How to attach Altitude encoders to dobsonians

Started by Adun , May 25 2021 01:33 PM

Adun

Posted 25 May 2021 - 01:33 PM

4 years ago I shared a DIY project for building an inexpensive DSC (https://www.cloudynights.com/topic/589521-37-dobsonian-dsc-for-diy-makers/) which used an encoder for Azimuth but an accelerometer for Altitude, mostly because of the difficulty of attaching an encoder to the altitude axis of my Z114 mini dob or my Skywatcher 10" dob.

Recently, while working on a dual encoder version of my DSC, I found a simple way to attach an Altitude encoder to my Z114 minidob. It seems almost obvious now, but 4 years ago I couldn't come up with it, so I want to share the Z114 fix, and **invite others to share** how they have managed to attach encoders to their dobs.

So here's the rule for this thread: Share your solution for attaching altitude encoders for your dobsonian, regardless of whether said dob is commercial or DIY, tabletop or gargantuan, truss or solid tube. Hopefully this will aid others in figuring out how to turn their starter dob into a push-to.

I'll start myself:

For the Zhumell Z114 tabletop mini-dob, the key is using a GT2 open belt:

(https://www.cloudynights.com/gallery/image/122773-open-gt2-belt/)

The Z114 OTA is held by a clam which connects to the wooden arm using a white nylon "bearing disc", of which you can see the edge in this picture:

(https://www.cloudynights.com/gallery/image/42115-img-20170118-210457/)

You can see that right next to the white nylon disc, the black cylinder has a little space where one could (using a silicone glue gun) attach a piece of GT2 open belt to turn the black cylindrical surface into a GT2 gear:

(https://www.cloudynights.com/gallery/image/122774-gt2-

belt-glued-to-z114/)

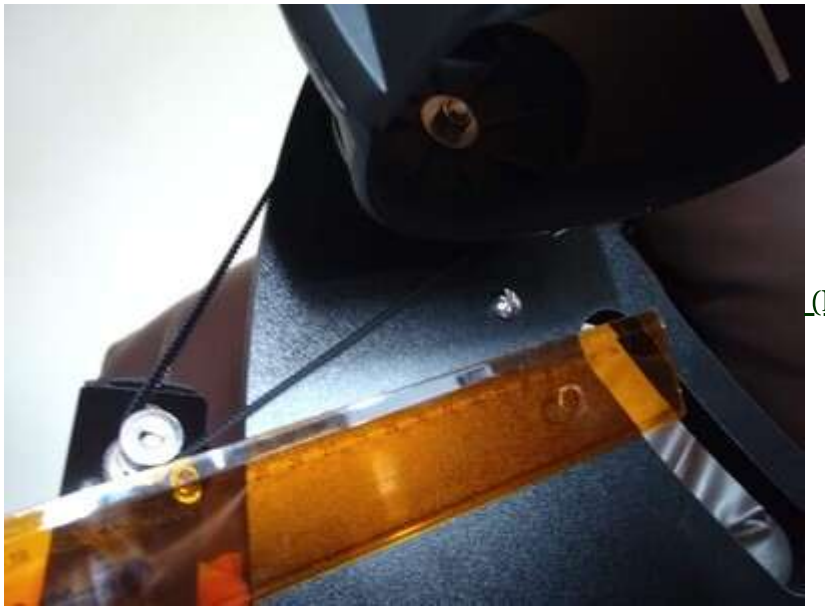
Now we can use a regular closed GT2 belt (I used one of 488mm length):

(https://www.cloudynights.com/gallery/image/122775-a-gt2-timing-belt-488mm/)

And fix the Altitude encoder somewhere to the side:

(https://www.cloudynights.com/gallery/image/122776-altitude-gt2-belt/)

At first I was going to use an acrylic Pelican ruler as an encoder bracket, drilling a hole in one side to fix the ruler in position using one of the Z114's existing screws, and 3 holes in the other side to affix the encoder to it, and let gravity provide the tension:


(https://www.cloudynights.com/gallery/image/122787-ruler-to-attach-encoder/)

However, 3 years ago, **pgrunwald** printed some brackets for the SignWise optical encoders:

> ***pgrunwald, on 25 Jul 2018 - 01:14 AM, said:***
>
> In case anyone is 3-D printing, I found a bracket for the encoder here: https://www.thingive...m/thing:2242951 (https://www.thingiverse.com/thing:2242951) .
>
> Specifically it is "OH_Frame_SignWise.STL". I was also able to easily raise the height of the mount using Autodesk Meshmixer by just selecting the top and extruding it 20mm. The modified file is attached.

