Bosma Startracker Series EM11 EQ Mount

Part One

By: Mark Nordle

Astronomics landed at NEAF, and brought along a new mount for the masses to see and buy. This report, in 2 parts, will dig deep into it and see just what makes it tick. Is it right for the masses? Are the details done right? Can it carry its rated payload? Let's tear it down and find out.

SPECS

According to published specs, and speaking with Bosma reps at NEAF, the payload is 25 pounds. The list price is $899.

It is equipped with Ioptrons Gotonova hand controller and motor drives. An integrated polar finder, and 7 pound counterweight is provided. A 120v 7A power supply that gives 12v @ 1.25 Amps, with center positive feed is provided. A cigarette lighter plug cord for field use is not.

Scope mounting is the standard Vixen saddle style with the regular bolt/safety arrangement. The tripod comes with 2" adjustable legs, and extends from 28 1/2" to a length of 43", putting the saddle from approx. 41" to 54 1/2" high. The leg ends comes with moveable flat feet on ball ends to accommodate the ground beneath it. The counterweight shaft is stored inside the head like the Atlas, but is larger in diameter. One locking screw holds the shaft in position on the head.

The head, hand controller, counterweight, power cord, and tripod come shipped in 2 boxes. Opening up the mount head box we find that the head assembly, counterweight, controller, and power cord comes shipped in its own case. Case dimensions are 16 ½ long x 12 ¼ high and 6 ¼ wide.

The inner lid uses black egg carton foam found in most cases; the bottom uses what looks like 2 individual pieces of white molded medium density foam. The bottom is one piece, and the molded section is glued to the bottom piece, forming the padded cavities. The total packed case weight is 25 Lbs.

The tripod box contains the tripod and tripod spreader plate in another box.

Specs from the website:

Intellectualized auto-guiding celestial objectives
32-Bit RISC Processor
Over 130,000 objects database, with 256 customized charts to be connected through RS232 serial port. (NOTE: this connection has been updated to USB instead of RS232)
High precision 180-tooth gears
More than 10pcs of ball bearings applied ensuring smooth tracking
9-speed dual axis align up to 3.5° per second
Encoder dual axis servo motor with gear box
PEC & MEC for precision tracking
Over load protection
Real time clock
Max loading capacity of 12 kg (25 lb) approx
2" Stainless steel tripod
Aluminum case available

INITIAL IMPRESSIONS

On first glance, this mount resembles the Vixen Sphinx mount in quite a few ways. Print handouts show the motor, azimuth bolt, and polar scope covers in slightly clear blue plastic, similar to the Sphinx. The mounts at the show were equipped in solid black plastic covers.

The fit and finish of the head is impressive. The paint job is well done, with minimal overspray into the inner portions of the castings. The castings themselves are very clean, with little to no flash from mold seams. The machining is surprisingly well done, with no major burrs, tooling, or handling marks/dents to be found at all. Finishes on all machined surfaces inside and out is also very smooth. There were no “chatter” cuts on any parts at all. Both drive gears have very light burrs from the hobbing process, but it’s not enough to cause any major concern. I actually had to use a 10x loupe to see it, and could barely feel it.
During the inspection tear down, I found no chips whatsoever anywhere inside the head. Bosma has done well in this respect. This is one area where attention to detail counts. The grease was surprising as well. Some places had it where it wasn’t needed, others places had little to none where it was needed. I’m not sure what kind of grease it is, but it’s nothing like the black tar grease that used to be found in other CG5 class mounts. It feels a bit sticky, but not grabby.
The tripod does seem to be a weak point. The leg to plate fit is very loose, and no amount of tightening the mounting bolts would make them stop wobbling in the plate. The paint finish on the tripod was the same, even finish found on the head. The moveable feet on the leg ends are a neat idea as well.
The hand controller initially was missing one line in the LCD. After using it a few times during test runs, it mysteriously appeared, and has been fine since. During the test runs outside, I’ve noticed a

mysterious “whine” that comes from the drive area that I haven’t been able to pin down. It was thought to be from the power supply, but running it on battery power gives the same results. The motors use 50:1 gearboxes, and are somewhat noisy at max slewing speed. At the next fastest speed, it’s not objectionable. Even at max speed, it seems quieter than the LXD55/75 mounts, and much quieter than my SVP Meade GOTO converted mount.

The accuracy tests on the hand controller, goto, and alignment will be covered in part two.

OBSERVATIONS

I had the opportunity to assemble 4 of these mounts during NEAF setup. A 5th had tripod damage during shipping to the show, and wasn’t displayed. The head from that set is the one used for this review. The following is what I observed and found during assembly at the show.

