

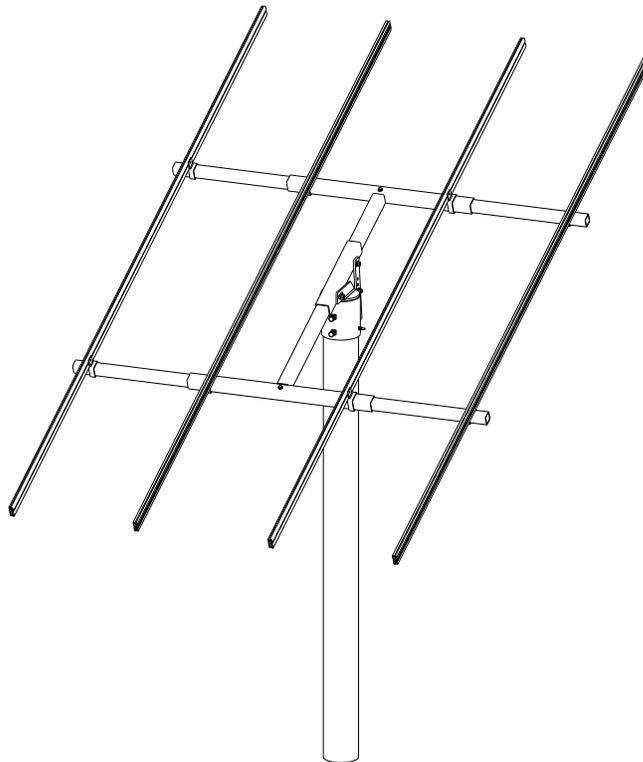
ZOMEWORKS

CORPORATION

FXL FIXED RACKS

ASSEMBLY INSTRUCTIONS

Rev. July 2018



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FX Series Selection & Array Sizing Guide

All Zomeworks fixed racks and trackers are sized according to the total module area.

$$\text{Length[ft]} \times \text{Width[ft]} \times \text{No. of Modules} = \text{Total Area [sq.ft]}$$

Or, for dimensions in inches:

$$\text{Length[in]} \times \text{Width[in]} \times \text{No. of Modules} \div 144 = \text{Total Area [sq.ft]}$$

Choose a gimbal size with the Maximum Module Area greater than or equal to the total area of the modules to be mounted. The names roughly correlate to maximum module area in square feet.

MODEL (Gimbal)	Maximum Module Area	Pole Dia. (Nominal)	Maximum Crossbar Width	Maximum Rail Length
FX2	20 square feet	2"	55" (4 ft 7")	117" (9 ft 9")
FX3	30 square feet	3"	55" (4 ft 7")	117" (9 ft 9")
FX4	45 square feet	4"	120" (10 ft)	117" (9 ft 9")
FX6	65 square feet	6"	120" (10 ft)	117" (9 ft 9")
FXL-090	90 square feet	6"	144" (12 ft)	180" (15 ft)
FXL-120	120 square feet	6"	144" (12 ft)	192" (16 ft)
FXL-168	168 square feet	8"	168" (14 ft)	192" (16 ft)

The area capacity of a rack is driven mainly by wind load considerations, and is based largely on the bending strength of the steel pole and gimbal. Within this area limit, various array shapes are possible, but the maximum area is a limit that must not be exceeded.

It is important to note that while racks have a max crossbar width and max rail length, both maximums cannot be used at the same time. Doing so may exceed the module area limit. We can make an array tall and narrow, or we can make it short and wide. But, we *cannot* make it both tall and wide at the same time, even if both crossbar width and rail length are within their individual limits. The area limit takes precedence over the length limits. If using full width & length together will cause module area to exceed the area limit, then choose the next larger model.

Crossbar Size is determined by the spacing of the module mounting holes. There are two different ways of specifying mounting hole location: by **distance apart**, or **distance from ends** (from the end of the module). The cross bar does not need to extend to the end of the modules, it only needs to reach far enough to set the rails under the outermost mounting holes.

For the FX2 and FX3, there will only be one column of modules, usually in Landscape, with rails running vertically. Choose a crossbar that fits the **distance apart** of the mounting holes.

For the FX4 and FX6 (arrays with more than one column of modules), choose crossbar width by the total width all modules, minus 2 × the mounting hole **distance from ends**, plus 2" to accommodate mounting brackets.

Rail Length is simply the total length of modules, accounting for Landscape or Portrait orientation, plus ¼" space between modules, plus ¼" at each end. Round up to next whole inch. (The presence or absence of spacing between modules has negligible effect on wind loading, and may be ignored for purposes of module area calculations.)

Note: Nominal sizes of poles are not exact to their names, due to wall thickness and industry naming conventions for "nominal" sizes. For convenience, we refer to a gimbal that fits on a Nominal 6-inch pole as a "6-inch gimbal" (even though neither the pole nor the gimbal is exactly 6 inches).