And he was kind enough to gift me a few (Thank you again!). It turned out one of them was perfect for fixing the alt encoder in a "click-in" removable way, so that's what I used, although a drilled ruler + gravity would work too.

(https://www.cloudynights.com/gallery/image/122777-3d-printed-part-used-to-attach-it/)

(https://www.cloudynights.com/gallery/image/122778-side-view/)

So, that's one way of attaching an Altitude encoder to a Z114. ¿What about your dob?

lphilpot

Posted 25 May 2021 - 06:14 PM

I've had (Lumicon) encoders on only two scopes: My homebuilt 10" f/5.5 and my 14.5" TeleKit. Lumicon provided a screw on flange with a center hole and set screw, plus stay-arm, for the altitude encoder.

That worked fine on the 10" - I attached the flange to the center of the altitude bearing and mounted the encoder shaft in the flange. The stay-arm attached to the encoder housing. The recommended way of mounting to the TeleKit was the reverse - Foam double stick tape was used to stick the back of the encoder to the altitude bearing and the stay-arm was attached to the encoder shaft. Either way would've worked on either scope (just had to flip the altitude rotation direction in the computer), but mounting the encoder directly to the altitude bearing was slightly lower profile. However, it was more difficult (or at least, less margin for error) to center with the "first try is last try" nature of double stick tape.

No photos of the 10", here's the TeleKit

Kunama

Posted 25 May 2021 - 07:50 PM

I made the trunnions, drilled a 1/4" hole for the encoder, then made some tangent arms, attached the US Digital S6 encoder to them and ran the cables to the Nexus DSC....

Attached Thumbnails

(https://www.cloudynights.com/uploads/monthly_05_2021/post-213391-0-73139000-1621990127.jpg)

(https://www.cloudynights.com/uploads/monthly_05_2021/post-213391-0-81071100-1621990192.jpg)

pgrunwald

Posted 25 May 2021 - 10:52 PM

I'm happy to print at cost. Shipping USPS priority is $7. PM me to tell me what you might want.

Speo

Posted 26 May 2021 - 08:53 AM

Last year I built a similar project, using 2 encoders and ESP32 board. I installed one on a 10" Orion dobsonian, one on a 12" Meade Lightbridge dobsonian, and now I am installing one on a 12" Celestron Starhopper dobsonian.

Below are some pictures of my 12" Lightbridge installation.

High resolution pictures available here: https://astrostuff.w...ic/tune-speaker (https://astrostuff.wixsite.com/magic/tune-speaker)

More details and few other installation ideas were posted here: https://www.cloudyni...ith-2-encoders/ (https://www.cloudynights.com/topic/753765-diy-digital-setting-circles-wifi-bluetooth-with-2-encoders/)

Here is a neat installation that does not require drilling in the mount: https://www.cloudyni...2#entry11062230 (https://www.cloudynights.com/topic/753765-diy-digital-setting-circles-wifi-bluetooth-with-2-encoders/page-2#entry11062230)

Encoder brackets for 3d Printing: https://www.cloudyni...2#entry11066038 (https://www.cloudynights.com/topic/753765-diy-digital-setting-circles-wifi-bluetooth-with-2-encoders/page-2#entry11066038)

Attached Thumbnails


LIGHTBRIDGE

(https://www.cloudynights.com/uploads/monthly_05_2021/post-310148-0-92566000-1622037178.jpg)

Edited by Speo, 26 May 2021 - 01:32 PM.

