

March 2022

Hello Benefactors. It's time for me to tell you about what I've been working on in March.

This has been a quieter month for me than February, mostly because I have had to rebalance my activities after spending a huge proportion of my time on the T-wist 4 design. This month I have invested some real hours into converting the OSR2 T-wist into one that also works for the SR6, which hasn't been completely straightforward.

That's not been the only thing that I can show you this month. I have been working on getting my OSR2 build document up to date and testing some new servos, for both the T-wist and the T-valve. I can also give you a behind-the-scenes look into the creation of some of my media content.

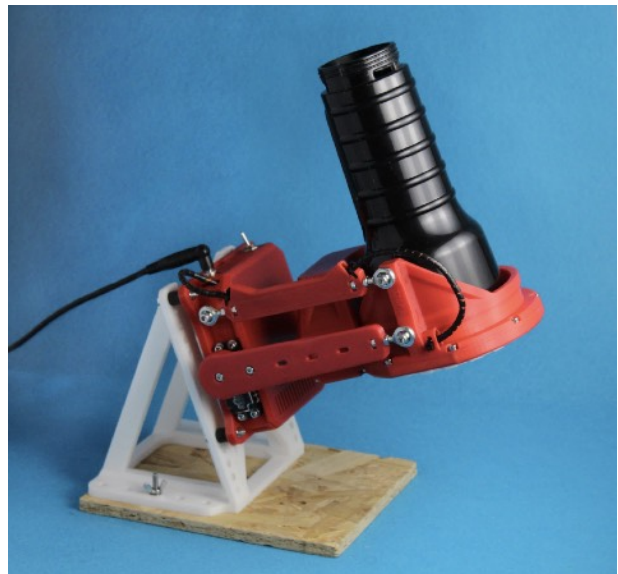
Photography

Whenever I create a new design and release it to the world I like to post photographs of the design to show it off. If you look back through some of my early efforts you will see that to start with I'd just throw my work onto my dining room table and take a quick picture of it with my smartphone.

The smartphone pictures look okay, but more recently I wanted something a bit more professional. I recently acquired a DSLR camera so I put this to work. What I found quite quickly is that, unlike a smartphone, it's no longer a simple case of point and shoot. In fact you start to appreciate just how much clever stuff is being done by the software in your phone. The results with a DSLR camera with a big lens can be a lot better, but to get a good photograph a lot more work is required.