About the FXL Fixed Racks

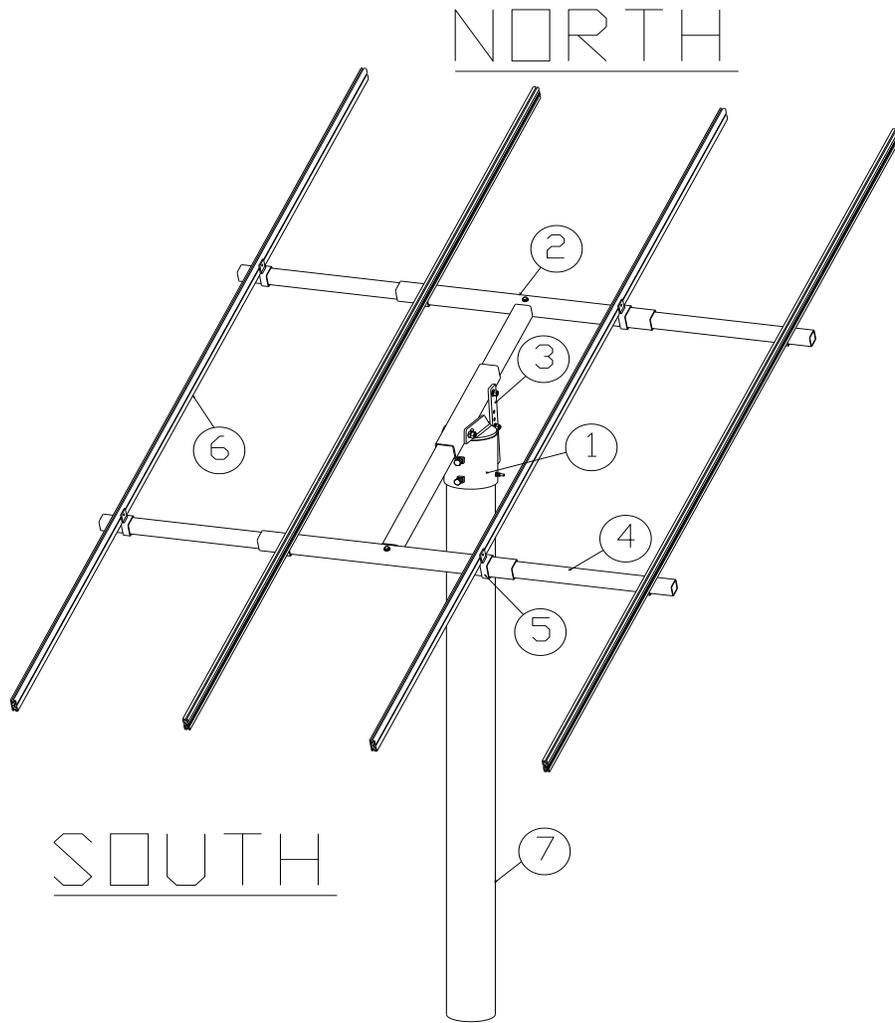
The FXL racks are the largest of the FX series, and differ significantly from the smaller types. FXLs use either a 6" or 8" gimbal equipped with a seasonal adjustment arm, and an I-shaped strong-back with square truss-tubes.

FXL racks are custom-sized for each order. The customer need only specify the type and number of modules to be mounted, and provide the module spec sheet. Zomeworks will calculate the length of truss tubes and rails, and any special hardware needed. All parts are cut to size at the factory.

All Zomeworks FX Racks are normally intended to have modules mounted in **landscape** orientation, using bolts in the module mounting holes. Modules can be mounted in **portrait** orientation if desired, but since the rails will be co-linear with the edges of the module, it may necessitate a wide gap in the center of the array to accommodate the gimbal and sleeve.

Zomeworks mounting rails are the Alex rail, a custom aluminum extrusion. This rail includes two slots to accommodate either 1/4" or 5/8" bolt heads. The Alex rail replaces all previous versions of slotted rail and HD steel-angle rails.

On the FXL racks, the module-mounting rails are attached to the truss tubes by "sliders" of various sizes (see diagram on following page). Normally the sliders fit directly on the truss-tube, but sometimes (due to positions of mounting holes on certain modules) the innermost sliders will need to be positioned so close to the center that it lands on the I-Beam. When this is the case, a special set of sliders is used. The special set consists of one slider that fits over the I-beam, and the other slider fits on the truss-tube but has a 1/4" longer tab to match the height of the first slider on the I-beam. Any time a module rail set spans two different size trusses, a large slider is always paired with a small long-tab slider.



FXL MAIN COMPONENTS IDENTIFICATION		
Key	Quantity	Structural Component Description
1	1 ea.	Gimbal
2	1 ea.	I-Beam, or Strong-Back
3	1 ea.	Seasonal Adjustment Arm
4	2 ea.	Truss Tubes
5	8 ea.	Sliders (or 12 each if an extra rail set is included)
6	4 ea.	Module Mounting Rails (or 6 each, if an extra rail set is included)
7	n/a	Customer-Supplied Mounting Pole

Summary of FXL-Series Components, By Model

Gimbal, one of:	
6" Gimbal Assembly, Has 14", 8-Position Seasonal Adjustment Bar	for both the FXL-090 and FXL-120. a.k.a. the "combo gimbal" (is also used on trackers UTRF-72, 90, and 120)
8" Gimbal Assembly Has 17", 8-Position Seasonal Adjustment Bar	for FXL-168, (also used on tracker UTRF-168)
I-Beam, one of:	
5.35ft x 24", 2.5" Square I-Beam	for FXL-090
6.35ft x 24", 2.5" Square I-Beam	for FXL-120
6.43ft x 48", 3" Square I-Beam	for FXL-168, has extra sleeve for strength
Truss Tubes, Qty 2 of one of the following:	
2" Sq Steel Truss-Tube, (cut to length)	fits in 2.5" I-Beams (for 090 and 120)
2.5" Sq Steel Truss-Tube, (cut to length)	fits in 3" I-Beams (for 168)
Sliders, two per rail:	
2.5" Slider (fits a 2" square tube.)	Normal (for 090 and 120)
3" Slider (fits a 2.5" square tube.)	fits over the 2.5" I-Beam (for 090 and 120)
2.5" Long-Tab Slider	used together with the 3" slider
3.5" Slider (fits a 3" square tube.)	fits over the sleeve of 3" I-Beam (for 168)
3" Long-Tab Slider	used together with the 3.5" slider (for 168)
Mounting Rails, Extruded Aluminum (custom cut to length)	Typically 4, but more if appropriate

Pricing of FXL racks is by standard package prices, same price regardless of the size of rails or truss-tubes provided.

