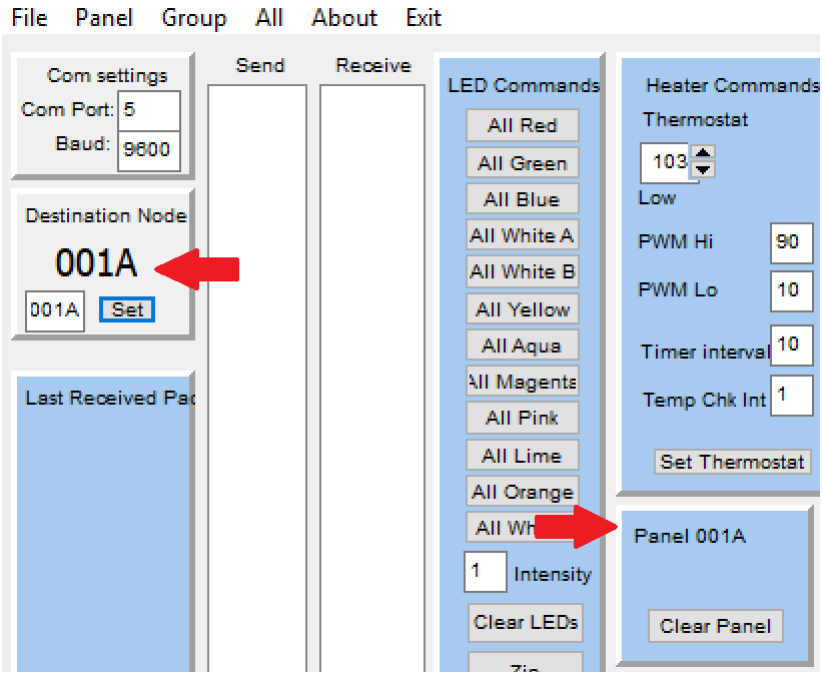

Figure 7. Screenshot. Entering an individual panel's address into the Destination Node box.

Panels should be communicated with individually when sending a specific (to that panel) graphic or when requesting information. If the user tries to request information from all of the panels at once, the system will not be able to process all of the returning information.

Commands such as "All Green", Heater Commands, Pattern Sequence, Dip Switch Update, etc., can be used with the "All Call" (FFFF) address.

The LED system

The software will show the installation (configuration of panels) that it has been configured for.
Example:

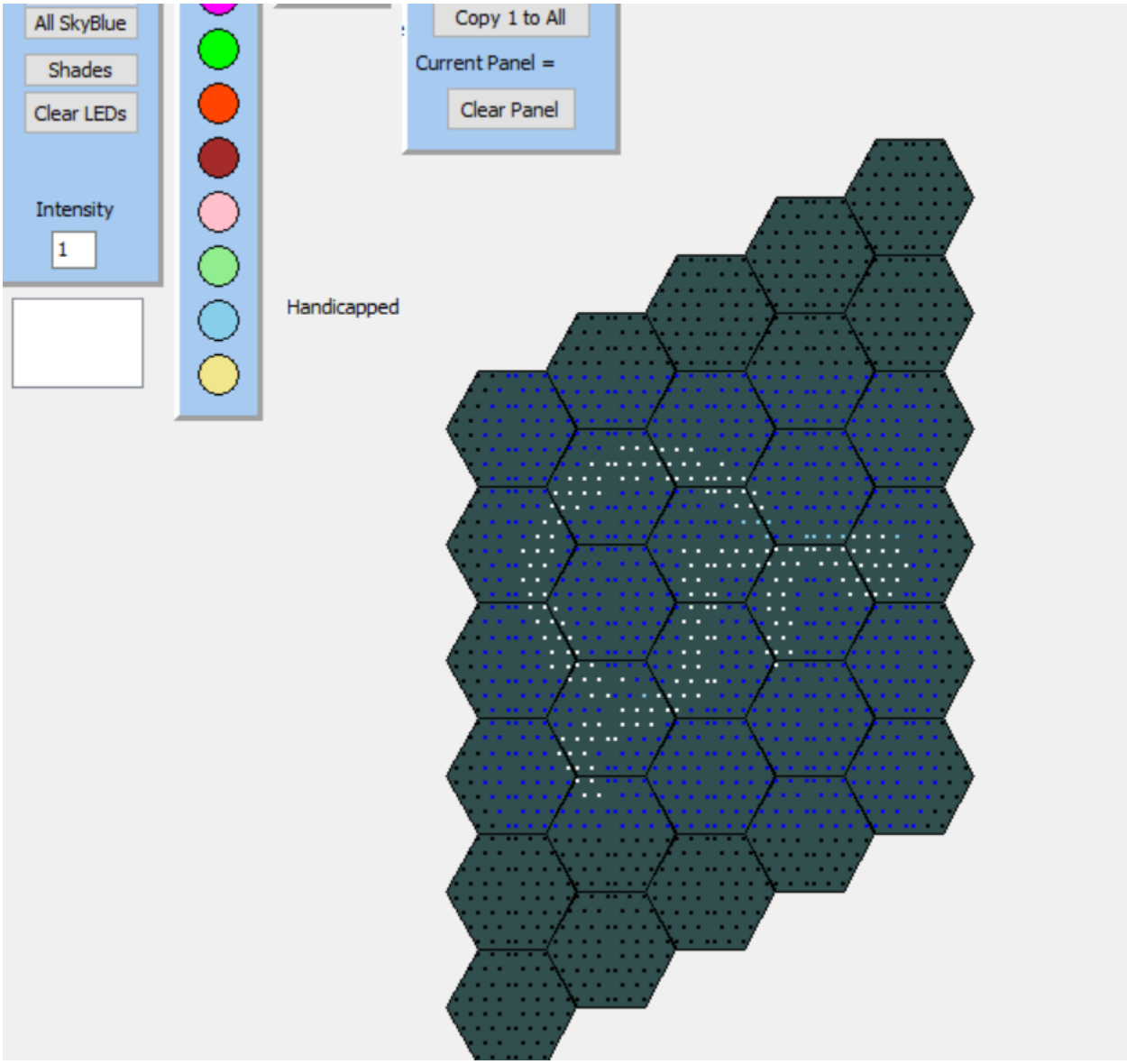

Figure 8. Screenshot. Panel configuration depiction of the Sandpoint, Idaho 30-panel installation.

Figure 9. Photo. Actual Sandpoint, Idaho 30-panel installation showing handicapped pattern.

Each Solar Road Panel contains 56 multi-colored LED clusters. Individual LEDs can be activated to create patterns and/or verbiage. Each panel can store over 8000 different patterns. These patterns can remain static, as the handicapped pattern shown in figure 9, or patterns can be rotated as shown in figure 10 below.

Figure 10. Photo. Sandpoint installation displaying rotating patterns.

The user creates these patterns with the software. Clicking on one of the panels on the screen causes it to enlarge, effectively “zooming in” on the panel to more easily see the LED locations.