*A PICTURE OF OSR2 I TOOK IN 2020
USING MY SMARTPHONE*

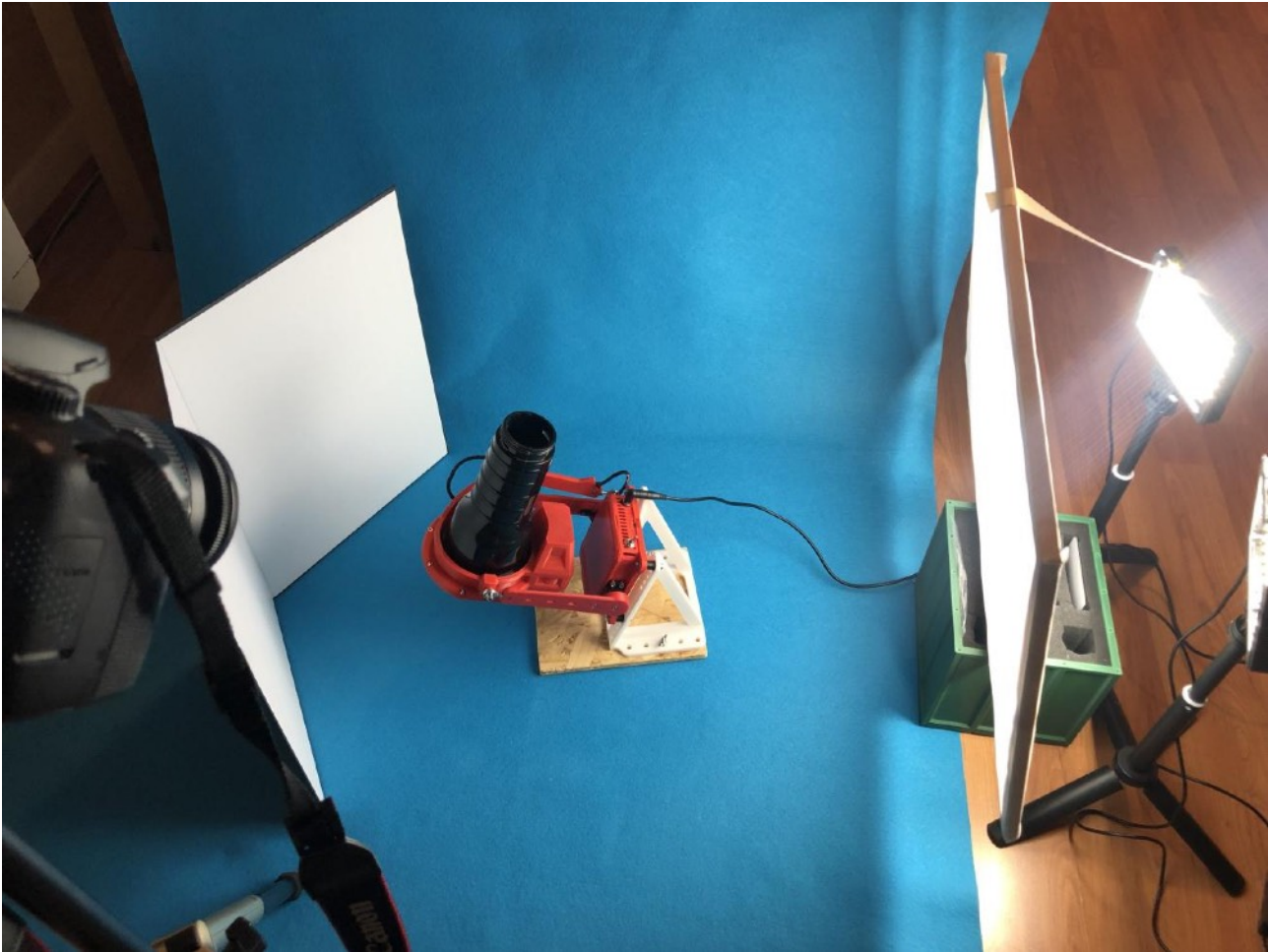


*A PICTURE OF T-WIST 4 I TOOK THIS MONTH
USING MY DSLR*

I set the scene by getting a nice roll of light blue felt fabric from a craft store. I liked the light blue a lot more than simply using a white background. I think it also goes well with the red PLA I have adopted for my prototypes. In the past I have used black PLA for my display models, but looking at my past photographs I found that a coloured material doesn't swallow light and makes it much easier to see shapes in the plastic.

The biggest challenge is lighting. A good strong light source really helps when it comes to getting good, clear images, but simply placing a powerful light or lights nearby creates really harsh shadows. I found this when I started using a nice little set of portable LED lights. I have been able

to soften the shadows very nicely by using a diffuser, which is actually made from a corkboard frame with fabric stapled onto it. The last touch is a reflector behind the subject, which prevents the back side of it from being too dark. For this I use a simple cardboard reflector I found on amazon.



*THE LIGHTING SETUP I USED TO TAKE IMAGES OF T-WIST 4.
THE KEY ELEMENTS ARE THE DIFFUSER (RIGHT) AND REFLECTOR (LEFT)
I'M GETTING BETTER AT THIS, BUT I STILL HAVE A LOT TO LEARN!*

Another thing that smartphones don't teach you about photography is depth of focus. Essentially, because smartphone camera lenses are tiny it's easy to get everything in focus. The large lens on a DSLR means you can get really clear, crisp images, but it also means that if you focus on one part of your subject, other parts of it can be completely out of focus. The best solution to this I have found is to move the camera further away and use a long lens.

There are other tricks you can use. It seems professional product photography studios will actually take a sequence of photographs at different focus points and then use clever software to splice them together. On more than one occasion I have done something similar, splicing together up to three separate images to get everything in focus. I did this manually of course, but the results looked pretty good.

