Configuration table for sizing the solar PV panels for using PicoCell™:

<table>
<thead>
<tr>
<th>Nominal Pump Power</th>
<th>Nominal Pump Current</th>
<th>Recommended solar PV module specification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-ph: 120Vac</td>
<td>1-ph: 230Vac</td>
</tr>
<tr>
<td>HP</td>
<td>Amps</td>
<td>Amps</td>
</tr>
<tr>
<td>1/2</td>
<td>6.0</td>
<td>3.0</td>
</tr>
<tr>
<td>3/4</td>
<td>9.0</td>
<td>4.5</td>
</tr>
<tr>
<td>1</td>
<td>12.0</td>
<td>6.0</td>
</tr>
<tr>
<td>1 1/2</td>
<td>-</td>
<td>9.0</td>
</tr>
<tr>
<td>2</td>
<td>-</td>
<td>12.0</td>
</tr>
</tbody>
</table>

* for 200-240Vac single and three phase motors/pumps

**Note:** The frequency of the motor can be either 50Hz or 60Hz and can be set using PicoCell’s DIP switch

**Example:** If a readily available PV panel is a 60 cell unit with the specification shown below, then the number of panels required for running a 3/4HP pump is shown in the yellow field. Although only 4 PV panels are required when supplying 120Vac pump, when supplying a 230Vac pump, 6 PV panels are required because the minimum specified MPP Voltage is 165V, as shown in upper table.

<table>
<thead>
<tr>
<th>PV - 60cells</th>
<th>Power</th>
<th>Voc</th>
<th>Vmmp</th>
<th>Impp</th>
<th># PVs for 120Vac</th>
<th># PVs for 230Vac</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>250 W</td>
<td>37.6 V</td>
<td>29.4 V</td>
<td>8.5 A</td>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>
**PicoCell™ at Glance**

*PicoCell™* is an off-grid solar water pumping controller that can operate any AC water pump from solar PV power. *PicoCell™* has unique functionality that enables users to match AC pump power with Solar PV power, in order to make solar water pumping systems affordable using commercially and locally available AC pumps.

For sizing the solar PV panels when using a using *PicoCell™* controller, please use the *Configuration Table* on the inside cover, or consult with your local distributor.

A typical diagram of a solar water pumping system that uses a *PicoCell™* controller is shown in figure 1. The solar PV array should be connected to the *PicoCell™* controller via the DC disconnect, as shown in figure 1. *PicoCell™* controllers should be installed in the shade and away from the direct sun.

When connecting the Solar PV or motor/pump wires to the *PicoCell™* controller, make sure the DC Disconnect is **OFF**. Make sure that the grounding wires from the DC Disconnect (PV Array) and the motor/pump are connected to the dedicated grounding lug of the *PicoCell™* controller. An optional water level switch can be connected to the *PicoCell™*. There is a dedicated terminal next to the motor terminal block for two water level switches (tank or well) inside the *PicoCell™*. One water level switch indicates when the tank is full. The other indicates when the well is empty.

The *PicoCell™* off-grid solar water pumping controller is unique because it can run single or three phase AC solar water pumps **using fewer PV panels**. Consult with your dealer in order to make sure the solar PV array is properly sized for your AC water pump.
PicoCell™ Hardware

A PicoCell™ controller consists of several hardware pieces, as shown in figure 2. The unit has three wire glands: two large glands for motor and solar PV cables, and one smaller gland for data cables (level switch sensor or other optional sensors). There is direct access to the power and signal terminals of the PicoCell™ once the enclosure door is removed.

The PicoCell™ controller should be mounted on the wall or other vertical surface using the back bracket (see figure 2 below). On a back side of the unit, in the upper corners of the heatsink, are two pins used to hang the unit on the back panel. More detailed mounting instructions are shown on page 4.