In setting up the head to tripod, I found that the head to tripod bolt threads are too long. The bolt bottoms out in the underside of the head before making contact with the underside of the tripod plate. The head wobbled around a lot until I installed the tripod spreader plate and tightened it down nice and snug. This brought the head down tight on the tripod. One mount head had problems with getting the lockdown bolt to screw in while sitting on the tripod. Looking further with the head off the mount, I found that the head threading was slightly cocked, causing the bolt when threaded into the head to be slightly skewed.

I later had the chance to speak with Greentea Zhang, the Bosma import/export man, and “Johnny” the Bosma Factory General Manager during Friday setup and brought the over length thread to their attention. The bolt needs the head thread length shortened by about ½”. They later brought over a slightly different head to tripod bolt that was exactly what we had spoken about, in regards to the fix. It worked perfectly, and was exactly what was needed. Bosma knows of the issue, and did rectify it after the first production run. What surprised me is that they did not find this issue and fix it prior to shipping the first batch. I also suggested that they replace any head to tripod bolts that have shipped like this through their dealers. I do not know for certain what will happen with this. Ask your dealer for details.

Two heads was found to have a loose saddle plate. Tightening the retaining ring screwed to the black cap that’s held on with 2 bolts at the top of the axis solved that.

The broken tripod had a loose leg end that holds the extension locking lever also. They are glued on the main leg ends, as well as having 2 screws. It more than likely broke free from the glue bond when the leg to tripod plate part broke in shipping.

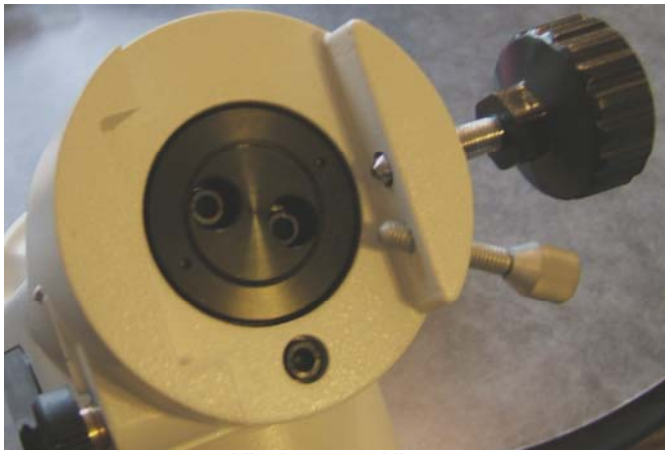
On all the heads, the locking levers on the RA, Dec, and Azimuth positions had to be moved so they would lock properly. When first tightening them down, the locks wouldn’t hold firmly when they hit the stops. Removing the lever after tightening to the stop and moving them back a few positions on the shaft solved this. A quick fix, but an attention to detail miss.

Two of the molded case compartments suffered some damage between the compartments, and the front or back panels of a few cases showed some damage from the inside out. This more than likely happened during shipping,

THE TEARDOWN

It took me awhile to figure out how they went about assembling this mount, so careful and slow was the order of the day. It took approximately 6 hours of slow careful work to tear it down, and reassemble it. Another go around would be much faster.

Declination Axis



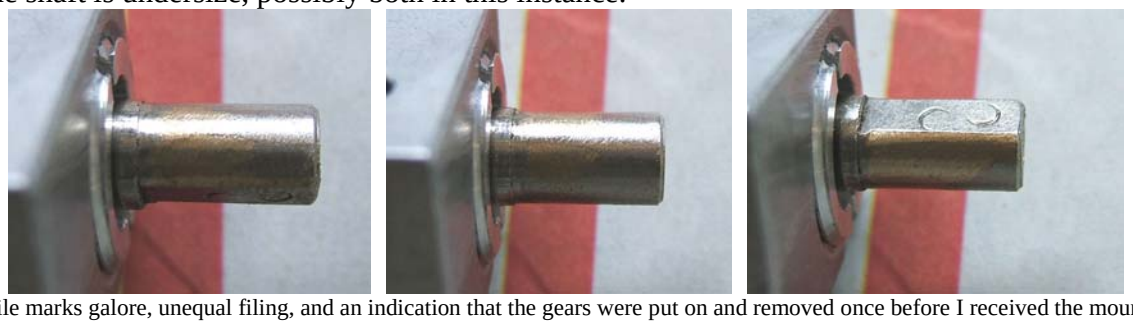
Dec axis saddle showing saddle retaining ring

Getting to the Dec locking ring was fairly straightforward. Remove the retaining ring, roller thrust bearing, loosen the lock, then lift the saddle. This exposed the saddle mount collar, with the shaft locking ring below it**.** The saddle plate lock actually locks on the saddle mount collar and not on the shaft directly.