When ordering, the customer needs to specify exact make & model number of modules to be mounted. Zomeworks will determine an appropriate array layout, sizes of rails and truss-tubes, all necessary sliders and hardware.

The standard package price includes 4 rails for two rows of modules, in landscape orientation. However, if more rows of modules are needed, Extra Rail Sets will need to be added to the package, at additional cost.

Extra Rail Set Contents

2 Rails, custom cut length

4 Sliders, size selected as appropriate

Before assembling your rack, use the list below to assure that you have all of your components and hardware. In the event of missing parts, contact ZOMEWORKS Customer Service at 800-279-6342. When calling, please have available your SO number, date of purchase, and name of the dealer you purchased from.

FXL-Series HARDWARE LIST		
Quantity	Description	
GIMBAL ASSEMBLY (ALL HARDWARE ATTACHED)		
2 ea.	3/4-10 x 2" Yellow Zinc-Plated Hex Bolts	Pole Set-Bolts
1 ea.	3/4-10 x 5" Zinc-Plated Hex Bolt, <i>or</i> 3/4-10 x 6" Zinc-Plated Hex Bolt (<i>for 168</i>)	Main Pivot Bolt
1 ea.	3/4 Zinc-Plated Flat Washer	
1 ea.	3/4-10 Zinc-Plated Hex Nut	
1 ea.	3/4-10 Zinc-Plated Jam-Nut	
1 ea.	3/8-16 x 9" Zinc-Plated Hex Bolt, <i>or</i> 3/8-16 x 11" Zinc-Plated Carriage Bolt (<i>for 168</i>)	Gimbal-to-Pole Anti-Rotation Through-Bolt
2 ea.	3/8-16 Zinc-Plated Hex Nuts	
2 ea.	3/8 Zinc-Plated Flat Washer	
I-BEAM (SMALL LABELED BAG)		
2 ea.	1/2-13 x 3.5" Zinc-Plated Hex Bolts, <i>or</i> 1/2-13 x 4" Zinc-Plated Hex Bolts (<i>for 168</i>)	I-Beam to Truss-Tube Bolts
4 ea.	1/2" Zinc-Plated Flat Washers	
2 ea.	1/2-13 Zinc-Plated Nylock Nuts	
SEASONAL ADJUSTMENT BAR (ALL HARDWARE ATTACHED)		
1 ea.	5/8-11 x 4.5" Zinc-Plated Hex Bolt, <i>or</i> 5/8-11 x 5" Zinc-Plated Hex Bolt (<i>for 168</i>)	I-Beam Pivot Through-Bolt
1 ea.	5/8-11 x 2" Zinc-Plated Hex Bolt	Tab Through-Bolt
4 ea.	5/8" Zinc-Plated Flat Washers	
2 ea.	5/8" Zinc-Plated Lock Washers	
2 ea.	5/8-11 Zinc-Plated Hex Nuts	
TRUSS TUBE SLIDERS (ALL HARDWARE ATTACHED)		
8 ea.	3/8" x 1" Zinc-Plated Carriage Bolts	Slider-to-Rail attachment bolts
8 ea.	3/8" Zinc-Plated Flat Washers	
8 ea.	3/8" Zinc-Plated Nylock Nuts	
8 ea.	3/8" x 3/4" Yellow Zinc-Plated Hex Bolts	Slider Set-bolts
8 ea.	3/8" Zinc-Plated Jam Nuts	
PV MODULE MOUNTING HARDWARE (Qty times # OF MODULES)		
4 /mod	1/4" x 5/8" Stainless Steel Bolts	
4 /mod	1/4" Stainless Steel Hex Flange Lock Nut	

POLE INSTALLATION

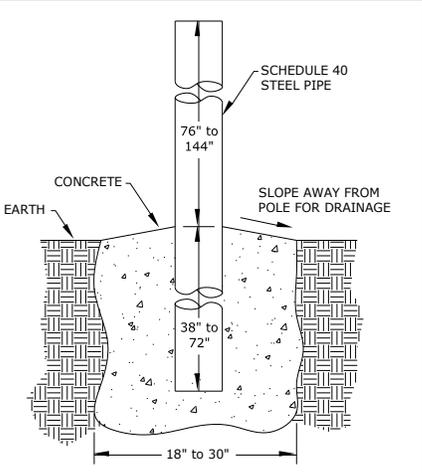
IMPORTANT NOTE: *Zomeworks Corporation assumes no liability for the structural integrity of the pole and its installation. Soil and wind conditions vary. If there is any doubt, consult with a local structural engineer.*

Location & Site Considerations

For installations in sandy or muddy areas, for tall mounting poles, or for any installation different from the situations described in these instructions, you will need to consult a local structural engineer. Large racks can receive significant wind loads, so a strong mounting pole and foundation is very important. The rack should be sited to receive maximum possible sunlight from sunrise to sunset, winter and summer. Avoid shade from buildings and trees, including shade that may occur in other seasons. The height of the pole should provide adequate ground clearance for the mounted modules.