I'm getting better at taking these images, but I still have a lot to learn, and I will no doubt be tweaking my setup for the foreseeable future. The thing that stands out to me the most now in these pictures is the stand I have been using, which is something I just threw together a long time ago to use for testing. I have ordered in some light blue PLA and I intend to create a much more professional looking stand. It will be a good design if you don't notice it!



A GLAMOUR SHOT OF T-WIST 4 ON AN OSR2

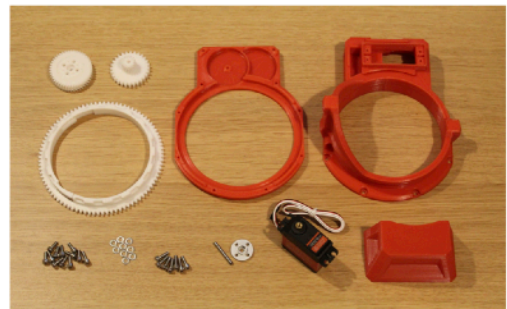
T-wist 4

Most of my development work in March has been devoted to getting T-wist 4 finished and release. You will no doubt have seen the early March release of the OSR2 version at this point, and I've also been working on getting the SR6 version ready to release in early April.

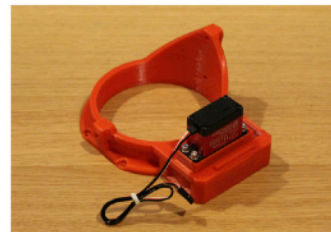
This work is a lot more than just CAD design, it also involves creating multiple prototypes in order to work through issues like size tolerances, and finally going through the assembly process one last time with a camera. Those of you who have joined me on recent livestreams will appreciate just how laborious it is to lay out and photograph all of the assembly steps.

I seem to spend a crazy amount of my time these days writing up build instructions. This is offset, of course, by the positive feedback I get from my users about how easy they were to follow, which means hopefully I'm doing a good job!

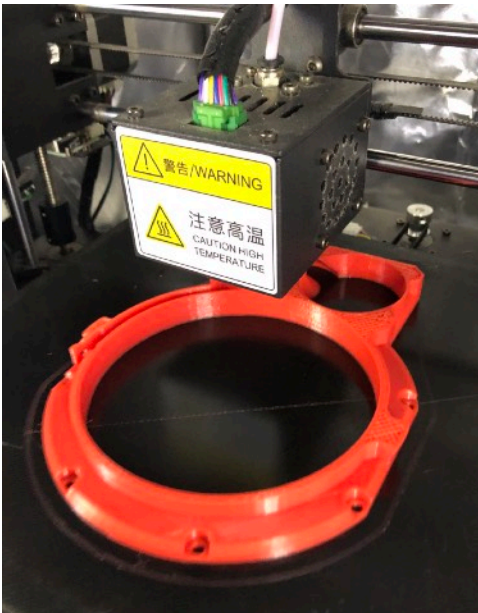
Assembly steps



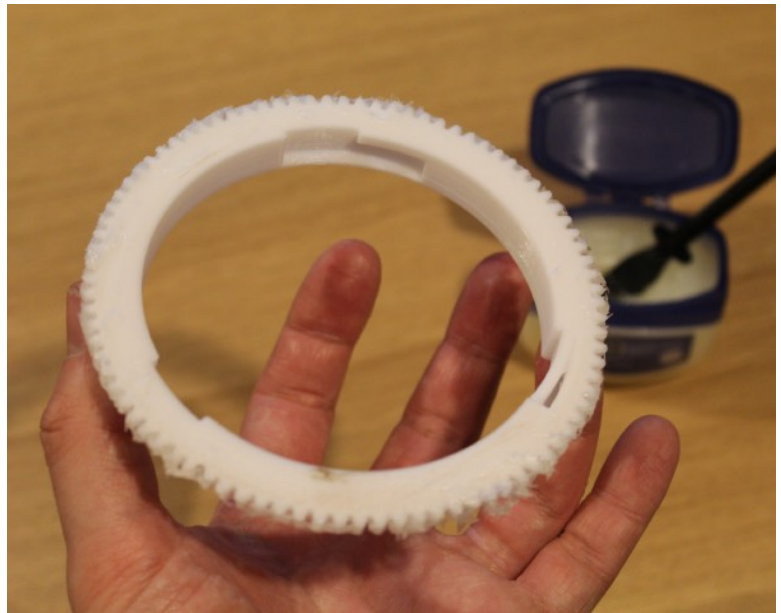
1) Mount the servo into the receiver body and attach it using 4x M3x10 bolts and M3 washers. Do not fully tighten the bolts at this stage, allowing some freedom of movement to the servo.