Dec shaft locking ring loosened with the saddle mount collar removed

On initial inspection, the worm to gear mesh was too tight, as was the driving gear mesh from motor to worm. Removing the gear on the motor isolated out the worm to gear mesh tightness.

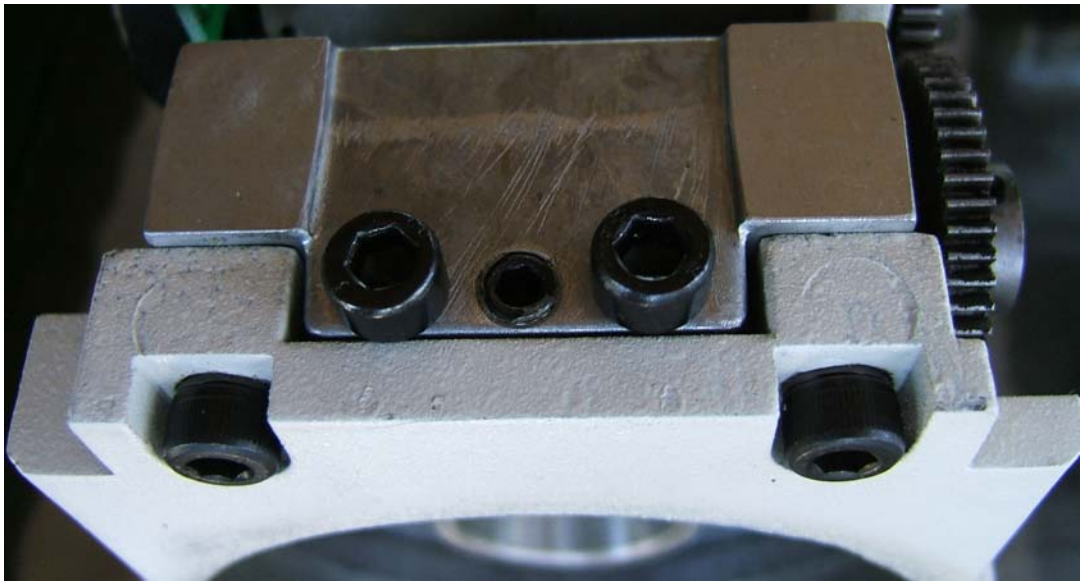
There also seems to be some run out in the shaft, indicating either worm thread to shaft run out, or a slightly bent shaft. After removing the worm shaft housing and spinning the shaft by hand, I found that the shaft drive gear also has excessive run out on 2 axis. Looking at the gear to worm shaft fit finds that the end of the shaft where the gear fits was filed by hand to fit the gear, as well as having the inside of the hole in the gear filed somewhat. I'm not sure what the issue is here, or what the person assembling this was attempting to fix. Either the shaft end is oversize, or the hole in the gear for the shaft is undersize, possibly both in this instance.



File marks galore, unequal filing, and an indication that the gears were put on and removed once before I received the mount

Getting the gear off the shaft was difficult. Replacing it was just as hard. The filing on the shaft and gear is probably the cause of gear issues here. The gear runs both out of round radially and wobbles side to side.
The worm housing uses bearings between housing and shaft with a threaded locking ring similar to Orions SVP setup minus the ring locking nut. The locking ring seems to be locktighted into place, and I was not able to adjust it. The above picture shows the end of the locking ring, as well as the file marks I found all around the end of the shaft.

Getting to the worm to gear set screws was easy, and I was able to reset the worm to gear mesh. It still does have a bit or stiffness in the worm gear shaft while turning on one side, but it's nowhere near as bad as before. Unfortunately, there's little to no provision for adjusting the motor gear to worm gear mesh, aside from a small amount of play in the motor mounting screws, so if you're not in the correct position with the worm shaft housing when you set the mesh, you'll have to loosen, and slightly change the worm housing position, keeping the mesh proper. I got lucky, and didn't have to do this. The play in the mounting holes for the motor was enough.



The declination worm mesh setscrews. Typical push/pull setup

The Dec. shaft uses 2 6806Z bearings. One in the top of the dec housing under the dec shaft locking cap, and one slipped onto the underside of the dec driveshaft gear.