- **Pole Size** must be a minimum schedule 40 steel pipe, black or galvanized, size by the chart below.
Note: Heavier steel pipe, schedule 80, or schedule 160, may also be used.
- **Pole Height** above finished grade should be 6 feet or more. The largest rack will be at least 12 feet above grade when the rack is tilted to the maximum winter angle.
- **Hole Depth** should be 1/3 of the pole length or greater (1/3 of the pole in ground, 2/3 above ground).
Example: 3' below grade, 6' above grade, total of a 9' pole.
- **Hole Diameter** should be three times the pole diameter, or greater.
- Center the pipe in the hole, and hold it vertical (plumb) using ropes or a temporary frame.
- Fill the hole with concrete, 3000-psi minimum strength. Check the pole for plumb with a level.
- For added strength, the pole may be filled with concrete up to a few feet above ground.
- Allow the concrete to set for a minimum of 36 hours before installing the rack.

Description	Model					
	FX3	FX4	FX6	FX90	FX120	FX168
Minimum Schedule 40 Pipe	3" (3½" OD)	4" (4½" OD)	6" (6⅝" OD)	6" (6⅝" OD)	6" (6⅝" OD)	8" (8⅝" OD)
Min. Pole Height (Above Grade)	72"	72"	72"	108"	120"	120"
Min. Pole Depth (Below Grade)	36"	36"	36"	54"	60"	60"
Min. Recommended Hole Diameter	12" Ø Set in Concrete	14" Ø Set in Concrete	20" Ø Set in Concrete	24" Ø Set in Concrete	24" Ø Set in Concrete	30" Ø Set in Concrete



POLE INSTALLATION DETAIL

ASSEMBLING THE FXL RACK

RECOMMENDED TOOLS

- (2) Adjustable 12" Crescent Wrenches.
- (2) 1-1/8", 15/16", 3/4", 9/16 and 7/16" Wrenches.
- Rubber Mallet (Hammer will scratch the finish).
- Heavy hammer and wooden block (for truss tubes).
- (2) Sawhorses (Not required, but helpful).
- (2) 6ft Step ladders.
- Tape Measure.
- Permanent marker

Step 1: Attaching The Gimbal To The Mounting Pole

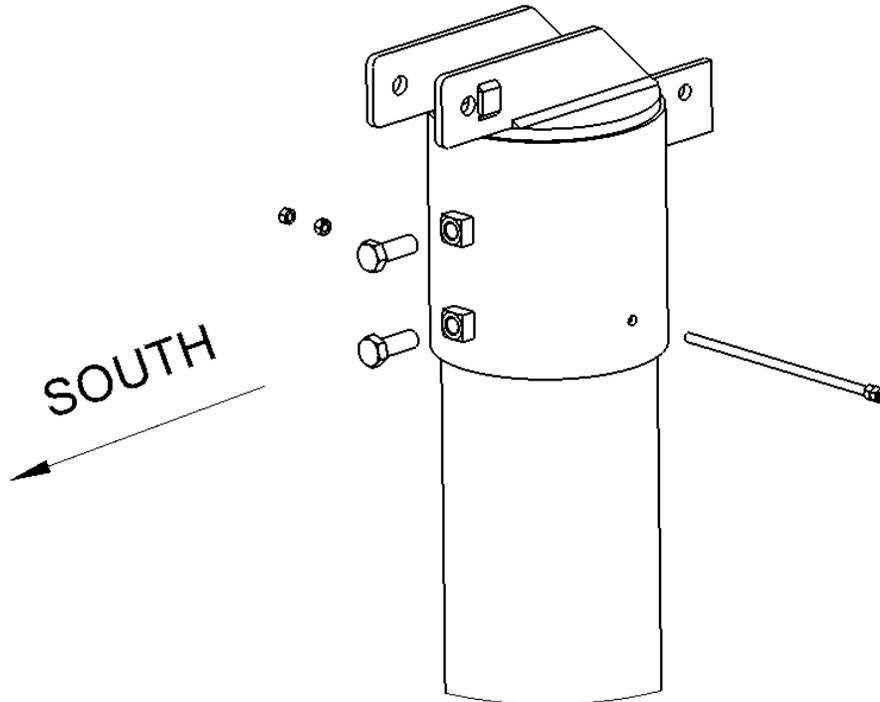


Diagram 1:

- Place gimbal on top of pole.
- Orient gimbal so that 3/4" x 2" bolts are facing **true** south (adjust for magnetic declination).
- Tighten bolts to 75-100 ft-lbs torque in turns to insure both are tight.
- **Option:** a 3/8" carriage bolt can be installed to provide additional resistance to uplift and twist. This may also be a requirement of your permitting authority.
- With gimbal oriented properly (set bolts pointed true south), use pre-drilled 7/16" holes as a guide to drill through the pipe on both sides.
- Slide the long carriage bolt through the gimbal and pipe, using two 3/8" hex nuts and a 3/8" flat washer to fix the bolt in place.

Step 2: Attaching the I-Beam to the Gimbal

Caution - Be careful when working around the rack after installation on the pole. Some of the structural members may be at head level.

