Universal Top-of-Pole Mount
6 Modules (UTPM6)
Module Type G

Assembly Instructions

step-by-step assembly and installation
A few words about the product

The Universal UTPM6 for Type G modules is designed for a wide range of Module sizes from any combination of 37-42” in width to 61-67” in length. The Universal Top-of-Pole (UTPM) support structure mounts on 6 inch SCH40/80 galvanized steel pipe (installer supplied).

Pipe size and foundation requirements are based on several factors including the array surface area, maximum design wind speed, exposure category, soil type, steepest expected tilt angle and above-ground clearance.

For foundation and pipe size recommendations on a specific installation, please contact us at:
Phone: 800-260-3792
Email: info@power-fab.com

About these Assembly Instructions

These instructions...

- Are intended to be used by individuals with sufficient technical skills for the task. Knowledge and use of hand tools, measuring devices and torque values is also required.

- Include various precautions in the forms of Notes, Cautions, and Warnings. These are to assist in the assembly process and/or to draw attention to the fact that certain assembly steps may be dangerous and could cause serious personal injury and/or damage to components. Following the step-by-step procedures and these precautions are designed to minimize the risk of any personal injury or damage to components while making the installation safe and efficient.

Required Tools

- 7/16 inch wrench or socket for 1/4 inch module hardware
- 9/16 inch wrench or socket for 3/8 inch hardware
- 3/4 inch wrench or socket for 1/2 inch hardware
- 1-1/8 inch wrench or socket for 3/4 inch Pivot Bolt hardware
- Torque wrench
- Ratchet wrench
- Ratchet extension bar
- 3 to 6 foot level
- Tape Measure
- Square
Main Structural Components

1. Module Rails
2. Cross-Bars
3. Support Bar
4. Mounting Sleeve
5. Double Hole Slide Plate
6. Single Hole Slide Plate
7. Strongback

NOTE: Knowing the main structural components makes for easy assembly.

The Two Types of PV Module Slide Plates

- Single Hole Slide Plate
- Double Hole Slide Plate (secures two adjacent Modules)
What makes it Universal?
Adjustability to accommodate a range of PV Module sizes.
Universal Top-of-Pole Mount for 6 Modules, Module Type G, Parts Identification

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Module Rail</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>3/8&quot; x 2&quot; x 2 5/8&quot; U-Bolt, lock &amp; flat washers, hex nut</td>
<td>8 sets</td>
</tr>
<tr>
<td>3</td>
<td>Double Hole Slide Plate, 3/8&quot; x 7/8&quot; Track Bolt, lock &amp; flat washer, hex nut</td>
<td>8 sets</td>
</tr>
<tr>
<td>4</td>
<td>Single Hole Slide Plate, 3/8&quot; x 7/8&quot; Track Bolt, lock &amp; flat washer, hex nut</td>
<td>8 sets</td>
</tr>
<tr>
<td>5</td>
<td>1/4&quot; x 3/4&quot; Bolt, lock &amp; flat washers (2 flat washers), secures PV Module</td>
<td>24 sets</td>
</tr>
<tr>
<td>6</td>
<td>Cross Bar</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>Strongback</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Support Bar</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>3/8&quot; x 1-3/4&quot; Bolt, lock &amp; flat washers (2 flat washers)</td>
<td>2 sets</td>
</tr>
<tr>
<td>10</td>
<td>Mounting Sleeve</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>3/4&quot; x 5-1/2&quot; Pivot Bolt, lock &amp; flat washers (2 flat washers)</td>
<td>1 set</td>
</tr>
<tr>
<td>12</td>
<td>3/8&quot; x 3 1/4&quot; Bolt, lock &amp; flat washers (2 flat washers)</td>
<td>4</td>
</tr>
<tr>
<td>13</td>
<td>3/8&quot; Square washer</td>
<td>4</td>
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Step 1: Calculate the Required Site Specific Dimensions

In order for the UTPM to be a universal racking system that accepts a wide range of PV modules (various manufacturers, various mounting hole patterns and locations), it is necessary to complete a few simple calculations based on the site specific PV Modules before assembly begins.

These calculations result in the measurements needed to accurately and precisely position and install the Module Rails and the Slide Plates. The end result will be components which align perfectly to the PV Modules mounting holes.