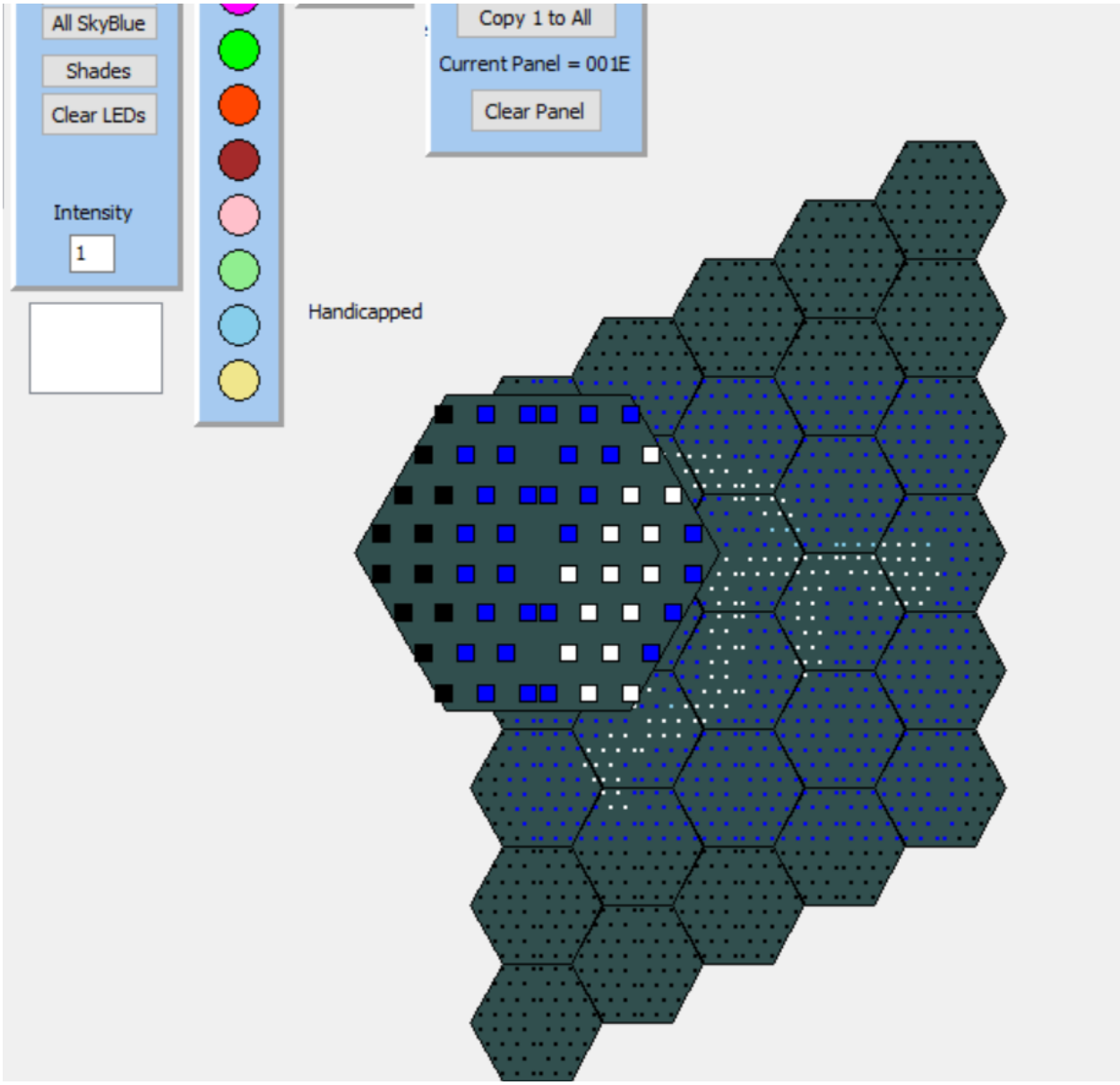

Figure 11. Screenshot. Panel expanded to access LED coloring.

Figure 11 shows that the user has selected the panel in the upper left-hand corner of pattern number 10. When the panel has been selected (clicked on), it enlarges, making it easier to "paint". Notice that the panel's address – 001E – is displayed in the panel box.

The user selects a color from the color palette. The rectangle at the top of the color palette indicated the color selected. The user can then change the individual LED clusters to this color by either left-clicking on the cluster location or by holding the left mouse button down and dragging it across the cluster locations (each location will take on the active color in the color palette).

Clicking the right mouse button on one of the clusters (or dragging it across several clusters) turns the cluster(s) black. This indicated that the LED cluster is to remain off.

All the panels in the system can be “painted” individually. This would be the case for a static image such as the handicapped space in figure 11. Then, each panel must be addressed individually to have their distinct patterns transmitted. Select the proper address in the “Destination Node” box, click the correct pattern number, and then click “Send (new)”. Repeat for all panels.

If the user wants all the panels to display the same pattern, then panel number 001A can be “painted” and saved. Then the user simply clicks “All” in the menu to change the destination node to FFFF and then clicks Send (new). All of the panels in the system will now have the same image under that pattern number. This is particularly useful when making rotating patterns.

Example:

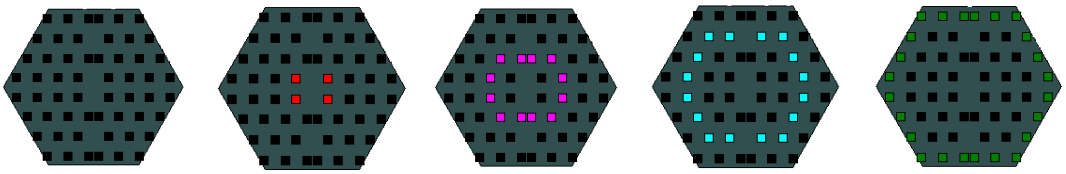

Figure 12. Graphics. Patterns 1 through 5.

Pattern 1 has all black clusters, meaning that the LEDs will all be turned off. Pattern 2 has four red LED clusters in the middle of the panel. Pattern 3 shows a fuchsia image, pattern 4 shows an aqua image, and pattern 5 shows a green perimeter.

If each of these patterns are created and saved, and then transmitted to all of the panels in the system, then the user can now create a rotating sequences of patterns.

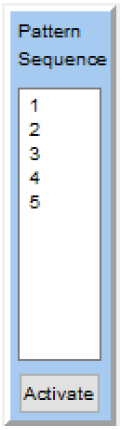

Figure 13. Screenshot. Pattern Sequence box.

The user can then enter the pattern numbers into the Pattern Sequence box. Clicking Activate will send this sequence to all the panels (if the Destination Node box reads “FFFF”).

The user would then go to the Toggle Box, turn on the “Rotating patterns” switch, and click “Update”. The panels will then begin displaying the sequence as show in figure 13.

The Heating system

Each Solar Road Panel has a built-in heating system to prevent snow/ice accumulation on the surface. The heating elements are activated by the on-board microprocessor. Through the software, the microprocessor is given a threshold temperature.

The microprocessor polls four on-board temperature sensors and if any one of them provides a reading below the threshold temperature, the heating elements are activated.