Figure 2: PicoCell™ hardware
**PicoCell™ Overview**

The features of a PicoCell™ controller are shown in figure 3. The unit has two wire glands (right and left, for motor and solar PV power cables), and one wire gland (in the middle, for the data cables for outside sensors). Further details about wiring the unit are provided on page 5.

Three LEDs are used to indicate the PicoCell™ controller’s operation. More details about the unit's operation and how to understand PicoCell’s™ LEDs are provided on page 8.

Once the door of the enclosure is open, there are three terminal blocks: 1.) solar PV wires, 2.) motor or pump wires, 3.) pump or tank sensor wires. More information about signal wiring and how to use the toggle ON/OFF switch and DIP switches is provided on pages 6 and 7.
Mounting *PicoCell™*

1. Fix the back plate to the support surface (wall) through 3 holes using screws (not included).

2. Once back plate is fixed to the wall, hang the *PicoCell* onto the back plate using the screw pins on the heatsink.

3. Make sure both screw pins are used to hang the *PicoCell* onto the back bracket.

4. Mounted!
**PicoCell™ Wiring Instructions**

A typical wiring scenario of the *PicoCell™* controller is shown in figure 4 below. The AC motor pump wires should be brought inside the *PicoCell™* controller through the left gland. The PV solar wires should be brought inside through the right gland. Make sure the grounding wires from both AC pump and PV panels are connected to the dedicated grounding lugs as shown in figure 4. The *PicoCell™* unit should be grounded using *separate* grounding wires: one for the PV panels, and one for the AC motor or pump, as shown in figure 4.

**CAUTION:** When connecting the wires between the DC Disconnect and the *PicoCell™* controller, make sure the **DC Disconnect is turned OFF**. Make sure the **toggle switch** of the PicoCell is in the **OFF position as well**!

**IMPORTANT:** Never run the *PicoCell™* controller when the AC pump is not connected! It might damage the controller.

If an installed 3-phase pump does not start pumping water immediately, switch the positions of any two out of three motor wires. The pump will change direction of rotation and start pumping water!

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**Figure 4:** PicoCell™ wiring details
The PicoCell™ controller can be remotely turned ON or OFF, by using digital inputs, or by using a standard float switch. There is a 4 position terminal block used for wiring float switch(es) to the PicoCell™, as shown on the figure 5 below.

Usually, float switches have three leads: black, brown and blue. In most cases, brown and black wires are used as a tank sensor, so when the tank is full, there is a short circuit between the brown and black wires.

Usually, well switches have two leads: blue and black. When the well is empty, there is a short circuit between the black and blue wires.

A typical example of how tank and well switch signals can be used with a digital input port is shown in figure 6. For a tank application, if brown is connected to Position 1, and black is connected to Position G of the connector, then the PicoCell™ will stop the pump when the tank gets full.

For a well application, if blue is connected to Position 2 and black is connected to Position G, then the PicoCell™ will stop the pump when the well runs out of water.

The same digital terminal block can be used for other remote control operations of the PicoCell™ controller if the above logic is applied.

Figure 5: Tank/well float switch

Figure 6: Water tank full and well empty example
**PicoCell™ Settings**

The PicoCell™ controller has a **RESET** button, positioned on the left side, next to the motor power terminal block, as shown in figure 7.

The Reset button can be used to reboot the software if the PicoCell™ controller is not performing correctly. **The same reset button should be used if the DIP switch positions are changed to match correct pump settings.**

![Figure 7: Reset Button](image)

The PicoCell™ controller has an internal **toggle switch** for turning the unit ON and OFF. This switch is not a power switch. It is signal switch (figure 8), so when it is in the OFF position, the PicoCell™ controller is not de-energized from the solar PV array. It is in **STOP mode**, not running the pump. When the toggle switch is OFF, all three LEDs are OFF as well.

When the toggle switch is in the ON position, the PicoCell™ controller is in regular **RUN mode**, controlling the AC water pump and pumping the water. During RUN mode, the green PUMP LED is ON (page 8).

