

## M2 Antenna Systems, Inc. Model No: 222XP40



### **SPECIFICATIONS:**

Model	.222XP40
Frequency Range	.222 To 223.5 MHz
*Gain, V & H	.16.8 dBd (18.9 dBi)
Front to back	.20 dB Typical
Beamwidth	.E = 19° H = 21°
Feed type	.Folded Dipole
Feed Impedance.	.50 Ohms Unbalanced
VSWR	.1.2:1 Typical
Input Connector	."N" Female

Power Handling	.1.5 kW
Boom Length / Dia	.35' / 1-1/2",1-1/4",1",3/4"
Maximum Element Length	.26-5/8"
Turning Radius:	.240" (20')
Stacking Distance	.132" to 144"
Mounting	.H or V
Mast Size	.2" Nom.
Wind area / Survival	.3.0 Sq. Ft. / 100MPH
Weight / Ship Wt	.15 Lbs. / 18 Lbs.

### XP = cross polarized; H = horizontal; V = vertical; EME = Earth-Moon-Earth; \*Subtract 2.14 from dBi for dBd

### FEATURES:

The 222XP40 is the hot, new dual polarized Yagi specifically for EME and long haul terrestrial communications. It is our latest design using computer techniques to allow maximum gain and patterns in both the horizontal and vertical planes. The vertical elements have been shifted  $\lambda/4$  in front of the horizontal set to allow circular polarization if needed. This means four possible polarization modes with one antenna! Two antennas stacked are a great tropo and EME package and four or more are amazing allowing Even small Yagi EME contacts using CW or JT65B. Structurally the 222XP40 is sturdy and clean. Elements are 3/16" 6061-T6 aluminum rod mounted through the boom on UV stabilized "button" insulators. The boom is a full 1-1/2 inch diameter in the middle 3 sections tapering through two 1-1/4 inch sections to stiff 1" and a short 3/4 inch front tip. The main 'N' connectors are O-ring sealed to the CNC machined block and 4:1 balun connectors feature triple seals. The internal module connections are sealed in a space-age silicone gel. See our other accessories including preamps, power dividers and custom made phasing lines.

# 222XP40 ASSEMBLY MANUAL

- TOOL REQUIRED FOR ASSEMBLY: screwdriver, 11/32 nut driver or wrench, 7/16" and 1/2" socket or end wrenches, measuring tape.
- Start by laying out the boom sections using the DIMENSION sheet as a guide. Use the appropriate 8-32 screws and locknuts as shown to join the sections. To make the assembly easier, support the completed boom about waist high on bucks, tables, etc. Or even better, drive a 1-1/2" to 2" pipe into the ground and temporarily attach boom using the boom to mast plate and U-bolts at the balance point shown on the DIMENSION SHEET.
- 2. Lay out the 3/16" elements by length and position as shown the DIMENSION sheet. Start with the REFLECTOR (26.188") element. Balance across finger to find center and push on a black button insulator to about 1/2" from center. Push the element through the holes 1/2" from the rear of the boom and install the second button, snugging it up into boom. DO NOT BOTHER WITH ACCURATELY CENTERING the element at this time and DO NOT INSTALL the stainless steel internal locking "KEEPERS" yet. This is easier to do after all the elements are installed in the boom.
- 3. Install the 3/16" ROD DRIVEN ELEMENT as you did the reflector. Then continue with the installation of the DIRECTORS. *Note that the Director Elements do not consistently diminish in length from rear to front, so pay close attention to length and position. D3 AND D17 are on different boom diameter sections so their length is different also.*
- 4. Now begin centering the elements. Use a tape measure to EQUALIZE the amount the element sticking out on each side of the boom. Once you have all the elements centered, sight down the element tips from the rear comparing each side. Look for any obvious discrepancies and correct if found.
- 5. Begin installing the stainless "keepers." Use thumb and index finger to hold a keeper over end of the 3/8 x 3" push tube (keeper dished into tube). Hold the element firmly and start the keeper onto the rod by applying pressure with the push tube. Push the keeper until up tight against the button insulator (Locking pliers, *lightly* clamped up against opposite button insulator will help maintain center reference and keep you from pushing the first keeper too far). Repeat for the opposite side. Continue installing keepers until all elements are locked in place.