Speo

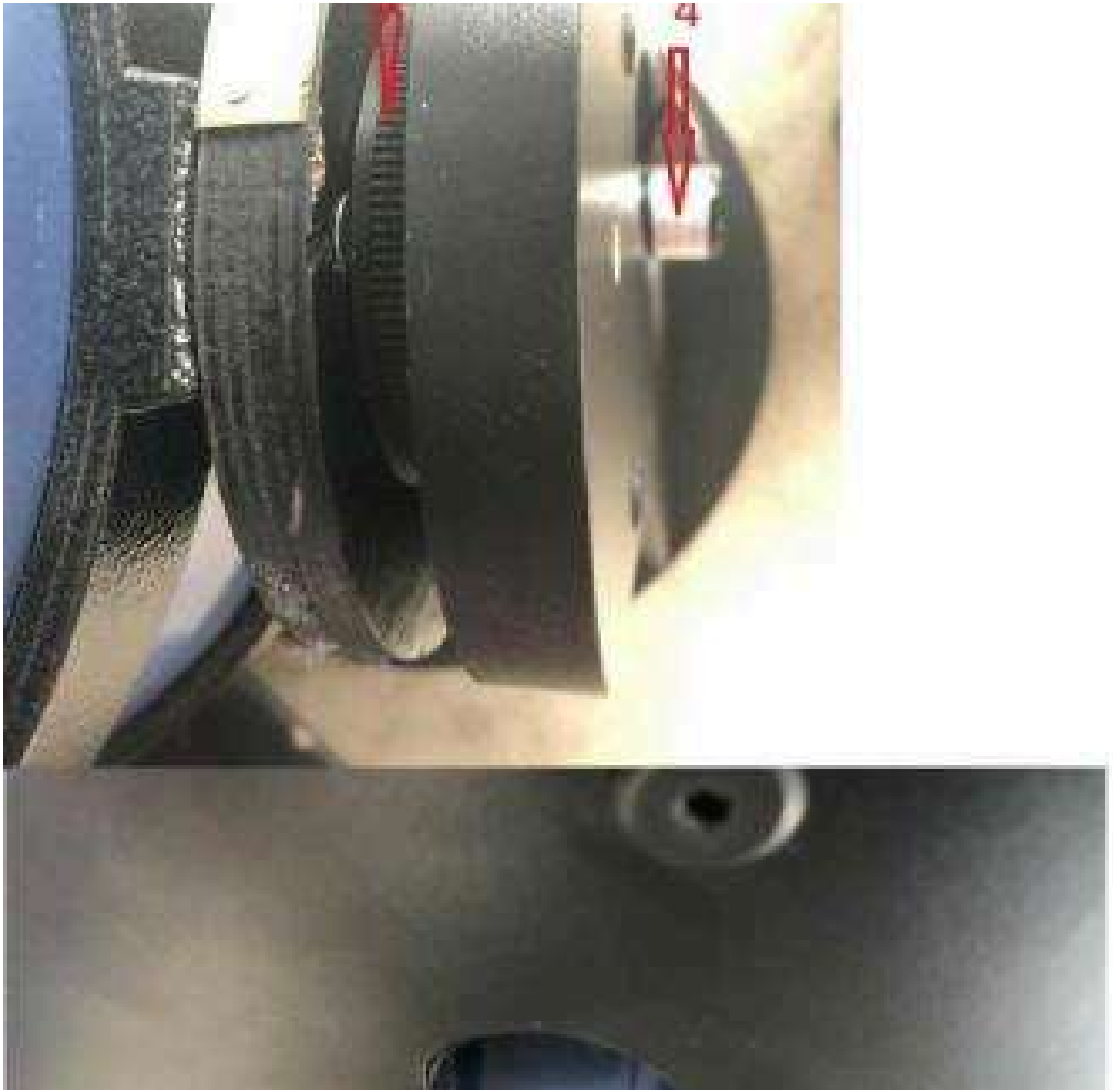
Posted 26 May 2021 - 12:21 PM

Encoders installation on 10" Orion base. I removed the intelliscope system and installed a SW OTA on rings
1 - OTA rings
2 - plywood trunnions (altitude bearings) with a strip of brass for friction
3 - 120 tooth gt2 3d printed
4 - altitude encoder