![Figure 8: ON/OFF Toggle switch](image)

The PicoCell™ controller can operate any AC water pump: single/three phase; 50 or 60Hz; 120Vac or 230Vac rated. In order for the PicoCell™ to match the correct pump, DIP switches are used:

- **DIP switch 1** – if pulled up (ON – as on figure 9), the unit is configured for 120Vac pump operation; if pulled down (OFF), the unit is configured for 230Vac.

- **DIP switch 2** – if pulled up (ON – as in figure 9), the unit is configured for single phase pump operation; if pulled down (OFF), the unit is configured for three phase operation of pump.

- **DIP switch 3** – if pulled up (ON – as on figure 9), the unit is configured for 50Hz pump; if pulled down (OFF), the unit is configured for 60Hz pump.

![Figure 9: DIP switches](image)
If the PicoCell™ controller is connected to the solar water pumping system as shown (figure 1, page 1), and wired per instructions shown (figure 5, page 5), and all of the settings are correct, then the unit is ready for operation. Once the toggle switch (figure 5, page 6) is turned ON, the green Pump LED (figure 10) will start blinking, indicating that the PicoCell™ controller is trying to start the pump. If there is enough solar power available, the pump will start running, at which point the green Pump LED will turn solid.

After the green Pump LED is blinking, if there is not enough solar power to start the pump, the yellow Solar LED (figure 11) will start blinking, indicating that there is not enough solar PV power. The yellow Solar LED will be blinking for about 30-60 seconds, indicating that the unit is in idling mode. During this time, there is no activity and the PicoCell™ controller is getting ready for another attempt to start the pump. Low Solar PV can be due to cloudy weather, or can happen in the early morning or late evening, when solar PV panels do not generate enough power for running the pump.

The PicoCell unit will automatically shut down under two conditions:

First, when the unit gets too hot, it will shut down. This may occur when the unit is running a pump at full power for many hours on a very hot day in direct sunlight. In this case, the PicoCell™ controller will stop its operation, and the Warning LED (figure 12) will start blinking.

Reminder: PicoCell should not be installed in direct sunlight!

Second, if a tank or well float switch are used (figures 6 and 7), and when the tank becomes full or the well becomes empty, the PicoCell™ controller will stop its operation, and the Warning LED will be solid red.
**PicoCell™ Installation - 10 Quick Steps**

1. Securely screw the enclosed mounting bracket onto a solid vertical surface. Hang the PicoCell unit on the bracket, using the heatsink screw pins as shown in the picture.

2. Turn the DC Disconnect OFF, and ensure that there is no voltage on the solar PV wires.

3. Remove the enclosure door and make sure that the toggle switch is in the OFF position before doing any wiring!

4. With the enclosure door removed, connect the motor or pump connections first. Pass the wire leads through the wiring glands and connect to the left side connectors and left-bottom ground lug. These connectors are clearly labeled A, B and C. The ground lugs are located directly below the circuit board.
   - Connect phases A and C for a single phase pump
   - Connect phases A, B and C for a three phase pump

5. While the DC disconnect is still OFF, connect the solar PV wires. Pass the PV+ and PV- wires through the right cable gland and connect them to the right side connectors. Also connect the solar ground to the right-bottom grounding lug. The connectors on the board are labeled PV+ and PV-.

6. Set up the DIP switches to match the phase, voltage and frequency of the motor or pump that the PicoCell is connected to.

7. After passing the wires through the middle cable gland, connect the remote tank or well float switch to the terminal block next to the motor connector.

8. Once all of the power and signal connections are made, and the pump settings are adjusted on the DIP switch, energize the circuit by switching the DC Disconnect ON!

9. After the PicoCell is powered up, flip the toggle switch to the ON position. This will start the pump.

10. Replace the enclosure door using the slotted screws.
Contact:
info@suntechdrive.com
SunTechDrive.com

For installation videos – scan this code:

Pat. Pending: US Patent
Application No.: 62/240,979