- 6. Now loosen the 1-1/2" U-Bolts on the boom to mast plate and rotate the boom 90 degrees and repeat steps 2 through 5 for the VERTICAL set of elements.
- 7. Mount the DRIVEN ELEMENT BLOCK ASSEMBLIES to the boom using 8-32 X 1-1/4" screws. Orient the block with the 'N'-connector facing towards the rear of the antenna and balun 'F'connectors facing towards the front.
- 8. For the two DRIVEN ELEMENT BLOCK ASSEMBLIES, install a gold 3/8" SEAL NUT all the way onto BOTH 'F'-connectors, with the black Neoprene seal facing out. Attach the balun to one of the 'F'-connectors on the block, and connect the other side to the other 'F'-connector. Now tighten the connectors gently using a 7/16" end wrench. Once the connectors are tight, back the Seal Nuts out and finger-tighten firmly up against the face of the connectors (or tighten very gently with

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1/2" end wrench). Secure the balun close to the boom with a nylon cable tie in such a way so that it's snug but not crushing or kinking the coax.

- 9. Install the 8-32 x 1/4" set screws (internal Allen head tool supplied) into the four SHORTING BARS. Slide the bars onto the 3/16" rod driven element tips and then onto the Driven Element Block Rods. Position the Shorting Bars as specified on the DIMENSION SHEET: the distance given is between the outer edge of the Driven Element Block and the inner edge of the Shorting Bar. Align the bars and rods with each other and tighten the setscrews.
- 10. If you have not already done so, attach the boom to mast plate to the boom. It is normally mounted at the balance point, as shown on the DIMENSION SHEET. Use two 1-1/2" U-bolts and the stainless nuts and lock washers provided. DO NOT OVER TIGHTEN. 2" U-bolts are provided for mounting the antenna to your **NON-CONDUCTIVE** mast.

"XP" Yagis require the coax cables exit the boom just at the rear reflector and at right angle to the rear reflector. When mounting two antennas side by side the rear reflectors must be vertical so the cables can exit the boom horizontally. M2 offers a 'T' brace kit for two or more antenna arrays. It supports the cables from each XP Yagi and routes the cables back to the main crossboom. The two phasing or feed line represents significant weight it is best to have them, or a temporary equivalent, attached and hanging from the rear of the boom when positioning the boom to mast plate.

#### 11. OVERHEAD GUY SYSTEM

Locate the  $3/8 \times 24^{\circ}$  fiberglass rod, the three fiberglass rod mast clamp blocks, the fiberglass mast clamp flag and the remaining four 8-32 x 1-1/4" screws and locknuts. Attach two fiberglass rod mast clamp blocks to the boom to mast plate with two 8-32 x 1-1/4" screws and locknuts as shown below in the figure. Insert the  $3/8 \times 14^{\circ}$  fiberglass rod into the slot formed by the two blocks and tighten the two locknuts. Now assemble the remaining fiberglass rod mast clamp and mast clamp flag with two 8-32 x 1-1/4" screws and locknuts. Slide the assembly onto the fiberglass rod as shown below in the figure and tighten the two screws.



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- 12. Using the Dimension Sheet as a guide, install the two 1/4" eyebolts into the **top side** of the 1" front and rear boom sections. Align the eyes with the boom and secure with 1/4-20 locknuts.
- 13. Install the two turnbuckles into the fiberglass rod mast clamp assembly as shown above in the figure. Adjust threads until just one or two show inside turnbuckle body. Attach one end of the KEV-LAR cord to the rear eyebolt by taking two wraps through the "eye" and finishing with two halfhitches or a square knot. Adjust to leave 2" to 4" of cord after knots. Attach the other end of the cord to the front eyebolt in the same way. Equalize excess cord at the fiberglass riser and cut. Take rear cord end and make two wraps through rear turnbuckle eye, then pull line taut until the rear boom end levels and knot as above. Repeat for front cord and turnbuckle. If you cannot straighten the boom by adjusting the turnbuckles, open the turnbuckles again as before with no threads showing inside the turnbuckle body. Loosen the KEVLAR knots and pull taut again, perhaps even lifting the boom ends slightly. Re-tie the knots and final adjust the boom to level with the turnbuckles. Use solid #12 awg copper wire or equivalent to "safety wire" the turnbuckles to prevent loosening. **NOTE:** Kevlar has a core of Arimid fiber with a woven jacket of Dacron for protection from abrasion. Arimid fiber does not stretch and both materials are UV stabilized for decades of intense sun with no degredation. They are also impervious to salt spray and acid rain. Only fire will make KEVLAR fail. Philistran is another type of Arimid fiber guy cord and can be used interchangeably in this application. (It just costs more).

#### 14. MOUNTING INFORMATION

(M2 offers 2" X 1/4" wall **FIBERGLASS TUBE** in various lengths and we make a wide range of "H" frames for both "Xpol" and linear Yagis).

