![neo.tko logo]

Magnetic Head Changer for Ultimaker Original Plus

B.O.M.

x6 M3 Studding bolts 70mm long at least	The important area with screw it's the end
x8 M3 15mm	For the hangar bay assembly. You could use glue too I suppose…
x4 40x40x10 Fans 24V	Connect them in parallel to the FAN PWM - Check mA so it's never higher than 400-500mA
An Ultimaker Original Plus	On UMO (not plus) you should design an area to hold the Thermocouple Transmitter
M3 TAP	To process the Aluminium laser cut part for the m3 holes. You could also use m3 screws to make the 'screw' but I don't recommend that
M3 Drill and M10 Drill	To process some 3D printed parts. 10mm drill isn't a must, you can just clean the hole of the fan cap by hand, but I prefer a clean 10mm hole.
Needle Nails	To clean up some of the magnet holder holes.
x6 4,4mm dia springs	5mm springs should work too. Also you can use pen springs can work. I used 3 pens and did cut the springs in half. This works, but the spring will end up going through the washers or the wood and will make alignment a real pain.
x12 m3 Washers	To isolate the springs so they don't go through the wood/printed part
x12 10.0 x 5.5 x 2.0 mm N45SH	The 'SH' grade means it won't loose any strength unless it reach 150C. Each has 1kilo strength. Never use N50 or higher, they will lose strength at 60C. Better safe than sorry.
Araldite Crystal	That's what I used. You can google for glue's for neodymium magnets and use the one you prefer. **Read all the safety instructions and info before using it.**

Idea and Credits

Foehnsturm at the Ultimaker Forum proposed and developed this idea on his UMO with Anubis head at http://ultimaker.com/en/community/view/10657-a-different-multi-extrusion-approach-um-tool-printhead-changer I used his first stl designs to develop a usable version for UMO+.

The File mhc-head-part1 uses a part designed by Ultimaker team called 1037-A2P-A https://github.com/Ultimaker/Ultimaker-Original-Plus/blob/master/1037_Print_Head_Coupling_Plate/B1037-A2P-A.PDF I used this file to make the upper area where the Tube Coupling Collet goes, to make it as close as the original was.

All the files and info are under License: Creative Commons - Attribution Share Alike

Magnetic Head Changer

Before you start printing you will need to get someone to machine you (unless you have access to a cnc machine ofc) this:

mhc-aluminium-peek-holder-1unid1cm.dxf

This must be done on at least 4mm Aluminium. If you don't make it on 1 piece you will have to add nuts to make them stay as 'one'. I tried this, and it's a bad idea, it can work, but don't send me msgs about how to since it's a real pain to adjust the calibration this way.

This is the Aluminium parts I got. 4mm. You will need to file the corners and central hole, unless you order them with a special finish so they look clean. The 2.5mm holes are for you to use the M3 cap and make the screw. Do it nicely and they will serve you well, do it wrong and they will loose the screw over time.

mhc-wood-ptfeisolator-holder-1unid1cm.dxf

You can make this part also by cutting the original wood parts (better use a spare one if you bought the Dual Experimental kit). Print the part in paper, mark, and cut, drill. Done. Or get a laser cut service to make you one. I used 4mm and 3mm and both work fine. The ideal size it's 6mm to it's really robust. But for this you can just use x2 wood parts.

For my early designs I used a printed part to cut the wood parts, it does work, but if some of the wood 'breaks' it will lose precision when doing the alignment.

Print the stuff AND remember to print X mirrored versions of mhc-clamp, hangar-bay, hangar-holder, head-part1, head-part2. Cura does this fast and easy.

Preparing the stuff for the assembly

After printing the stuff. Get a M3 Drill (if you use pla try to use a low velocity drill so it doesn't melt.

Use it on the holes of Part1and Part2 (and mirrored ones). Also use it on the x4 holes of the Fancap.

The idea it's to make the M3 long 70mm screws to be able to pass 'softly', Try passing one in and out and check that it doesn't have any friction (the least the better).

Preparing the FanCap

I'm designing a stainless steel fan cap for 0.5 using the original design from the UM2 and adapting it for this head. But for now, you can just print this. The UM2 version in stainless steel will use 30x30x10 24v fans. So if you want the 'fancy' version, just wait.