2) If you are using a metal servo horn (recommended), place it onto the servo and secure it in place with an M3x8 bolt and M3 washer. Then install the drive gear onto the servo horn using 4x M3x10 bolts and M3 washers.



*AN ITERATION OF T-WIST 4 FOR
OSR2 ON MY 3D PRINTER*



*ALWAYS USE LUBE: LEARNING HOW TO GET
VASELINE ABSOLUTELY EVERYWHERE!*

Having got T-wist 4 for OSR2 released my next priority was to adapt the design for SR6. In some ways this was quite easy because I had designed the twist mechanism in such a way that it could easily be merged into either a standard OSR2 or SR6 receiver. It wasn't quite that simple however, because I had to take account of other things, such as movement geometry.



*CAD MODEL OF T-WIST 4 MERGED
INTO AN SR6 RECEIVER*



PRINTED SR6 T-WIST 4 RECEIVER

On OSR2 the only geometric concern is the back of the twist mechanism coming into contact with the lid on the OSR2 base. To mitigate this I actually made the T-wist ever so slightly shorter than previous versions. Otherwise the machine's arms and pitcher link do not move in a way that might cause them to contact the larger enclosure that holds the new twist mechanism.

This isn't the case on SR6, partly because of the lateral movement that a 6-axis machine is capable of, but mostly because the pitch links are angled diagonally inward. With this larger enclosure a clash seems almost inevitable!

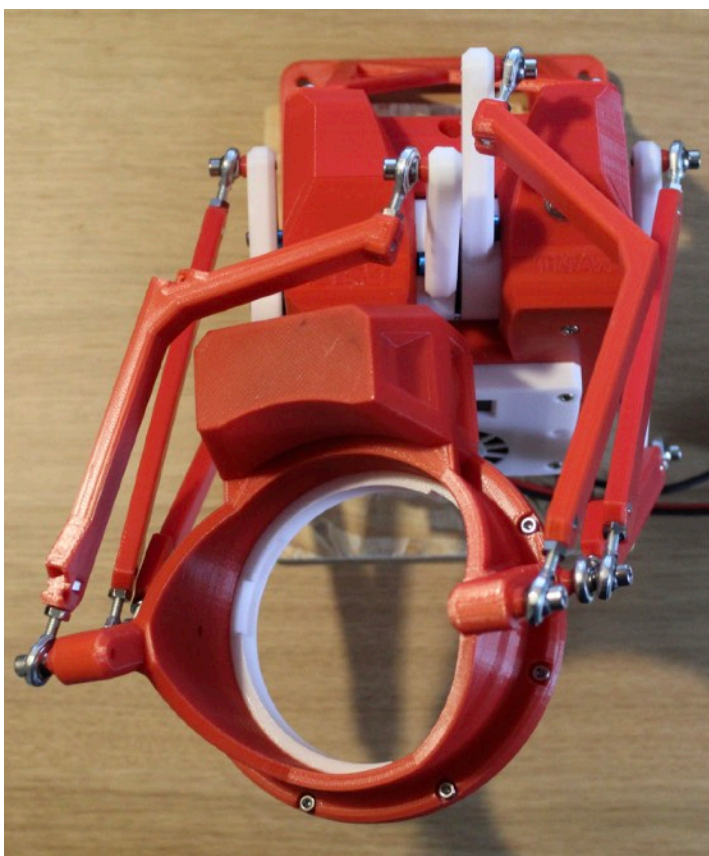
With my tests I actually found that this was less of a problem than you might think. The pitcher links are naturally angled down, and the top of the T-wist enclosure is lower than where the pitcher links mount on the receiver. There are, however, combinations of axis positions that result in a nasty conflict between the links and the enclosure, and the servo inside it.