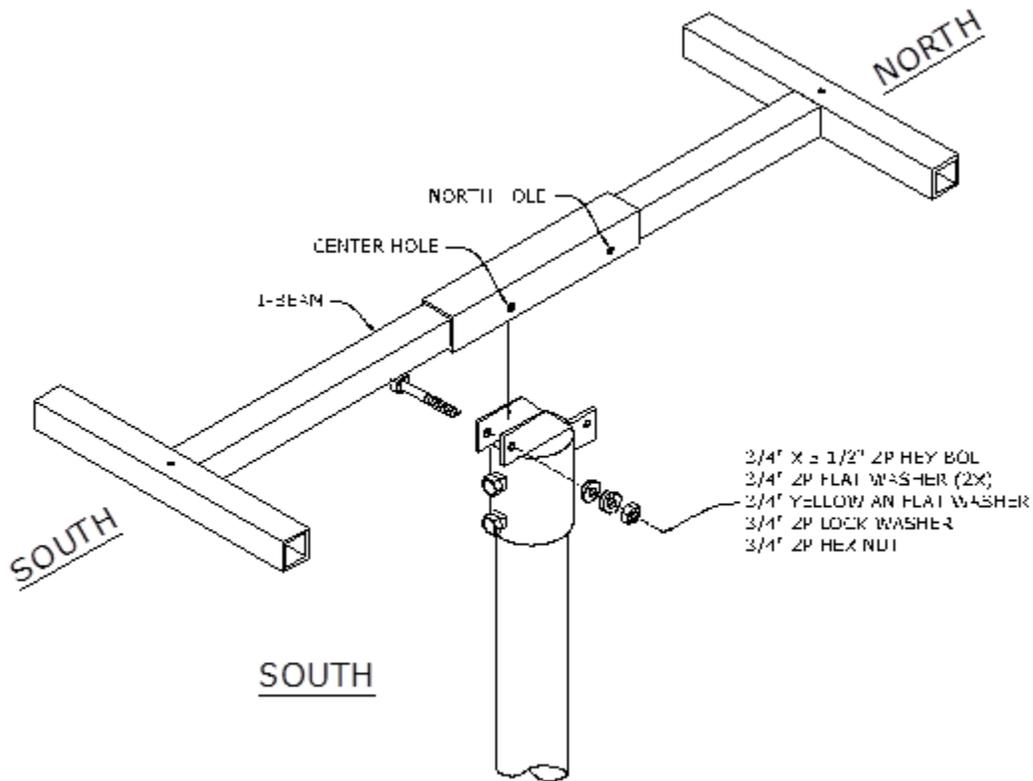


Diagram 2

- Remove the main pivot bolt from top of Gimbal.
- Place I-Beam atop the Gimbal between the two vertical tabs and align center bolt on I-Beam with holes on tabs.
- Insert the main pivot bolt through both tabs and the I-beam, and secure with a hex nut and jam nut. Be careful to not apply too much torque; do not bend the axle support tabs.

Step 3: Installation of the Seasonal Adjustment Arm

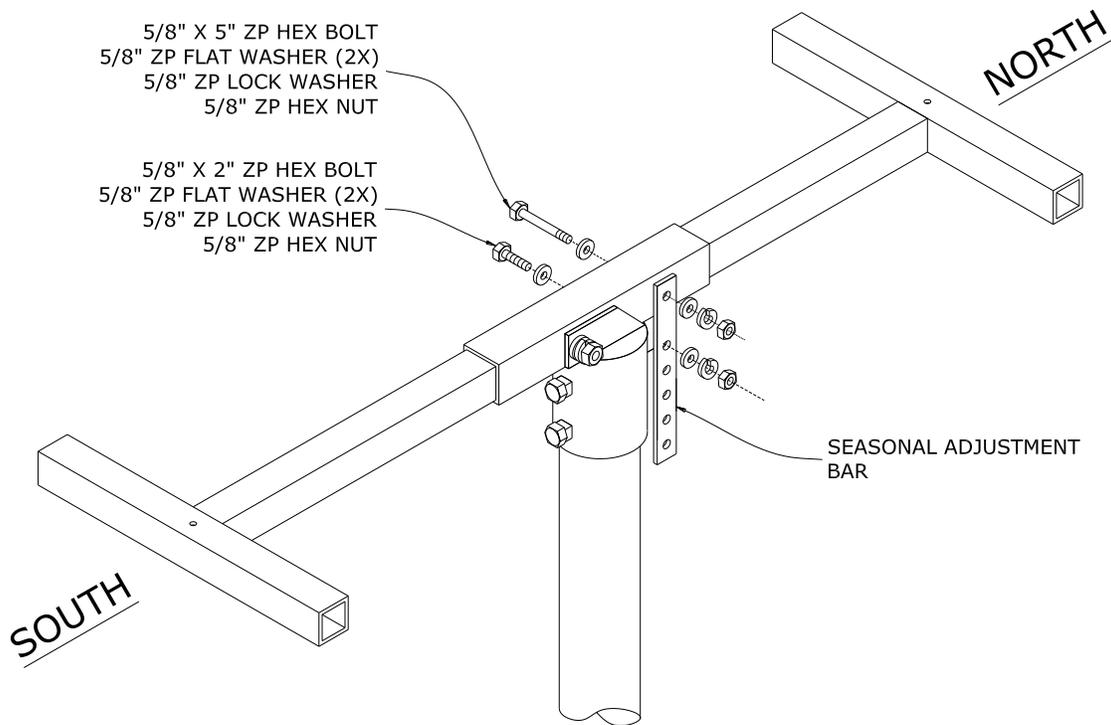


Diagram 3

- Level the I-beam.
- Bolt the seasonal adjustment arm to I-beam through the north hole using the long 5/8" bolt, flat washers on both sides, lock washer and hex nut.
- Bolt the seasonal adjustment arm to the tab on the gimbal using 5/8"x 2" bolt, flat washers on both sides, lock washer and hex nut as shown.
- Recommended bolt torque for the long bolt going through the I-beam is 100-120 ft-lbs. For the seasonal adjustment bar, the recommended torque is 75 ft-lbs.