The Fancap it's my 4th design, after many tests of heat I finally can say that this will hold nicely, at least if you turn it on your lowest speed so the pla don't melts. Print it on XT or something nice so you can forget about the heat. But even so, if you want to print heavy hours (like we all like) you must do this:

a) Buy a heat insulator film. There are many on ebay. I used Heat Shield Reflective Mtex, cheap and it works.
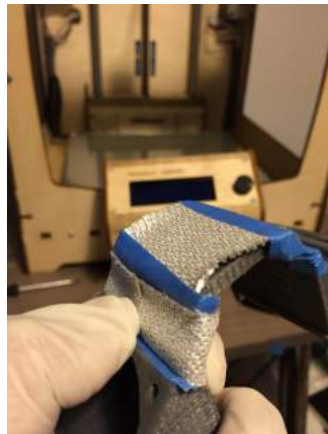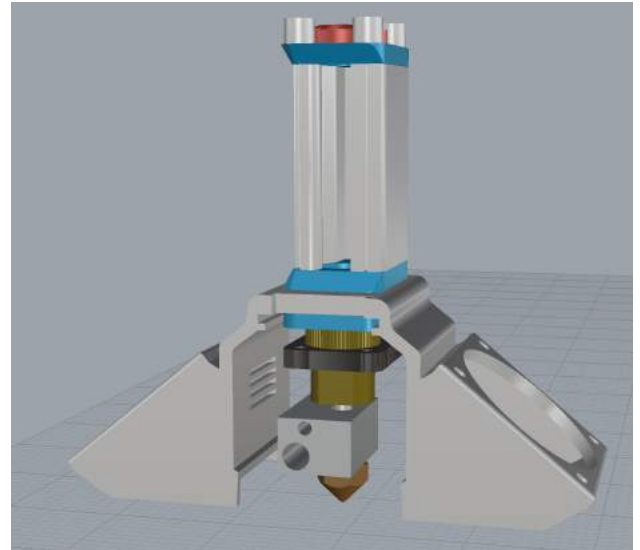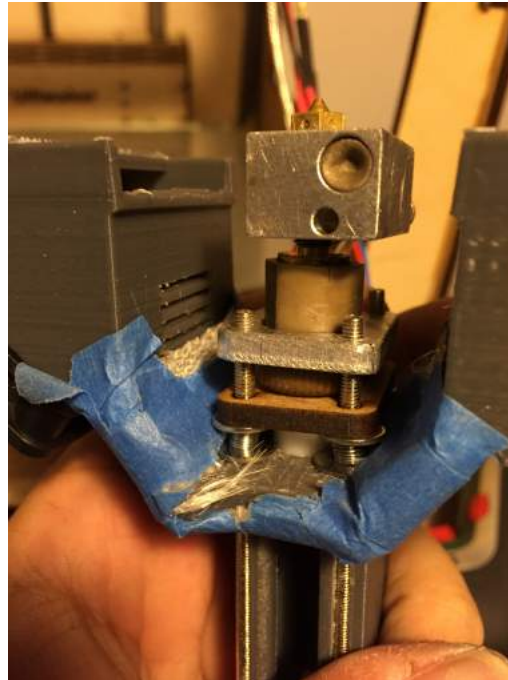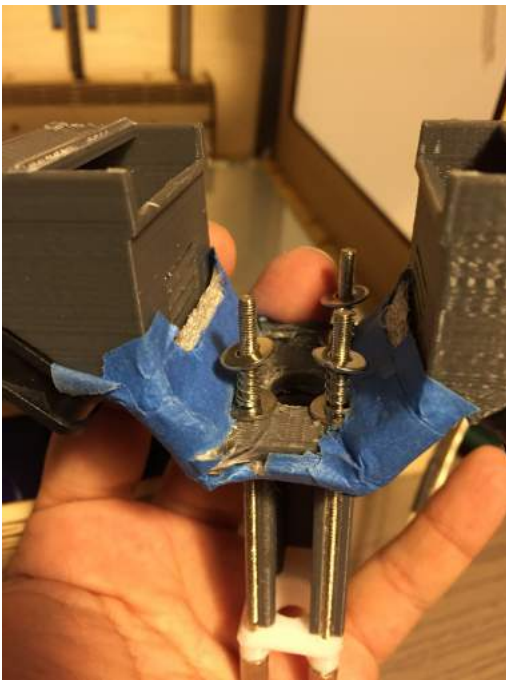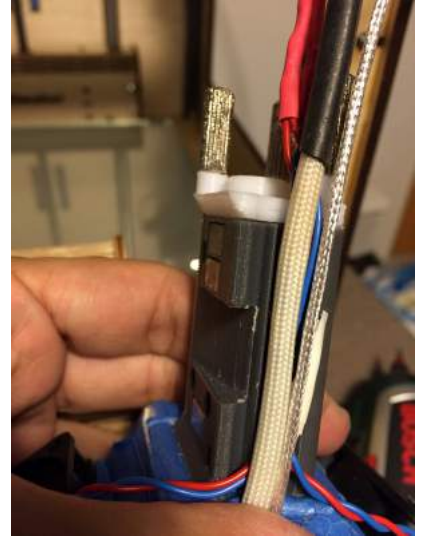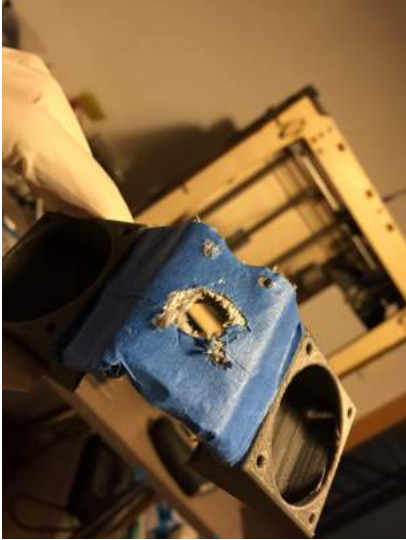

b) Cut a piece like the photo.
c) With some blue tape or kapton you some on the photos areas to hold the film. Remember to keep the air exits clean. It's designed to keep the peek and the upper part cold, so the heat don't go up and deforms the printed part.

d) Clean the hole areas so the screws and the 10mm hole are clean for the bowden to pass through.