I had expected this issue and to address it I had a solution ready. As on the OSR2, the pitcher links on the SR6 do not actually experience a large amount of axial force during use. It is therefore possible to introduce a dog-leg to the design without the risk of the link breaking. By arranging the pitcher links so that they run parallel to the main links before angling inward to the pitcher arms, it's possible to preserve the original function of the links, whilst preventing them from coming into contact with the T-wist enclosure.

Naturally a re-design of the pitcher links for the T-wist also presented an opportunity to tidy up the servo wire harnessing arrangement. In the past I've just made provision for the wire to be attached to arms or links using cable ties, but with these newer designs I have decided to accommodate the wires inside the links, which should look a lot neater.

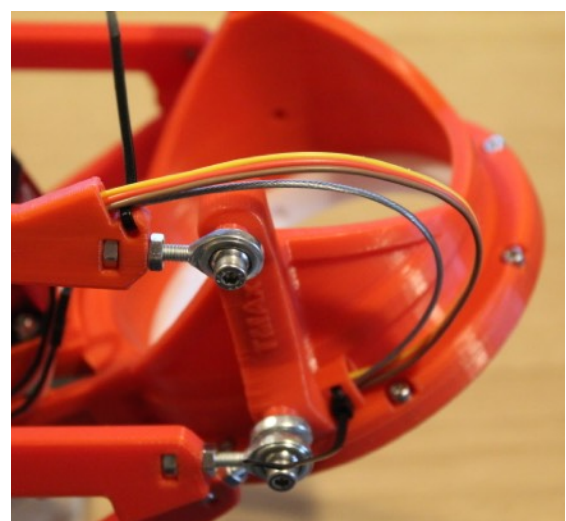


ANGLED CONDUIT LINK



*THE NEW ANGLED LINKS ON AN SR6
DRIVEN TO AN EXTREME POSITION*

I have also been experimenting with ways to prevent the servo cables from becoming damaged. It only takes a little bit of localised bending to rapidly cause a section of the cable to fail. What I am currently trying, and may end up recommending, is to wrap the servo cables up in cable binding along with a length of stiff cable, for example bicycle brake cable.