MOUNTING THE 222XP40 ON A METALLIC MAST WILL GREATLY DEGRADE ITS PERFORMANCE IN THE PLANE OF THE MAST, THEREFORE THE ANTENNA SHOULD BE MOUNTED ON A NON-CONDUCTIVE SUPPORT EXTENDING FROM THE ANTENNA AT LEAST 36". MOUNTING THE ANTENNA WITH THE ELEMENTS IN AN "X" CONFIGURATION WITH REFERENCE TO A METAL MAST, DEGRADES PERFOMANCE LESS, BUT IN BOTH PLANES, NOT JUST ONE.

REMEMBER ALSO THAT THE FEEDLINES MUST EXIT AT THE REAR OF THE ANTENNA! If you have not already done so, install your antenna on your non-conductive mast. Supporting the antenna at the boom-to-mast plate will tension the KEVLAR cord and will allow turnbuckle adjustment for a straight boom. Cut any excess length of cord, leaving just 2" to 4". To prevent fraying, melt the ends with a match or torch and tape back to main line. NOTE: You may notice that the boom tips may drop slightly beyond the eyebolts. This is normal and in no way will affect the performance of the antenna.

#### 15. STACKING INFORMATION

Optimum stacking for two or more 222XP40 antennas either horizontally or vertically is 144" (12 feet / 3.65m) from boom center to boom center. This yields the maximum theoretical gain, with clean patterns. Reduced stacking distance of 132" is acceptable. When stacking 4 or more antennas use the same figure, 144" when stacking high or wide. Be sure all antennas are oriented so the HORIZONTAL and VERTICAL driven element blocks are on the SAME SIDE of the boom and NOT MIRROR IMAGE to each other. M<sup>2</sup> also offers low loss LMR400 phase lines and 2 or 4 port power dividers, depending upon your system requirements.

If you need any additional information or HELP with your system, **PLEASE CALL US!** We also have Hints and tips on our Web Site

### THIS COMPLETES THE ANTENNA ASSEMBLY.

# **222XP40 DIMENSION SHEET**



# 222XP40 PARTS & HARDWARE

DESCRIPTION	QTY
BOOM, 3/4 X .049 X 33" ALUM. TUBE	1
BOOM, 1.0 X .058 X 57" ALUM. TUBE	1
BOOM, 1.0 X .058 X 60" SOE ALUM. TUBE	1
BOOM, 1-1/4 X .058 X 60" SOE, ALUM	1
BOOM, 1-1/4 X .058 X 54" SOE, ALUM	1
BOOM, 1-1/2 X .058 X 57" SBE, ALUM	1
BOOM, 1-1/2 X .058 X 60" SOE, ALUM	2
ELEMENT, 3/16 X SEE DIMENSION SHEET	40
λ/2 BALUN, RG6-U	2
'T' MATCH BLOCK ASSEMBLY	2
BOOM TO MAST PLATE, 3/16 X 4 X 6"	1
SHORTING BAR (M2ASB0090)	4
KEVLAR, 1/8" X 30 FT	1
NYLON TIE, 5" BLACK	4
ALLEN WRENCH, 5/64"	1
PUSH TUBE, 3/8" X 3" ALUM	1
ASSEMBLY MANUAL	1

### HARDWARE BAG #1

U-BOLT AND CRADLE, 2"	2
U-BOLT AND CRADLE, 1-1/2"	2
NUT, 5/16-18 SS	4
LOCKWASHER, 5/16" SPLIT RING SS	4
TURNBUCKLE, 1/4" X 3-1/4"	2
EYEBOLT, 1/4" X 4"	2
NUT, 1/4-20 SS LOCKING	2

## HARDWARE BAG #2

NUT SEAL	4
BUTTON INSULATOR, 3/16" BLACK POLY	80
KEEPER, 3/16" SS	80
SCREW, 8-32 X 1-3/4" SS, PHILLIPS	8
SCREW, 8-32 X 1-1/2" SS, PHILLIPS	4
SCREW, 8-32 X 1-1/4" SS, PHILLIPS	8
SET SCREW, 8-32 X 1/4" SS	8
LOCKNUT, 8-32 SS	18

## HARDWARE BAG #3 (OPTIONAL)

VERT. SUPPORT ROD, 3/8 x 24" FIBERGLASS ROD1	
CLAMP BLOCK, 1/4 x 1" ALUM	3
CLAMP BLOCK FLAG, 1/4 x 1-1/2" ALUM1	