

ZOMEWORKS

CORPORATION

FX2 and FX3 POLE TOP RACKS

Product Manual

Rev. July 2018



1011 Sawmill Road NW, PO Box 25805, Albuquerque, NM 87125 USA

(505) 242-5354

(800) 279-6342

FAX (505) 243-5187

E-mail: zomework@zomeworks.com

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 limit, various array shapes are possible, but the maximum area is a limit that must not be exceeded.

It is important to note that racks also have a max crossbar width and max rail length, but 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 one 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 X 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 FX2 and FX3

The FX2 and FX3 racks are the smallest and simplest of Zomeworks Fixed Racks. They hold a single pair of rails on an adjustable-width crossbar, and have adjustable tilt and azimuth that can be easily changed seasonally. They are very similar and share some of the same components. The only essential difference is the FX2 gimbal fits on a 2" pole, and the FX3 gimbal fits on a 3" pole. Both models use the same size U-bolts to secure and rotate the cross-bar, and both use the same crossbars and rails.

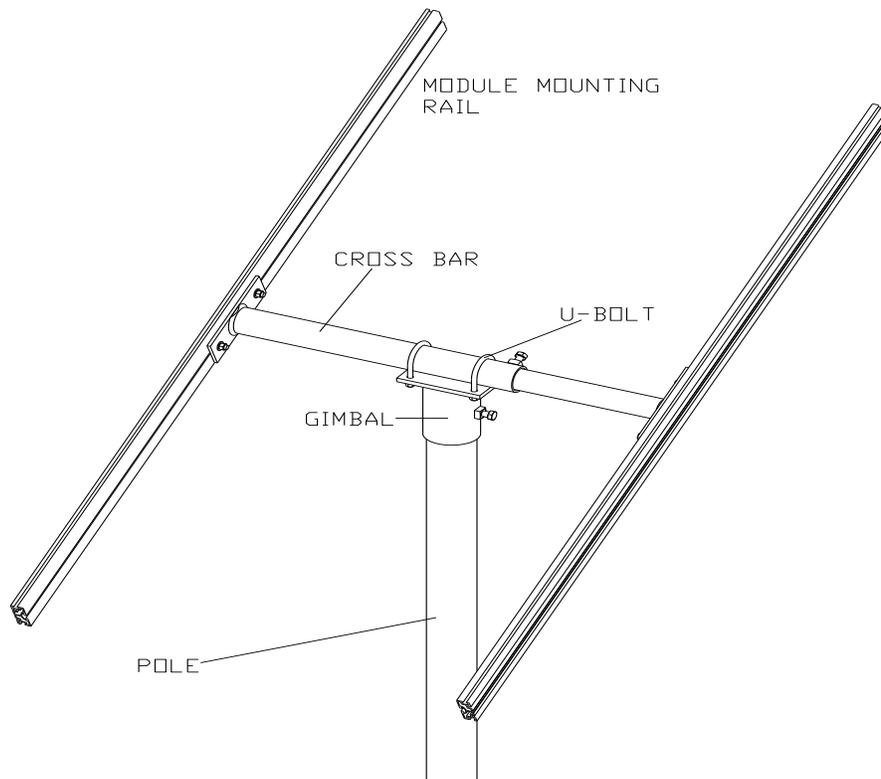
The extruded aluminum module rails, named the Alex™ rail, are the same as used for all Zomeworks racking products, both fixed racks and trackers. This rail has two slots to accept either 1/4" or 5/8" bolt-heads to use with the module's mounting holes. The slots are also compatible with most types of after-market top clamps.

Model Numbers are coded to describe the size of the pole & gimbal, and size of the cross bar.

1st number: FX2 or FX3, means the nominal size in inches of the gimbal, and the pole it fits on. It also roughly correlates with the max module area, in square feet.

2nd number: Size of the crossbar, coded as S, L, or XL. The crossbars are adjustable in width to accommodate the mounting-hole spacing of any module.

Crossbar Size	Tube Length	Module Hole-Spacing (Apart)	
		Min	Max
S	15"	17"	to 26"
L	22"	24"	to 40"
XL	30"	32"	to 55"



Choosing Crossbar Size: The crossbar for the FX2 and FX3 is a two-piece adjustable unit, consisting of two pipes, one that slides inside the other. The minimum overlap is 6", to provide sufficient rigidity. The crossbars are named for the length of a single pipe: for instance a crossbar with two 15" pipes is called a 15" crossbar set. The two bars together (accounting for pipe overlap and rail width) can accommodate hole-spacing up to 26" wide. Using the chart above, choose a crossbar whose adjustment width will accommodate the **distance apart** of your module's mounting holes. Specify the cross bar as S, L, or XL appended to the model number.