Step 4: Attaching the Truss Tubes to the I-Beam

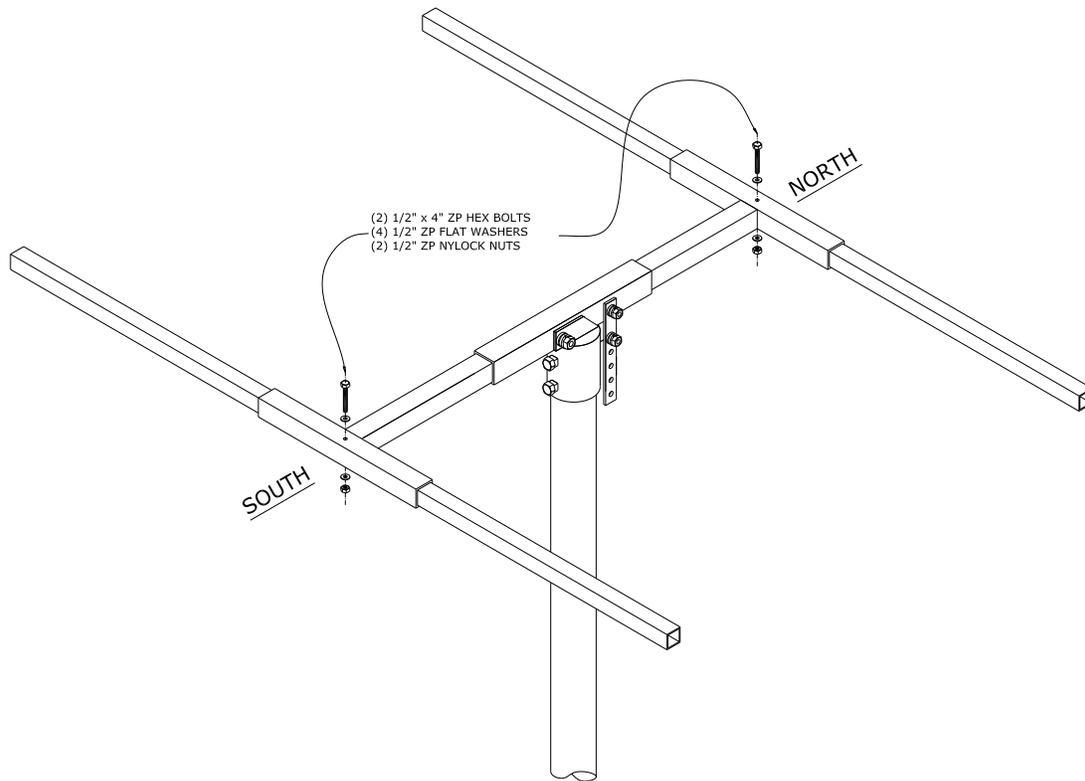


Diagram 4

- Insert truss-tubes into ends of the installed I-beam and slide in until hole in I-Beam aligns with that of the truss-tube (you may need to tap the trusses into the I-Beam with a heavy hammer and wood block).
- Insert the 1/2" bolts and hardware as shown, and tighten.