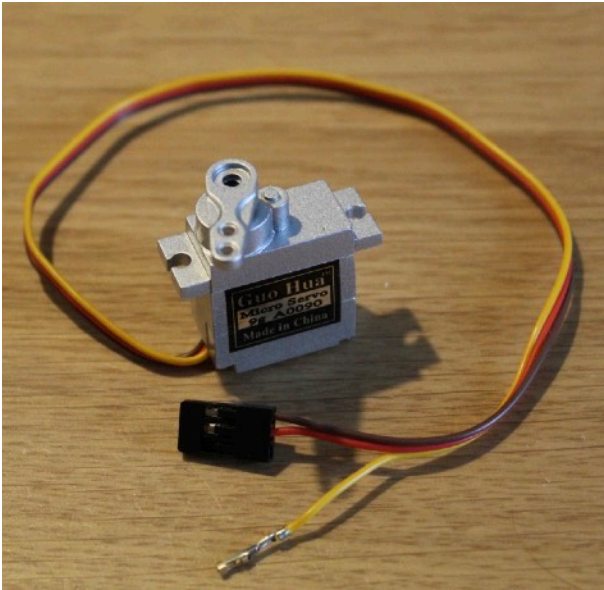


*SERVO CABLES NEXT TO A LENGTH
OF BICYCLE BRAKE CABLE*

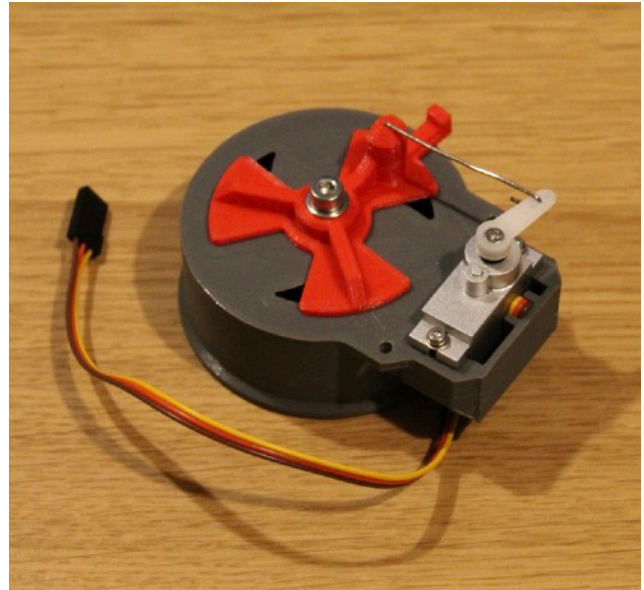
T-valve

I've been having some thoughts about the T-valve. Like the T-wist it's an older part of the OSR2/SR6 infrastructure and I think it's a prime candidate for significant improvements.

The first thing that needs improvement is the noise. In the past I've actually found that the T-valve is easily the loudest part on the OSR2/SR6. This is actually quite easily done, because it turns out that a 9g servo isn't just a 9g servo. In terms of quality it seems that you really get what you pay for! I recently performed some trials with a higher-end servo and the result was actually incredibly quiet.



*DILWE 9G RC METAL SERVO
QUIETEST SERVO I'VE COME ACROSS SO FAR*



*THE NEW SERVO INSTALLED
IN THE T-VALVE BODY*

I'm still not completely happy with the design though. I think it should be possible to eliminate some parts and make the arrangement more compact. A project for later this year perhaps!

OSR2 updates

I said that I seem to spend all of my time these days writing build plans!

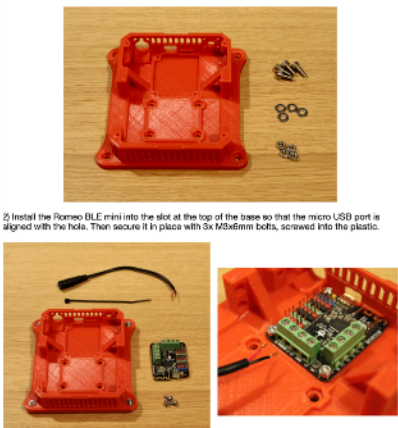
I am currently working on an update to the "Start here" OSR2 build pack. This will be a minor update with respect to the design itself - mostly it will just be the incorporation of the new bearing arms and T-wist - but I want to bring the document up to date.

The current document still uses outdated images from the original OSR2 design (pre OSR2.1). The cover image of the OSR2 also dates back to before my new camera setup and looks very dated for it! Obviously I want to rectify that!

I started taking the new images on a recent livestream, which you can find [here](#).