The heating elements remain activated (on) until all four temperature sensors indicate that they are equal to or above the threshold temperature. There is a red LED located in the hexagon to indicate that the heating elements are currently activated. This LED can be disabled through software.

The entire heating system can be enabled/disabled through software commands. There are times when the heating system may be undesirable. For instance, a home owner in Montana may winter in Arizona. In this case, there would be no need to heat the Montana driveway, so the heating system could be disabled.

To activate the heating system:

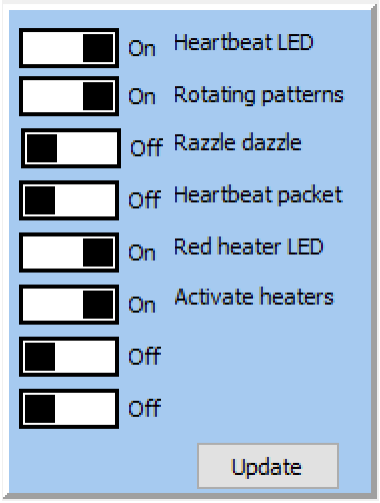

Figure 14. Screenshot. Toggle switch showing heaters and red heater LED activated.

On the toggle switch, move the toggle for Activate Heaters to the “On” position. To activate the red LED (heater on) indictor, move the toggle for Red heater LED to the “On” position. Click “Update”. The panel(s) selected in the Destination Node box will be updated with the latest information from the toggle switch.

The Solar Harvesting System (monitoring software)

The owner of the solar installation has the option of monitoring the energy harvesting of their system. When this option is selected, a monitor is installed and connected to the internet. The system is set up on the Enphase website, where the user can monitor all aspects of the energy harvesting. The website access is set up by the installer of the system.

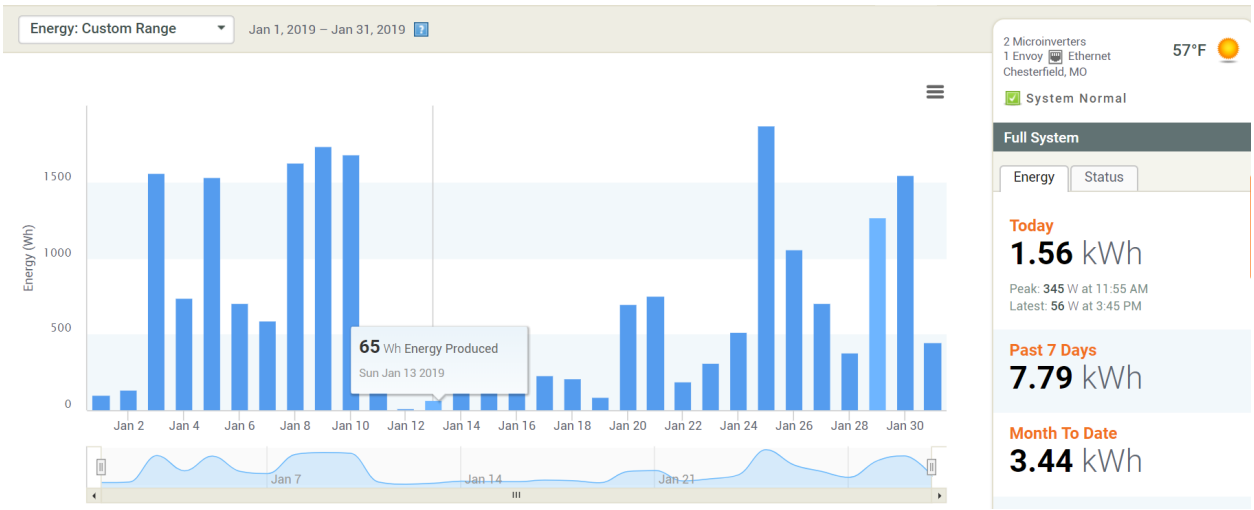

Figure 17. Screenshot. The Enphase monitoring portal.

Graphs can be displayed for the current day, the past week, month-to-date, and a custom range as shown in figure 16.

Each microinverter is connected to six Solar Road Panels. The monitoring portal tracks the energy harvesting and doubles as a trouble-shooting tool: if a microinverters stops reporting, then an alert is sent to the owner of the system.

Serial #	Part Number	Current Power	Lifetime Energy	Sku	Status
Serial #	Part Number			Sku	Active
121447031143	800-00194-r13 (M215-IG)	0 W	349 kWh	M215-60-2LL-S22-IG	Microinverter Not Reporting
121447021660	800-00194-r13 (M215-IG)	0 W	322 kWh	M215-60-2LL-S22-IG	Microinverter Not Reporting

Figure 18. Screenshot. The Enphase monitoring portal indicating a problem with the system.

When a problem is detected, the installer can be called in to correct it.