Step 5: Installation of Truss-Tube Sliders

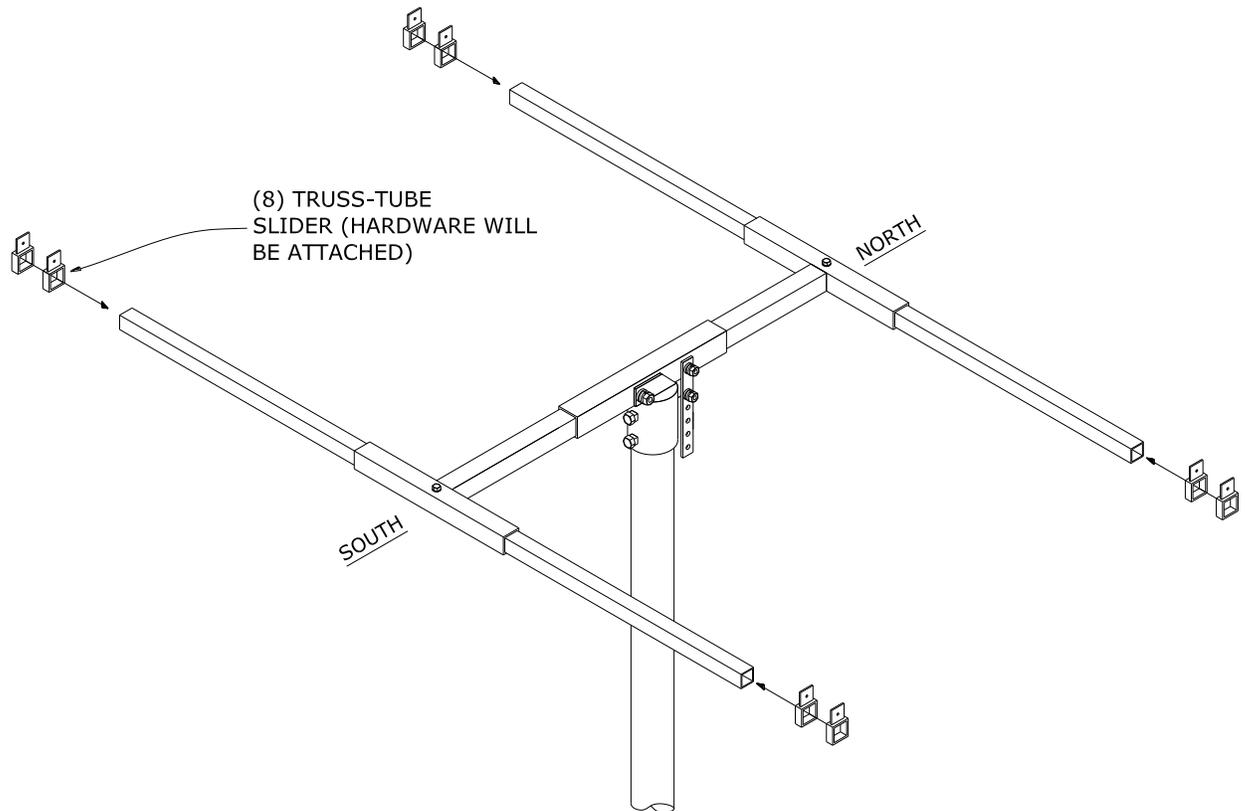


Diagram 5

- Remove all truss-tube sliders from the gimbal box, loosen the set bolts on each truss-tube slider and insert 2 each on each end of the truss-tubes as shown. If your rack has an extra rail set, you will need to install 3 truss-tube sliders on each end of the tubes.
- Do not tighten the set screws until the modules have been mounted.

Step 6: Module-Mounting Rail Installation

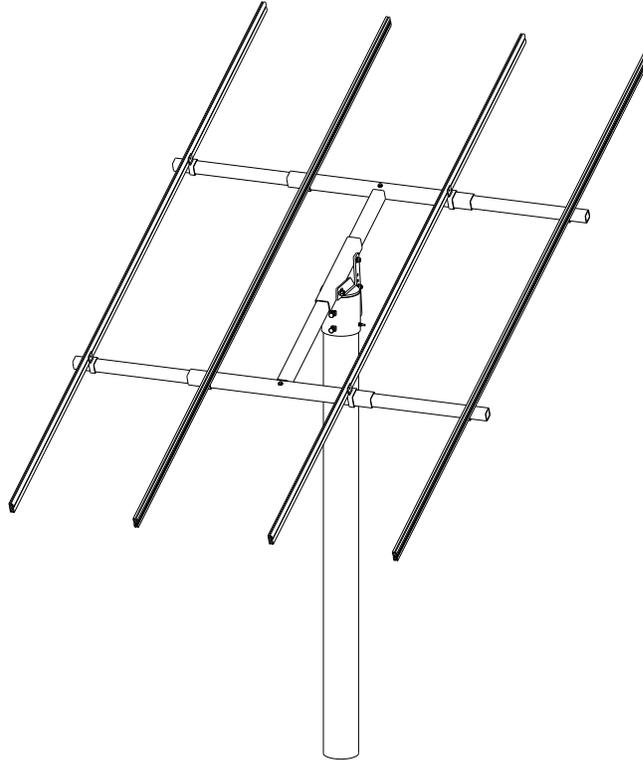
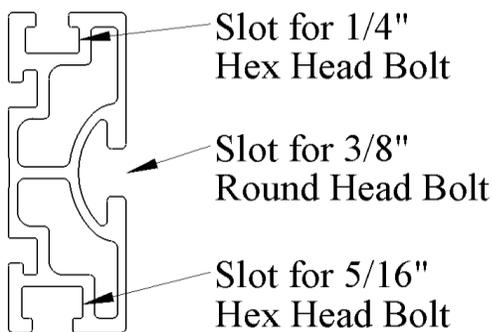


Diagram 6

- The Zomeworks Extruded Rail is designed to be mounted to the sliders using 3/8" round-head, square-neck bolts. Note that the edges of the extrusion are different – one side has a slot to accommodate standard 1/4" hex bolts, and the other 5/16" hex bolts. When installing rails, the slot for the hardware you intend to use must be facing up.



- Zomeworks only provides 1/4" hardware for modules. For specific modules, 5/16" hardware can be supplied by the customer / installer.

In order to mount the extruded rails in the correct spot, use a permanent marker to lay out the position of the rail sliders. This can be done by one of two methods:

Method 1: Find the center of the extruded rail. Mark lines the "half distance" away on both sides of center. Refer to the table below to find the correct distance. These marks will coincide with the centerline spacing of the truss tubes.

RACK MODEL	TRUSS TUBE SPACING	HALF DISTANCE
FXL-090	61 3/4"	30 7/8"
FXL-120	73 3/4"	36 7/8"
FXL-168	74 1/4"	37 1/8"
FXL-168HD	84 3/4"	42 3/8"

Method 2: Look at the layout drawing provided in the instruction packet. There is a dimension showing the distance from the cut end of the extruded rail to the centerline location of the rail slider. With the extruded rail in the correct orientation – the 3/8" slot facing the outside edge of the rail slider, and either the 1/4" or 5/16" slot on top (depending on hardware used) – mark a line.

Pre-Installing The Mounting Hardware

- Now that the extruded rails have been marked, slide the provided module mounting hardware (1/4" or 5/16" x 5/8" hex bolts) into the tracks at the approximate mounting locations. It is only necessary to locate the bolts in the general area of the module frame holes – this will make the installation of the modules easier. Also slide two 3/8" round head bolts to the center of the marked lines.