Assembly steps

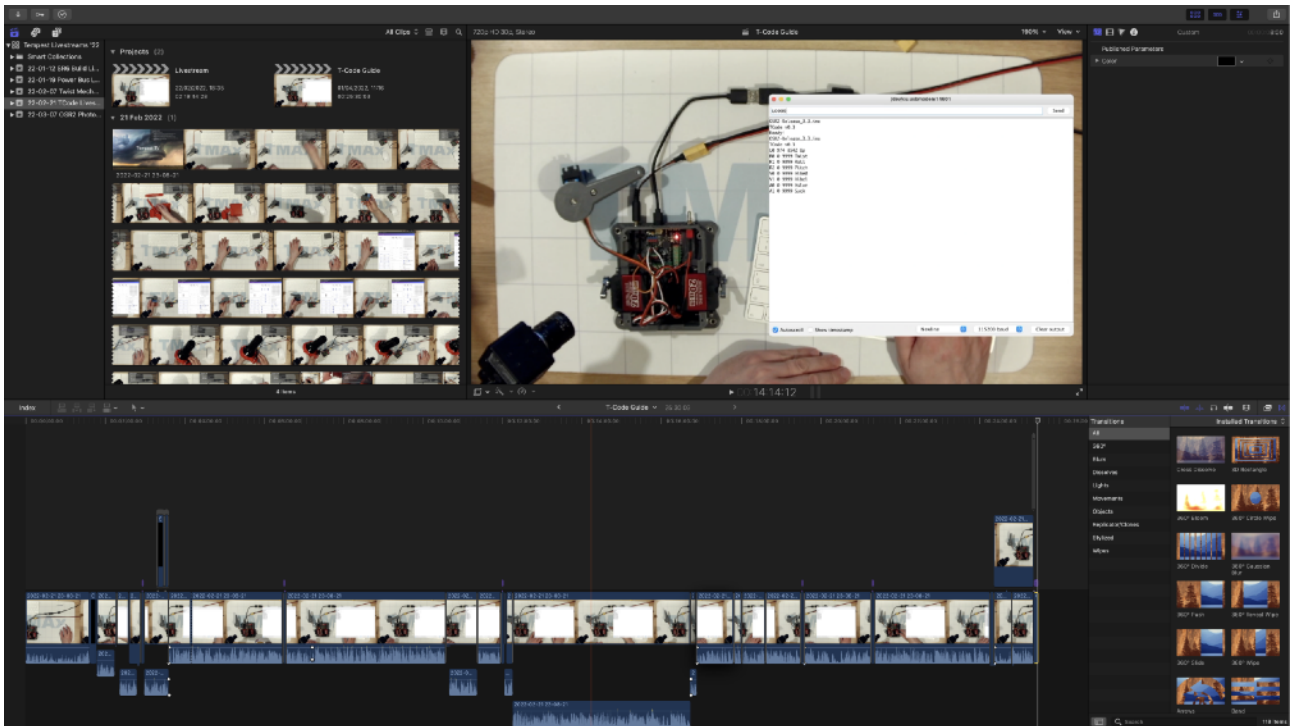
- 1) Insert 4x (or 6x) M4 nuts into the mounting holes you intend to use on the base part. You can secure them in place with a dab of superglue if you wish. Then insert 4x M4x10mm bolts, with M4 washers into the holes from the back. These are the bolts that will be used to attach the OSR2 to your mount of choice.
- 2) Install the Romeo BLE mini into the slot at the top of the base so that the micro USB port is aligned with the hole. Then secure it in place with 6x M2.6x6mm bolts, screwed into the plastic.
- 3) Install the trailing leads from the female barrel jack into the "Servo" screw connectors on the Romeo. Ensure metal-to-metal contact between the wire and the terminals and that the red wire goes to "+", black goes to "-".



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Video editing

Finally, a word or two about video editing. I think a video is worth a thousand pictures and pictures are worth a thousand words. Anyone who has been around my work for any length of time will know that I like to use videos as a way to show my work to you guys, and to help you get the most out of this tech.



EDITING THE T-CODE GUIDE FROM RAW LIVESTREAM FOOTAGE

To make my videos I use Final Cut Pro (Yes, most of my work is done on a Mac!), which is an absolutely superb piece of software and a joy to use. I use a couple of high-quality webcams, and I use OBS to record the video. OBS is very good for streamlining the workflow, for example allowing you to capture windows off the desktop and merge them with the recording in real time.

Back in the old days I used to capture video using my iPhone and edit using iMovie. Needless to say I don't look back to those times!

I am always looking for new ideas for subjects for new videos, so do let me know if there's anything you'd like to see me cover in more detail.

Finally...

I'd like to say a big thanks to you guys for the support you give me. I'm actually enjoying sharing this glimpse into my creative process with you, so I hope that it's interesting to see and read. I would like to invite you guys to engage more on the discord server, especially if you see something I've posted and you have any questions or suggestions. I'm also definitely open to organising livestreams and hangouts on there too if there's anything particular you'd like to see more of. Let me know.

Thanks again!
Tempest