For azimuth the only belt I had at the time was a bit too long so I 3d printed an idler to route the belt excess

Attached Thumbnails


1
2



(https://www.cloudynights.com/uploads/monthly_05_2021/post-310148-0-89047200-1622049807.jpg)

Edited by Speo, 26 May 2021 - 01:35 PM.

Speo

Posted 26 May 2021 - 12:30 PM

My 12" Starhopper I am working on right now

Attached Thumbnails

(https://www.cloudynights.com/uploads/monthly_05_2021/post-310148-0-47489100-1622050212.jpg)

(https://www.cloudynights.com/uploads/monthly_05_2021/post-310148-0-55809100-1622050226.jpg)

Adun

Posted 09 June 2021 - 11:06 AM

I'm quoting solutions for Skywatcher dobsonians from Ravi and stevo58:

> ***Ravi Bhat, on 30 Apr 2021 - 2:23 PM, said:***
>
> Here are the construction details of my DSC:
> 1. I am using 600PPR/2400CPR optical encoders with 9:1 gearing; effectively 21600 counts per revolution.
> 2. I made the gears using 6mm thick plywood discs and glued 6mm wide GT2 timing belt on the periphery.
> 3. Altitude axis uses a 135 deg. sector of 360 teeth gear and a 40 teeth GT2 timing pulley fixed to the encoder. I have fixed the gear sector to the altitude bearing using three M4 bolts & nuts.

4. I fixed the encoder to a 50mm aluminium L angle and fixed it to the rocker box using a 75mm long SS door hinge. I can engage or disengage the encoder by just “opening” or “closing” the hinge.

5. Azimuth axis uses a 180 teeth gear (again made of 6mm thick plywood and GT2 timing belt) and a 20 teeth GT2 timing pulley. I replaced the azimuth axis bolt with a longer one and fixed the gear to it. The encoder is fixed to a 50 mm aluminium bracket and is lightly tensioned against the gear using a tension spring.
6. The encoders are connected to Arduino via a cat6 cable (because I'm going to fix the circuit to the platform).

stevo58, on 08 Jun 2021 - 10:35 AM, said:

I just replaced the non-adjustable handle with a length of 10mm threaded rod on my SW. I'm using a 60-tooth GT2 pulley, though, so I don't have the same resolution ("only" 9000). I ground a flat on the rod at the right point, put a fender washer between the pulley and rocker, and tightened it down. This has worked fine for me, and it doesn't take any longer to knock the scope down than it did before. If it starts to have a problem, a bit of non-permanent LocTite will take care of it.

It would also be simple to put a larger pulley or higher pulse encoders if I decide I 'need' insane resolutions like 50-75k.

Adun

Posted 20 July 2021 - 10:57 AM

From OskiBear:

> ***OskiBear, on 19 Jul 2021 - 02:40 AM, said:***
>
> I was able to use 2 600 p/r encoders, installed on an AWB OneSky, and am very happy with the results.

Fortunately there is just enough room on the OneSky's alt bracket to hang a belt (shamelessly stealing from Adun's idea in another forum). I worried originally about lining the belt up just so - but if you think about it, there's always going to be a point that doesn't need contact i.e. you'll never point the scope straight down. So you don't have to be exact when gluing a belt fragment tooth-side up to the alt bracket.

.
.
.

I wanted to keep the handle grab accessible, so drilled a hole thru the other side of the mount upright and ran a coupler (as short as I could get it) thru from the encoder to the belt pulley. (see the little red barrel sticking out?). Drilled the hole a little oversize to allow for tensioning the belt (doesn't have to be much)

Mcrajah

Posted 15 May 2023 - 08:13 PM

I have a Meade 10" lightbridge open truss tube model. I did not want to use belts and pulley mechanism. Using belts and pulley would mean that I have to remember before tear down and save the belt etc. So I went with gear mechanism as shown below. Hope it helps folks that may want to go this route. The circular discs were cut on my table saw.