Choosing Rail Length: Modules are normally intended to be mounted in Landscape orientation, but may be in Portrait if needed. Choose a length of rail long enough to span the vertical dimension of the modules, including 1/4" spacing between each module, plus at least 1/4" for some spare at both ends. Round up to the next whole inch.

A **High Wind Brace** is available for the FX3. It does not increase the design wind load (90mph) but it does help stabilize the array and prevent it from slipping out of adjustment in areas with constant high winds, and decreases metal fatigue from vibration.

FX2 & FX3 Size Selection & Ordering

Specify a choice for each of the following:

- **Gimbal & Crossbar Base Kit:** Chosen according to total module area.
- **Rails:** Priced by the foot, and cut to your specification. Order 2 rails for each Gimbal kit. Let Qty = total feet of all rails, and write-in the number of rails and length of each. Round up to the next inch.

Example: Assume an installer wants to mount two GenPro modules. Its dimensions are 62.2" wide by 31.8" tall, in landscape orientation. The mounting holes are 31.5" apart.

Multiply the module's length by width, and divide by 144 to convert to feet. The module's area is 13.7 square feet, times two modules is 27.4 square feet. By the Sizing Chart on page 2, this is too large for an FX2, so we choose the **FX3**, which can hold up to 30 square feet.

The mounting holes in landscape are 31.5" apart, too large for the S crossbar, but will fit within the adjustment range of the **L** size crossbar. So the base kit to choose is the **FX3-L**.

The two modules stacked will be 31.8" x 2 = 63.6" high, plus 0.25 for spacing, plus 2 x 0.25 for the ends, is 64.35". Rounding up to the next inch, you need 65" rails. (This is well within the FX3's rail length limit of 117".) Rails are priced by the foot, so the total feet of rail is 65" / 12 = 5.42 ft each, times two rails is 10.83 ft. On your order, call out the total Qty of rail, and write-in the number of individual rails and the length of each.

Bolts and Flange Nuts are included in the price of the kit, but we need to know how many to include. Please call out the number of modules you be using, so we can include the right number of mounting bolts.

The itemized list on your sales order should look like this:

<u>QTY</u>	<u>Part#</u>	<u>Description</u>
1	FX3-L	FX3 Gimbal, with 22" Telescoping Crossbar (26" to 40")
10.82 ft	Alex Rail	Alex Rails (2 rails, cut 65" each) (For two GenPro modules)

FX2 and FX3 Parts & Hardware List

Ships in one box, 10" x 7" x (rail length), total weight
approximately 50 lbs (weight depends on rail length)

Zomeworks Part #	Description	Qty	Packaged Location	✓
	Gimbal, one of:			
AS-Gimbal-FX2	2" Gimbal Assembly, <i>or</i>	1	main box	
AS-Gimbal-FX3	3" Gimbal Assembly			
RM-BLT-Z15207-FR	1/2"-13 x 1 1/4" Yellow Zinc-Plated Bolt (one on FX2, two on FX3)	1 or 2	threaded into gimbal	
	Crossbar Assembly, one of:			
AS-CROSSBAR-S	Standard Crossbar	1	main box	
AS-CROSSBAR-L	Long Crossbar	1	main box	
AS-CROSSBAR-XL	Extra-Long Crossbar	1	main box	
RM-BLT-Z15207-FR	1/2"-13 x 1 1/4" Yellow Zinc-Plated Bolt	1	threaded into cross-bar	
	Alex extruded aluminum mounting rails	2	main box	
	Gimbal To Crossbar Fasteners			
RM-BLT-42036-FR	3/8" x 2 1/2" Zinc-Plated U-bolt	2	rack hardware bag	
RM-WSH-Z33082-FR	3/8" Zinc-Plated Flat Washer	4	rack hardware bag	
RM-WSH-Z33622-FR	3/8" Zinc-Plated Spring Lock Washer	4	rack hardware bag	
RM-NUT-36106-FR	3/8"-16 Zinc-Plated Hex Nut	4	rack hardware bag	
	Crossbar To Rail Fasteners			
RM-BLT-Z21357-FR	3/8"-16 x 1" Zinc-Plated Short-Neck Carriage Bolt	4	rack hardware bag	
RM-WSH-Z33082-FR	3/8" Zinc-Plated Flat Washer	4	rack hardware bag	
RM-NUT-N37024-FR	3/8" Zinc-Plated Nylock Nut	4	rack hardware bag	
	Module Mounting Hardware (times number of modules)			
AS-MODHRDW-FX	1/4" Module Hardware Kit (Contains 1 bolt & 1 nut. Rack includes 4 per module, plus 1 extra.)			
RM-BLT-S70002-FR	1/4" x 5/8" Stainless Steel Hex Bolt	4 per module		
RM-NUT-S01929150-FR	1/4" Stainless Steel Hex Flange Lock Nut	4 per module		

Before assembling your rack, use the above list to check that you have all your parts.