Select the Set of PV Module Mounting Holes & Note Dimensions

PV Modules typically have several mounting hole patterns within their frames. Evaluate the site specific Modules and select the mounting hole(s) set to be used in this installation. Once selected, measure (or refer to the PV Modules spec sheet) the hole span dimensions and note these dimensions in figure 1-2 for later use.

Keep the following in mind during this step:

• PV Modules will be mounted in landscape orientation as shown in Figure 1-1.

• Most PV Modules have multiple sets of mounting holes that run along their long dimension, or in this case the “D” factor shown in Figure 1-2. Any set may be used so long as the holes accept the 1/4” mounting hardware.

• Three dimensions will be used to calculate and establish the exact placement of components. They are identified as B, D and H in Figure 1-2.

Now fill in the blank fields B, D, and H on Figure 1-2.

NOTE:
PV Modules vary in the number of holes and the patterns of those holes, figure 4-1 is a typical example of mounting holes and used for illustration purposes only.

Figure 1-1: Bottom View of a Typical PV Module in Landscape Orientation Showing an Example of Mounting Hole Sets
Step 2: Calculate & Mark the Rail Positions on Cross-Bars

The following instructions provide information on precisely calculating, measuring and marking the Module Rail positions on the two Cross Bars. Figure 2-2 indicates where the markings (defined here as positions “I” and “O”) are located on the Cross-Bars. These marks facilitate the precise E-W positioning of the Rails.

Using the Module Rail Positioning Calculator

A. Enter dimensions B and D from Figure 1-2, into their respective fields of the Module Rail Positioning Calculator. (Figure 2-1)

B. Complete the two equations resulting in factors I and O. These factors are the dimensions used to mark the Rail positions on the Cross Bars as shown in Figure 2-2.

Refer to site specific PV Module and:
• Select preferred mounting hole Set and enter dimension D
• Enter dimension H

NOTE:
When selecting a set of holes, make certain that the hole diameters accept 1/4” hardware as it will be used to secure the PV Modules to the system.
Module Rail Positioning Calculator: Locate positions 1 & 0

<table>
<thead>
<tr>
<th>Factor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>.25&quot; or one-half of the .50&quot; space between Modules.</td>
</tr>
<tr>
<td>B</td>
<td>Insert factor B from Figure 4-1 (Module edge to Module mounting hole).</td>
</tr>
<tr>
<td>C</td>
<td>1.0&quot; distance from Module Rail to center of Slide Plate mounting hole.</td>
</tr>
<tr>
<td>D</td>
<td>Insert factor D from Figure 4-2 (Distance between Module mounting holes).</td>
</tr>
<tr>
<td>E</td>
<td>Center mark on Cross Bars. Divide Cross-Bar length by .5 and mark.</td>
</tr>
</tbody>
</table>

Factor I
- Distance from center of Cross-Bar to edge of inboard Module Rail.

Factor O
- Distance from edge of inboard Power Rail to edge of outboard Module Rail.

Calculate Position I
\[
\begin{align*}
\text{.25"} &+ \Box + 1.0" = \Box \\
A &+ B &+ C &\Rightarrow \text{Position I}
\end{align*}
\]

Calculate Position O
\[
\begin{align*}
\Box - 2.0" &\Rightarrow \Box \\
D &- C \times 2 &\Rightarrow \text{Position O}
\end{align*}
\]

Area of Detail
- (equals one-half the space between Modules)

Top View
- Note: For clarity, PV Modules are shown transparent.

Figure 2-1: Module Rail Positioning Calculator
Mark the Cross Bars

Collect the two Cross Bars and prepare to mark them by setting them side by side with the ends aligned and their mounting holes oriented as shown in Figure 2-2.

A. Measure the Cross Bar lengthwise, divide by .5 and mark their center points.

B. Using calculations I and O from figure 2-1, measure from the center point outward and mark positions I and O on each of the three Cross Bars as shown below.

NOTE:
To accommodate the site specific PV Modules the Module Rails must be carefully positioned/spaced E-W along the Cross-Bars.

NOTE:
Be precise in marking the components, as this will prove beneficial as the assembly progresses.

Figure 2-2: Marking the Cross-Bars for Module Rail Positioning
**Step 3: Calculate & Mark Slide Plate Positions on Module Rails**

In this array of six modules, it’s necessary to calculate the position of the eight Double Hole Slide Plates securing the center row of Modules. After the center row of Modules are installed, all remaining Slide Plate positions become obvious as the remaining PV Modules are put into position. As will be illustrated later, the remaining Slide Plates are simply shifted into alignment with the PV Module mounting holes as all other Modules are installed.