(https://www.cloudynights.com/gallery/image/179485-dec-axis/)

(https://www.cloudynights.com/gallery/image/179484-ra-axis/)

Edited by Mcrajah, 15 May 2023 - 08:13 PM.

brickbots

Posted 17 May 2023 - 12:37 AM

Here is how I retrofitted encoders on my dob with no hard pivots on altitude or azimuth. It worked, but was never as accurate as center pivot mounting solutions. The plus side is that it's easy to implement and allows for quick and easy assembly and disassembly.

(https://www.cloudynights.com/gallery/image/44905-wide-shot-of-encoder-mounting-positions/)

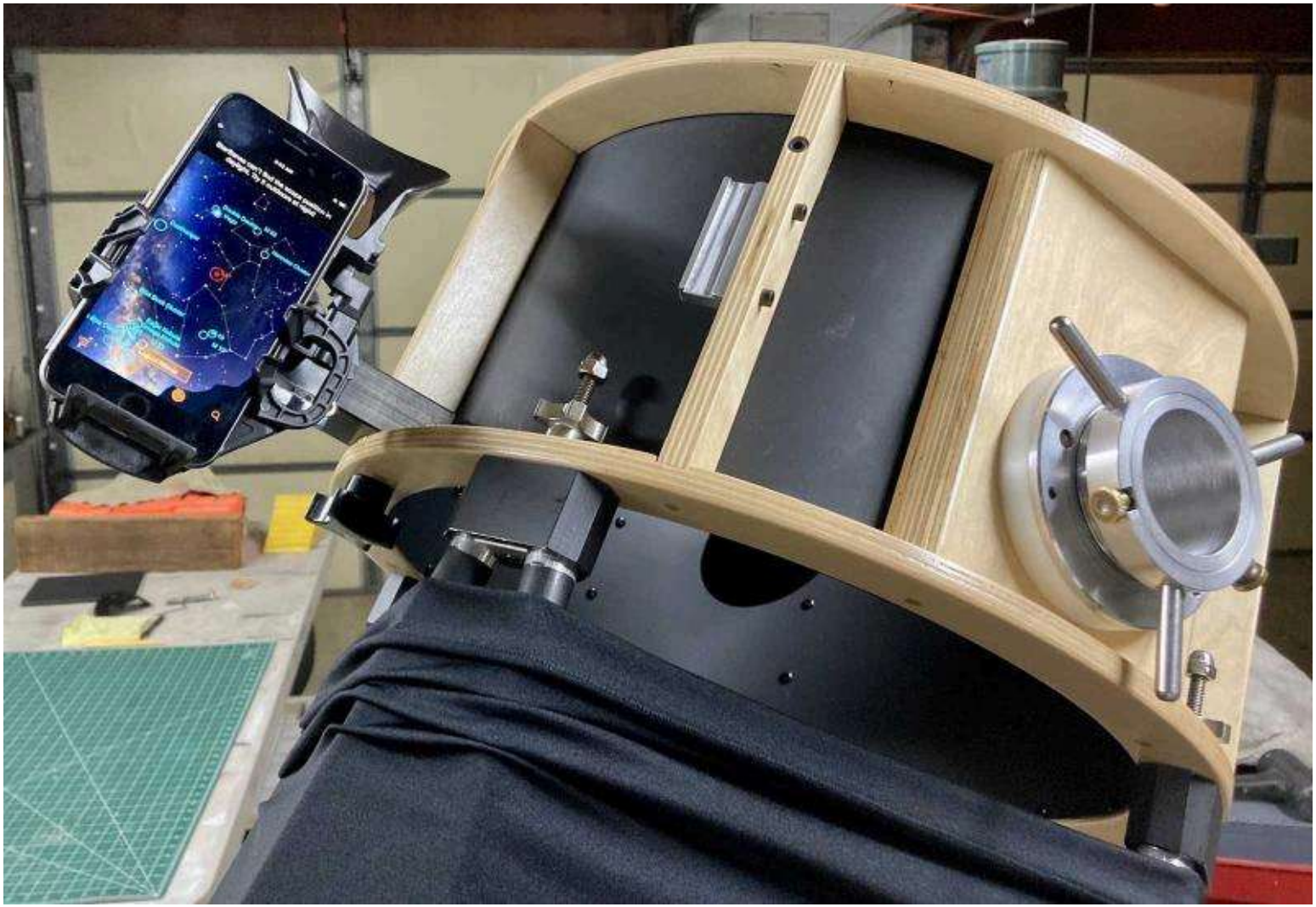
(https://www.cloudynights.com/gallery/image/44900-rotary-encoder-bolted-into-the-mounting-assembly/)