Top bearing in the Dec housing, and the bottom bearing on the Dec drive shaft

Both bearings were smooth, and free, with no play between inner and outer races. The bearing in the top of the dec housing came out with a gentile lift, and went in smoothly. The fit between housing and bearing is very close, and doesn't seem to wobble at all when inserted into the housing. There was no machining in the bearing area of the housing that I could tell. It seems the castings are very accurate. The Dec. driveshaft goes in the housing from the bottom. This places the gear at the bottom of the housing, instead of the top like most GEM mounts. The shaft locking ring is at the top and has 2 setscrews to hold its position after tightening. The lower bearing to housing fit was slightly looser at the bottom, but had no noticeable play when inserted. The fit on the shaft was free, with no play.

Right Ascension Axis

The R.A axis was stiffer in rotation with the lock free than the Dec was. And what causes it is a very different build.

The RA axis employs 2 more 6806Z bearings between the drive gear and RA shaft. Removing the worm drive shaft finds this portion of the assembly to move very free and smooth with the RA locking collar tight.

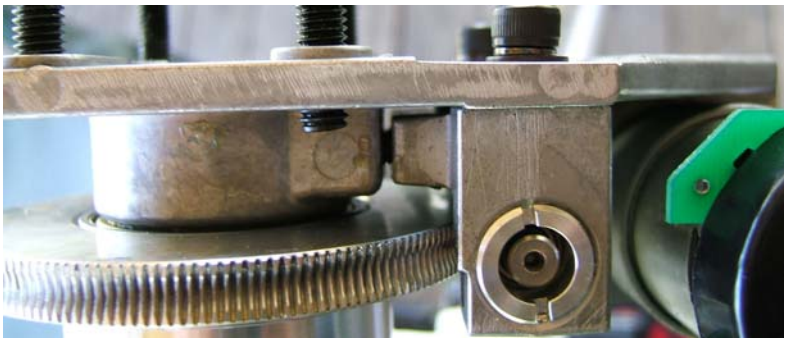
The bearings fit on the shaft and the gear was perfect. Not too tight, nor overly loose. Just enough room to get them where they needed to be with next to no play, just like the Dec axis.

There's also one other bearing at the bottom of the axis, which is a tapered bearing, # 32906X. It's used between the bottom of the RA housing, and the bottom of the RA shaft locking collar. The bottom of the drive gear sits on the inside of the RA casting pushing the gear base tight against the backside of the shaft when the locking collar is tightened. This in turn affects the worm to gear centering by slightly changing the gears position relative to the worm.

Tapered bearing in the bottom of the RA casting and the entire assembly when first exposed

After removing the motor drive gear, I found that the worm to gear spacing was tight, and has a tighter spot just like the Dec. axis. They both use the same shaft from the looks of it, so the same problems follow from one axis to the other. The only difference on this axis is that instead of filing the gear end of the shaft, it was polished slightly. With the worm housing removed, there is no appreciable run out in the gear. There is a tiny bit of wobble, but nothing like the Dec. axis had.

RA worm gear adjustment location. Yes, it's buried.



A side shot, showing the mesh push/pull bolts, and the worm housing lockdown bolts.

Adjusting the RA worm to gear mesh involves removing the gear from the motor, then removing the motor from the casting. Taking the gear off exposes the 3 screws that are used to set the worms position. Once the worm mesh is proper, replace the motor, leaving the screw behind the gear somewhat loose then slide the gear on, and see how much play there is between the gears. Loosen the other 2 motor mount screws to be able to use the play in them to set the mesh and check the feel with the gear on, but free. If good, tighten the last screw on the motor behind the gear, replace the gear, and tighten the rest of the screws and you're done.

Quality conclusions

After giving this head a good inspection, I'm impressed with some things, and surprised by others. The glaring QC miss on the head to tripod bolt being a case in point, the other being the filing marks on the Dec worm shaft to get the gear to fit, along with the very bad runout in that gear. The slightly bent worm shafts isn't very good either, and having them set so tight initially will most certainly wear out the drive gear unevenly if the mounts used heavily over the course of time.
The tripod legs being loose in the head, and being unable to tighten them down for better rigidity and settling times needs to be looked at as well.

The machining in general seems to be excellent and burr/chip free. Fit and finish of most of the internals is excellent, aside from the worm shaft issues. The paint is great, and looks really good.

I'd rate this mount at about a 7.5 quality wise, with 1 being a no-go and a 10 a solid winner. With a little more attention to detail, I think this mount could be a winner, hardware wise.

The electronics, goto accuracy, and payload capacity will be brought in part 2 of this review. I'm really looking forward to it. I have a few different scopes that should really stress this rig.

I've browsed through the hand controller quite a bit so far, and like what I see to this point. The proof will be in how well it performs, and if it can do all it's claimed to.

Until part 2……