The following instructions provide information on precisely calculating, measuring and marking the positions of the Double Hole Slide Plates on the four Module Rails. Figure 3-2 indicates where the marks (defined here as position K) are located on the Module Rails.

**Using the Double Hole Slide Plate Positioning Calculator**

A. Enter dimension H from Figure 1-2, into its respective field H of the Double Hole Slide Plate Positioning Calculator. (Figure 3-1)

B. Complete the equation resulting in factor K. This factor is the dimension used to mark position K on the Module Rails as shown in Figure 3-2.
Double Hole Slide Plate Positioning Calculator:
Locate positions K

<table>
<thead>
<tr>
<th>Factor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>N-S distance between PV Module mounting holes.</td>
</tr>
<tr>
<td>J</td>
<td>1.125&quot; distance from Module mounting hole to Rail mounting hole of Double Hole Slide Plate.</td>
</tr>
<tr>
<td>K</td>
<td>Distance (C to C) from Double Hole Slide Plate to Double Hole Slide Plate. Mark these positions on Module Rails.</td>
</tr>
</tbody>
</table>

Calculate Position K

\[ \text{Position } K = \text{N-S distance between PV Module mounting holes} \times 0.50 + 1.125" = \]

Note: For clarity, PV Modules are shown transparent.

Figure 3-1: Double Hole Slide Plate Positioning Calculator
Mark the Module Rails

Collect the four Module Rails and prepare to mark them by setting them side by side with the ends aligned and oriented as shown in Figure 3-2.

A. Measure the Rails lengthwise, divide by .5 and mark their center points.

B. Using calculation K from figure 3-1, measure from the center point outward and mark the K position on each of the four Rails as shown below.

**NOTE:** Be precise in marking the components, as this will prove beneficial as the assembly progresses.
Step 4: Attach Slide Plates to Module Rails

Slide Plates are secured to the Module Rails using 3/8" x 7/8" Track Bolts and hardware. There are two types of Slide Plates: a Single Hole and a Double Hole. Single Hole Slide Plates are used on the ends of the Module Rails and secure those PV Modules on the outer corners of the array. Double Hole Slide Plates are used along the Module Rails to secure two adjacent PV Modules. In this step, all of the Slide Plates will be installed on the Rails, starting with the eight double hole Slide Plates that align to the marks made previously. While these eight will be aligned and secured to the Rails, the others will be roughly positioned and hand tightened with their final positions determined as the Modules are installed.

Pre-assemble Slide Plates

Collect all the Slide Plates (single and double hole) as well as the attaching hardware shown in figure 4-1. Loosely assemble all of the Plates in preparation for attaching them to the Module Rails. Do not tighten the hardware at this time, as it should be left loose for ease of sliding the Plates into the Module Rails.

Install the Eight Double Hole Slide Plates

These are the initial eight (two per Rail) Double Hole Slide Plates that align to the marks made previously.

A. Align the tabs of the Double Hole Slide Plate and the head of the Track Bolt with the channel of the Rail and slide toward alignment mark. (See Figure 4-2)

B. Center Slide Plate over alignment mark and tighten securely. Torque at 32-34 ft.-lbs.

C. Continue in this manner installing the remaining seven Double Hole Slide Plates and ending with two Slide Plates per Rail.
NOTE: Be precise in the alignment of components, as this will prove beneficial as the assembly progresses.

**Install the Single Hole Slide Plates**

Because the positions of these Slide Plates on the Rail are not important at this time, they may be positioned anywhere near the ends of the Rail.

A. As done previously, align the Slide Plate tabs and the head of the Track Bolt with the channel of the Rail, and slide inward. Hand tighten to keep them from sliding off the Rail during handling. (See Figure 4-2)

B. Continue in this manner while installing the remaining Slide Plates. Upon completion, the Rails should look like the one in Figure 4-3 below.