(https://www.cloudynights.com/gallery/image/44901-bottom-view-of-encoder-mounting/)

Psalm19One

Posted 18 May 2023 - 08:15 AM

New wireless encoder installation :



(https://www.cloudynights.com/uploads/monthly_05_2023/post-330114-0-91501300-1684414967.jpg)

But seriously, my old encoder installation was to the center bolt and then I made a cover to protect the very fragile looking azimuth encoder so I did not need to remove it.

(https://www.cloudynights.com/uploads/monthly_05_2023/post-330114-0-66298200-1684414987.jpg)

And crude looking removable steel bracket for the altitude encoder which had a flexible aluminum shaft coupler (not shown, but inside that larger aluminum cylinder) that attached with a set screw:

(https://www.cloudynights.com/uploads/monthly_05_2023/post-330114-0-58164000-1684415050.jpg)

This was an early generation Meade DSC system on an 18" scope I built in 1992 which had a fairly un-user friendly controller but worked pretty well if alignment was done just right. Otherwise it could be off 4 degrees when you move the scope any significant amount. If aligned well usually put objects within a one degree field.

I didn't even consider encoders on a 13.1" scope I just finished recently, but decided to give the StarSense app a try which looks really promising. Tested the newly made mounting bracket out last night under Bortle 8 sky and under a bright street light in my driveway with an old iPhone 6s and it was working quite well. I did a daytime alignment on a distant street light maybe 200 yards away which was pretty good once it got dark but was off a little so did a better alignment on Vega and from

there on was picking up lots of targets that I would no way have a chance of spotting and was putting them almost dead center in a 1.12 degree field. Slewing the scope a ways causes it to lose position, but the app regains alignment after about a 5-10 second settling period to reacquire alignment. It only failed to plate solve when I got really low to the horizon where the sky was really washed out. So far impressed. The app could use a larger database and option to enter RA and DEC but I am not missing the encoders.

Edited by Psalm19One, 18 May 2023 - 08:22 AM.

Speo

Posted 18 May 2023 - 08:26 AM

> ***brickbots, on 17 May 2023 - 07:37 AM, said:***
>
> Here is how I retrofitted encoders on my dob with no hard pivots on altitude or azimuth. It worked, but was never as accurate as center pivot mounting solutions. The plus side is that it's easy to implement and allows for quick and easy assembly and disassembly.

What is the role of that bunjee cord on the side of the rocker box?

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jrazz

Posted 18 May 2023 - 09:10 AM

My solution:
https://www.cloudyni...conversion-dsc/ (https://www.cloudynights.com/topic/816560-orion-skyquest-xt10-push-to-conversion-dsc/)

(https://www.cloudynights.com/uploads/monthly_03_2022/post-402142-0-70904600-1647640322.jpg)

(https://www.cloudynights.com/uploads/monthly_03_2022/post-402142-0-35543700-1647818566.jpg)


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(https://www.cloudynights.com/uploads/monthly_03_2022/post-402142-0-09674100-1647787138.jpg)

brickbots

Posted 18 May 2023 - 10:46 AM

> ***Speo, on 18 May 2023 - 3:26 PM, said:***
>
> What is the role of that bunjee cord on the side of the rocker box?