In the event of missing parts, contact: **ZOMEWORKS Customer Service at 1-800-279-6342**. When calling, please have available your sales order number, date of purchase, and the dealer's name you purchased from.

POLE INSTALLATION

IMPORTANT: *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' steel pipe.
- **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	
	FX2	FX3
Minimum Schedule 40 Steel Pipe	2" (2-3/8" OD)	3" (3-1/2" OD)
Minimum Pole Height (Grade Level)	5 Feet	6 Feet
Minimum Pole Depth (Below Grade)	2.5 Feet	3 Feet
Minimum Recommended Hole Diameter	12" Diameter Set pipe in concrete	12" Diameter Set pipe in concrete

POLE INSTALLATION DETAIL

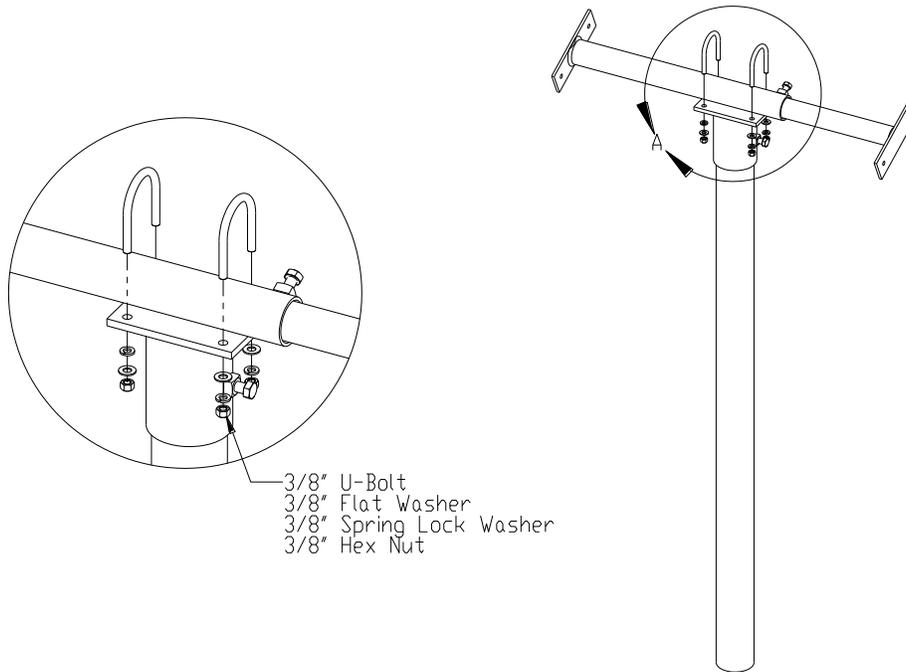
ASSEMBLY INSTRUCTIONS

RECOMMENDED TOOLS

- Two 9/16" and 7/16" open end, box or ratchet and socket wrenches.
- 3/4" wrench
- Tape measure.

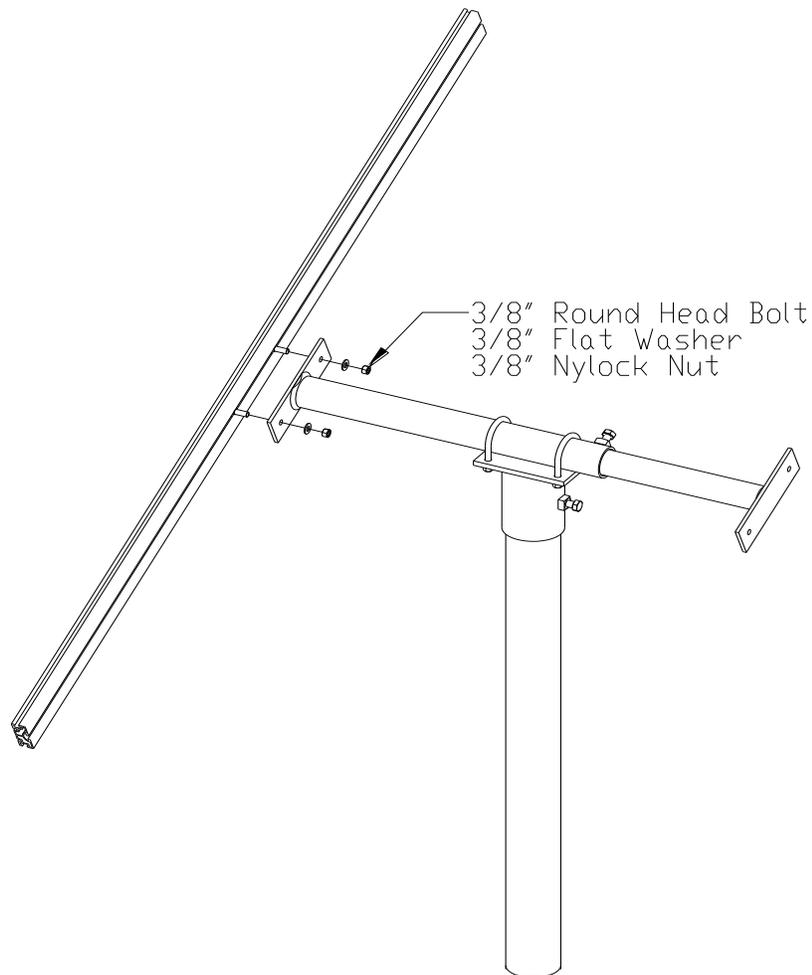
Caution - Be careful when working around the rack after installation on the pole. Some of the structural members may be at head level.