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**Figure 4-3: Slide Plate Positions**

**Figure 4-2: Installing and Aligning a Double Hole Slide Plate**
Step 5: Install the Mounting Sleeve on Vertical Pipe

Before installing the Mounting Sleeve, verify that the Mounting Pole is plumb to the ground and hasn't shifted or leaned while the concrete footing has cured. The Mounting Sleeve slips on top of the Mounting Pole and has four 1/2” Set Bolts which are used to secure it to the Mounting Pole. (See Figure 5-1)

A. Slip the Mounting Sleeve on top of Mounting Pole and slide it down until it rests on top of Mounting Pole.
B. Rotate the Mounting Sleeve so that the Support Bar Pivot Tab is pointing north and the Strongback Vertical Towers are leaning south.
C. Secure the Mounting Sleeve by tightening the four 1/2” Set Bolts. Torque each Set Bolt to 55-60 ft.-lbs.

Step 6: Install the Strongback to the Mounting Sleeve

The Strongback is attached to the Mounting Sleeve using the Pivot Bolt that passes through its two Vertical Towers and the Support Bar. The Support Bar is attached to the Strongback on one end and the Support Bar Pivot Tab of the Mounting Sleeve on the other end using 3/8” hardware.

A. Remove the Support Bar from the Strongback and re-install in the 15° elevation set point. Secure with the 3/8” hardware and finger tighten. (See Figure 6-1)
B. Remove the Pivot Bolt from the Mounting Sleeve and also collect the 3/8” x 1-3/4” bolt, flat washers and lock washer needed to secure the Support Bar to its Pivot Tab on the Mounting Sleeve. (See Figure 6-2)

C. Orient the Strongback to the Mounting Sleeve with its Lower Support Bar positioned on the same side of the Mounting Sleeve as the Support Bar Pivot Tab.

D. Slide the Strongback between the two vertical mounting tabs, aligning the thru-hole of the Strongback with the holes of the two Vertical Towers.

E. Insert the Pivot Bolt along with one flat washer through the one Vertical Tower and the Strongback exiting the second Vertical Tower on the opposite side. Secure with the remaining flat washer, lock washer and hex nut. For now, finger tighten only to allow movement for the next step.

F. Pivot the Strongback and the Support Bar to align the mounting holes of the Support Bar with its Pivot Tab on the Mounting Sleeve. Slide the Support Bar over the Pivot Tab. Insert the 3/8” x 1-3/4” bolt and one flat washer through the Support Bar and Mounting Tab and secure it with the remaining flat washer, lock washer and hex nut. **Torque hardware on both ends of Support Bar at 32-34 ft.-lbs.** (See Figure 6-3)

G. Return and tighten the Pivot Bolt. The Pivot Bolt cannot be left loose - the Mounting Sleeve Vertical Towers must be firmly clamped to the sides of the Strongback eliminating any gaps between the Vertical Towers and the Strongback. **Torque to 125-150 ft.-lbs.** (See Figure 6-4)
Step 7: Install the Cross-Bars to the Strongback

Cross-Bars run in an E-W direction and are secured to the mounting angles (welded to the Strongback) using 3/8” square flat washers along with 3/8” x 3-1/4” bolts and hardware. There are two Cross-bars to install, at opposite ends of the Strongback.

Cross-Bars are mounted to the outside of the Strongback mounting angles (these are welded to the Strongback); they are not nested into the Mounting Angles. (See Figures 7-1 and 7-2)

Installing the Cross-Bars.

A. Position the Cross-Bar to the outside of the Strongback mounting angle (see Figure 7-1). Align the mounting holes and secure using 3/8” flat and square washers along with the 3/8” x 3-1/4” bolts and lock washer placing the square flat washer against the Cross-Bar. Tighten hardware and **Torque to 30-32 ft.-lbs.** (See Figure 7-2)
B. Continue in this manner and install the opposite Cross-Bar to the Strongback. Refer to Figure 3-1 as needed for proper positioning.
Step 8: Attach the Module Rails on the Cross-Bars

Start by attaching the inboard Module Rails first and work outward.

Referring to Figure 8-1 for orientation of the Module Rails, position and align the Module Rails with the marks made in previous step. Straddle the two sets of mounting holes with the Cross-Bars and secure with 3/8" x 2" x 2-5/8" U-Bolts and hardware. Finger-tighten for now.

CAUTION:
This is a two person activity. Module Rails are unstable before they are fully secured to the Cross-Bars. Module Rails must be held in place by one person while the second person aligns and secures them to the Cross-Bars. Failure to do so could lead to serious personal injury.

NOTE:
Finger-tighten the Module Rails to the Cross-Bars while installing. When all Module Rails are installed, re-tighten to specified torque values.