That's my counterweight system! It applies force as the scope is moved in altitude to balance out the upper end of the scope. In those photos the cords are in the 'stowed' position, but in operation they connect to the altitude bearing. That photo is pretty old and I've adjusted the routing to better apply increasing force as scope is moved using an additional pully:

(https://www.cloudynights.com/gallery/image/179641-updated-counterweight-system/)

As the scope tilts down (bearings will rotate counterclockwise in this photo) tension on the bungie cords is increased so it adds more counter-force as the weight of the upper-tube assembly moves further from the center of gravity to balance it.

Since my altitude bearings are quite low, to keep the eyepiece height low, the scope would require a fair bit of weight to properly balance otherwise. So this saves me from having to carry/attach multiple kg of weight when I go out observing. I can swap out the cords or change the attachment positions to adjust for different eyepieces, but don't have to do this often with my core eyepiece set.

Edited by brickbots, 18 May 2023 - 10:59 AM.

Elara

Posted 26 January 2025 - 07:43 AM

> ***lphilpot, on 26 May 2021 - 01:14 AM, said:***
>
> I've had (Lumicon) encoders on only two scopes: My homebuilt 10" f/5.5 and my 14.5" TeleKit. Lumicon provided a screw on flange with a center hole and set screw, plus stay-arm, for the altitude encoder.
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>
> No photos of the 10", here's the TeleKit

I know this thread is a few years old but I've just obtained a Telekit Dob 254mm (10") f6 and have a question for you/anyone else who may be able to answer:
Is there meant to be a cover for the alt encoder (see my album) *and* also, is there meant to be a 'knob' for the alt. strut? I can't see anything in the manual so far?
Appreciate any thoughts on the Sky Commander XP4 system too, as I understand the company is no longer in business?
Cheers & good seeing all!

whereIsIt

Posted 26 January 2025 - 09:30 AM

Since posting this in 2017 (https://www.youtube.com/watch?v=SezbbfoszEI) , I've heard from many folks and I've tweaked and made gears/parts for them. A funny thing about people is several thousand have used my resource(s) and though many contact me, they (we, including myself) prefer to Not post for others to see... Truly amazing how similarities in Hobby interests can reveal similarity in personality traits...

This is an Altitude-Gear for Orion DOB from my Thingiverse page (linked in the YouTube post)

Attached Thumbnails

(https://www.cloudynights.com/uploads/monthly_01_2025/post-298122-0-49920800-1737901630.png)

Edited by whereIsIt, 26 January 2025 - 09:31 AM.

lphilpot

Posted 26 January 2025 - 02:48 PM

> ***Elara, on 26 Jan 2025 - 2:43 PM, said:***
>
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> Cheers & good seeing all!

No cover, that's the way it came from AstroSystems. If you're referring to a tension knob for altitude movements, also no. With large, properly balanced, bearings there's no need to adjust tension. The inherent friction of the mount covers it all.

However, if you're referring to a knob to clamp the arm to the encoder shaft, there's one there. Keep in mind while the encoders / computer were from Lumicon, I used mounting hardware from AstroSystems.

Dale Eason

Posted 26 January 2025 - 03:52 PM

No knob and no knob needed where the altitude encoder strut attaches to the rocker box. It is meant to slide up and down to take out any tiny amount of misalignment of the encoder not being exactly on the axis or alt bearing not being precisely round.

Elara

Posted 28 January 2025 - 01:36 PM

Many thanks @Iphilpot and @Dale Eason, I can rest easy.
I'm now needing a new secondary, after the original has succumbed to a scratch in transit! Here in the UK there are limited options, I've used Mel Bartels calculator and I think? I need a 1.83" minimum width to get the best illuminated field. I've imported from the USA a few times, so I know the drawbacks, but I'm prepared to pay for something good from the 'home' of the Dob! I reached out to Astrosystems but no replies so far...
Cheers
Graham

Back to ATM, Optics and DIY Forum

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