Mounting the Gimbal and the Cross Bar



- Set the gimbal on top of pole with the two set-bolts facing roughly north. Tighten the bolts hand-tight, enough to keep the gimbal from moving while working. It will be moved again later.
- Mount the pre-assembled crossbar to the gimbal using provided U-bolts.
- Take care to maintain set bolt access. Leave the crossbar width set-bolt loose for now.

Mounting the Module Rails



- Slide two carriage bolts into the mounting module rails, close to the center. Fit the bolts through the holes on the end plates of the crossbar, center the rail as shown, and fasten the rail using flat washers and nylock nuts.
- Note that the rail has two slots, one for 1/4" and the other for 5/16" module mounting bolts. The slot that matches the bolts you are planning to use should be on top. (All of our racks are shipped with 1/4" hardware unless otherwise requested.)
- Adjust the width of the crossbar & rails to fit your modules by loosening the crossbar set bolt, and slide the crossbar sections in or out. Sight across the rails to be sure they are parallel. Tighten the set bolt.
- Loosen the U-bolts, center the crossbar/rail assembly on the gimbal, and tighten the u-bolts just enough to keep the rack from moving while you finish mounting the modules.

Mounting the Modules

- Mount each module using (4) stainless-steel bolts and flange nuts, by sliding the head of the bolt into the top rail slot, fit the bolt shaft through the module's mounting holes, and secure with a flange nut inside the frame.
- Adjust the modules for even spacing and tighten the bolts.

Final note: the rack may be assembled on the ground and hoisted into place, or it may be assembled on the pole.

Adjusting Azimuth and Tilt

Azimuth, in almost all situations, should be set due south.

For **Tilt**, there are various options. (Note: tilt is the angle of the array as measured from the ground up. Zero degrees is lying flat, and 90 degrees would be standing up vertical. Tilt may be measured with an in-expensive inclinometer, such as used by roofers.)

If the array is to remain fixed in place without seasonal adjustments, the best performance is obtained when the tilt is set equal to the latitude of the site. This gives good performance generally throughout the year.

However, better performance may be obtained if the user adjusts the rack twice a year, to the optimum angle for the season. For winter, adjust the tilt to **latitude plus 15°**, and in summer adjust tilt to **latitude minus 15°**. Change the tilt on the spring and fall equinoxes.

To adjust the tilt and azimuth:

- Loosen the gimbal set screw, face the array due south by rotating the gimbal on the pole. Tighten the set bolt permanently.
- Loosen the cross bar U-bolts, adjust the tilt for the desired angle. Tighten the U-bolts. (This adjustment might be changed seasonally.)

ZOMEWORKS FX-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 fixed racks in compliance with the instructions provided by Zomeworks.

Some problems can be solved with a simple on-site adjustment. Please contact Zomeworks 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 it. Use this information to contact your freight carrier when damage is noticed.

Upon receipt of defective parts, freight pre-paid, Zomeworks Corporation will determine whether the defect was caused in manufacturing. If so, the parts 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 parts are needed. Individuals contacting Zomeworks desiring immediate replacement part will be required to provide Zomeworks with a valid credit card number to be charged for the replacement parts. Zomeworks will credit the valid credit card upon receipt of the warranted returned parts 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 the fixed racks with an epoxy primer.

Limitations On Warranty

The above ten-year warranty is the only warranty and remedy provided by Zomeworks Corporation to the 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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