Installing Rails On Truss Tubes

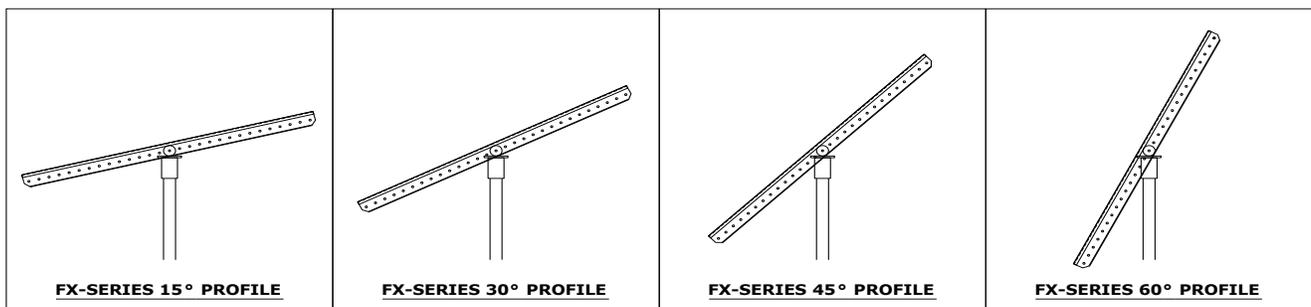
- Using the marked lines as a guide, align the rail to the rail sliders. Install one flat washer and nylock nut. Loosely tighten the nut.
- In the process of installing the rails, use a measuring tape to verify that the rails are square and parallel with the rack.
- The rack with module-mounting rails installed should look similar to Diagram 6.

Step 7: Solar Module Installation

- The truss-tubes and rails of an FXL rack are usually cut to length at the factory to accommodate a specific module and orientation as specified in the customer's order, and are unlikely to accommodate modules in any other orientation. If a module layout diagram was provided, the modules should be mounted according to this drawing.
- There are no spacing requirements between panels or about the center of the I-Beam; the only requirement is that the modules be center about the I-Beam to distribute the load evenly between East and West sides.
- When all modules have been mounted and centered, tighten the set bolts and jam nuts on the underside of each truss-tube slider.

Step 8: Seasonal Adjustments and Final Instructions

- For maximum solar gain, adjust the angle of your Rack at least twice a year in spring and fall. Setting the Seasonal Adjustment Arm so the Rack faces the mid-morning sun. Your settings will vary according to your location and latitude. See diagram below for guidelines.



- **Re-check all nuts & bolts for tightness.**

IMPORTANT NOTES TO REMEMBER:

1. The photovoltaic modules should be centered and mounted evenly as per the instructions and provided drawings.
2. The FXL-168 fixed rack should be in a location that maintains a clear line-of-sight to the sun throughout the day, and during different seasons. Remember that the sun's position in the sky changes from season to season.
3. To maintain optimum sun exposure you may want to adjust your FXL-168 fixed rack for the winter & summer seasons. Use the seasonal adjustment arm. This will vary with your location's latitude.

MAINTENANCE

1. Paint touch up will be necessary to prevent rusting (Rustoleum™ is recommended).
2. Retighten any nuts or bolts that aren't tight.

ZOMEWORKS FXL-SERIES

Limited Warranty

Zomeworks Corporation guarantees, to the original owner, its fixed racks against defects in materials and workmanship for TEN YEARS from date of purchase. This warranty is limited to the repair or replacement of the rack in compliance with the instructions provided by Zomeworks.

Some problems can be solved with a simple on site adjustment. Please contact Zomeworks Corporation at the address and phone number below before returning your product. You must have an RMA number to return the product for warranty repair. If possible, return only the parts that are defective or damaged. Reuse your original packing material, if it's available, or call the factory for further instructions.

IT IS THE OWNER'S RESPONSIBILITY TO CHECK FOR DAMAGED OR MISSING PARTS IMMEDIATELY UPON RECEIPT OF THE FIXED RACK. Freight claims are time sensitive and require immediate notice. If the packaging is damaged, write this on the receipt (freight bill) and have the driver initial this. Use this information to contact your freight carrier when damage is noticed.

Upon receipt of a defective part(s), freight pre-paid, Zomeworks will determine whether the defect was caused in manufacturing. If so, the part(s) will be repaired or replaced at no charge to the customer, and will be returned freight pre-paid. If the damage is not a manufacturing defect, the factory will contact the customer before any repairs are made. Original owners should contact their dealer if an immediate replacement part(s) are needed. Individuals contacting Zomeworks Corporation desiring immediate replacement part will be required to provide Zomeworks Corporation with a valid credit card number to be charged for the replacement part(s). Zomeworks Corporation will credit the valid credit card upon receipt of the warranted returned part(s) from the individual.

This warranty does not cover rusting of the steel due to a corrosive environment (such as salt air). Standard fixed racks are made of aluminum and painted mild steel and will require maintenance. It is the owner's responsibility to maintain the paint on the fixed rack in order to protect the steel against corrosion. For corrosive environments, Zomeworks Corporation can manufacture fixed racks with an epoxy primer.

Limitations on Warranty

The above ten-year warranty is the only warranty and remedy provided by Zomeworks to user. Zomeworks disclaims all implied warranties of merchantability and fitness. In no event shall Zomeworks be liable for consequential or incidental losses or damages under any theory of liability, except to the extent that this limitation is found to be unenforceable under applicable state law. Some states do not allow the exclusion or limitation of incidental or consequential damages, so this exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights that vary from state to state.

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