Figure 8-1: Aligning and Attaching Module Rails to Cross-Bars
Step 9: Installing PV Modules to Sliding Plates

In this step, the center row of PV Modules is installed and secured to the eight previously installed Double Hole Slide Plates (that were aligned to the marks made in step 3). Next, the outer most rows are installed and secured to the Single Hole Slide Plates on the outer edges of the array. All PV Modules are secured to the Sliding Plates using 1/4” x 3/4” bolts and hardware.

First secure the Two PV Modules to the Eight Double Hole Slide Plates

These two Modules represent the center row running E-W and must be secured to the pre-set and secured Double Hole Slide Plates.

A. Align one of the PV Modules to four of the secured Double Hole Slide Plates mounting holes. Secure with 1/4” x 3/4” bolts and hardware. Finger-tighten for now. (See Figures 9-1 and 9-2)

B. Continue in this manner and install the adjacent E-W Module, securing it as described above.

Install the Outer Rows of Modules

Working to the north or south of the previously installed rows of Modules, install and secure the outermost rows of PV Modules.

A. Place the next in-line PV Module, aligning it to the mounting holes of the two previously aligned Double Hole Slide Plates. Secure with 1/4” x 3/4” bolts and hardware. Finger-tighten for now. (reference Figure 9-2)

B. Locate the Single Hole Slide Plate, loosen the hardware enough so that the Slide Plate will move, and slide its mounting holes into alignment with the just-installed-module. Secure the Module with 1/4” x 3/4” bolts and hardware. Finger-tighten for now. (See Figures 9-3 and 9-4)

C. Continue in this manner and install the adjacent E-W Module, securing it as described above.
Figure 9-2: Installing the Outer Row of PV Modules

Pre-set and Secured Double Hole Slide Plate

1/4" Nut
Lock Washer
Flat Washer

1/4" x 3/4" Bolt

Slide into Alignment with Module Mounting Hole

Align to this Hole and secure with 1/4" hardware

Figure 9-3: Aligning the Single Hole Slide Plate with PV Module Mounting Hole

Figure 9-4: Securing PV Modules to the Single Hole Slide Plates
**Step 10: Square and Align the Array**

Using a square and visual references, ensure that the array is aligned to the mounting structure. Confirm that the PV Modules are square and have consistent even spaces all around. Adjust if necessary.

**Step 11: Now Return and Tighten Mounting Hardware**

A. Return and tighten each set of the 3/8” U-bolts, securing the Module Rails to the Cross-Bars. **Torque all at 32-34 ft.-lbs.**

B. Return and tighten each of the 3/8” hardware securing all of the Slide Plates (Single and Double Hole) to the Module Rails. **Torque all at 32-34 ft.-lbs.**

C. Return and tighten each set of 1/4” mounting hardware, securing the PV Modules to the Slide Plates. **Torque all at 6-8 ft.-lbs.**

**Step 12: Adjust the Tilt Angle of the Rack**

To adjust the tilt angle, loosen the Pivot Bolt hardware and remove the Support Arm upper hardware attaching the Support Arm to the Strongback.

A. While one person holds the south edge of rack, the other loosens the Pivot Bolt and removes the upper 3/8” hardware attaching the Support Bar to the Strongback. (See Figure 12-1)

B. Tilt the rack to the desired elevation angle (15°, 25°, 35°, 45°, 55°, or 65°) and re-attach the Support Bar to the Strongback, placing the 3/8” hardware in the appropriate hole matching the desired elevation. **Torque at 32-34 ft.-lbs.** (See Figure 12-2)

C. After changing the tilt angle and tightening the Support Bar hardware, the Pivot Bolt must be re-tightened. The Mounting Sleeve Vertical Towers must be firmly clamped to the sides of the Strongback eliminating any gaps between the Vertical Towers and the Strongback. **Torque to 125-150 ft.-lbs.** (See Figure 12-3)
CAUTION:
Do not attempt to remove the Pivot Bolt during tilt adjustments! Removal could lead to serious personal injury or death. Adjustments are made with the Pivot Bolt hardware loosened but in place.

Figure 12-1: Preparing to Adjust the Tilt Angle

Loosen Pivot Bolt

Remove Support Arm Hardware (upper hardware only)

Figure 12-2: Setting the Tilt Angle

Strongback

Support Bar

Elevation Set Points

Figure 12-3: Tighten and Torque the Pivot Bolt

WRONG

CORRECT

Figure 12-3: Tighten and Torque the Pivot Bolt