Assembly and springs

This is what you should have at this point. The assembly it's pretty straightforward at this point.

Magnets and Glue

The clamp and Head-part2 + it's mirrored part. Before getting your hands dirty with the Epoxy (remember to use gloves) you will have to 'file' the part that will be glued on the printed part. Check that the magnets go in and out nicely and that they don't hit any printed error or cleaned support. Use a needle nail to clean the area and scratch the magnets (but I must warn you that the byproduct that the magnets release it's toxic and you should never ever scratch them). Ok if you scratch them, (but you shouldn't) try to remember not to scratch the area that won't be glued).

Because the clamp magnet area it's too small, you will have to (specially the 2 magnets that are very close to each other) be sure that you don't let them 'flip' when using the same (x/-) alignment. This happened to me and I had to

print another and glue them again. Crystal Araldite only last 5mins on it's 'usefull' state, so if you wear latex gloves (remember this stuff it's toxic and can should not be in contact with your skin) you can 'hold' the 2 magnets that are close to each other and wait a good 3-5minutes untill they don't run free. That will give you enough margin of error for you to BLUE TAPE the magnet and the printed part so it can dry without moving. Remember to place each part 50cm away from other magnets or metals so they don't move. Avoid using metal clamps to fix them, I used this on an early version and sometimes the attraction makes the magnet move and the glue doesn't stick well. If you have a plastic clamp, use it, otherwise just use a lot of blue tape and keep pressuring each layer so it's all well and tight. You should wait 3-4h to dry, but I really recommend that you wait 24h.

Magnet Alignment

Magnet Alignment (option b)
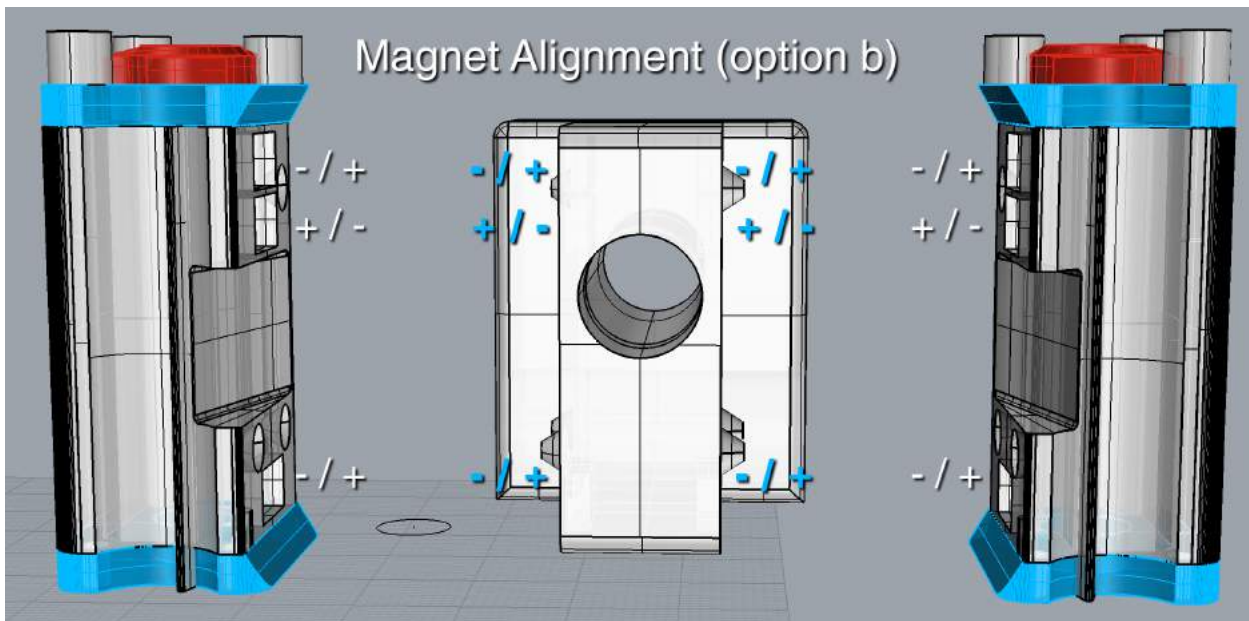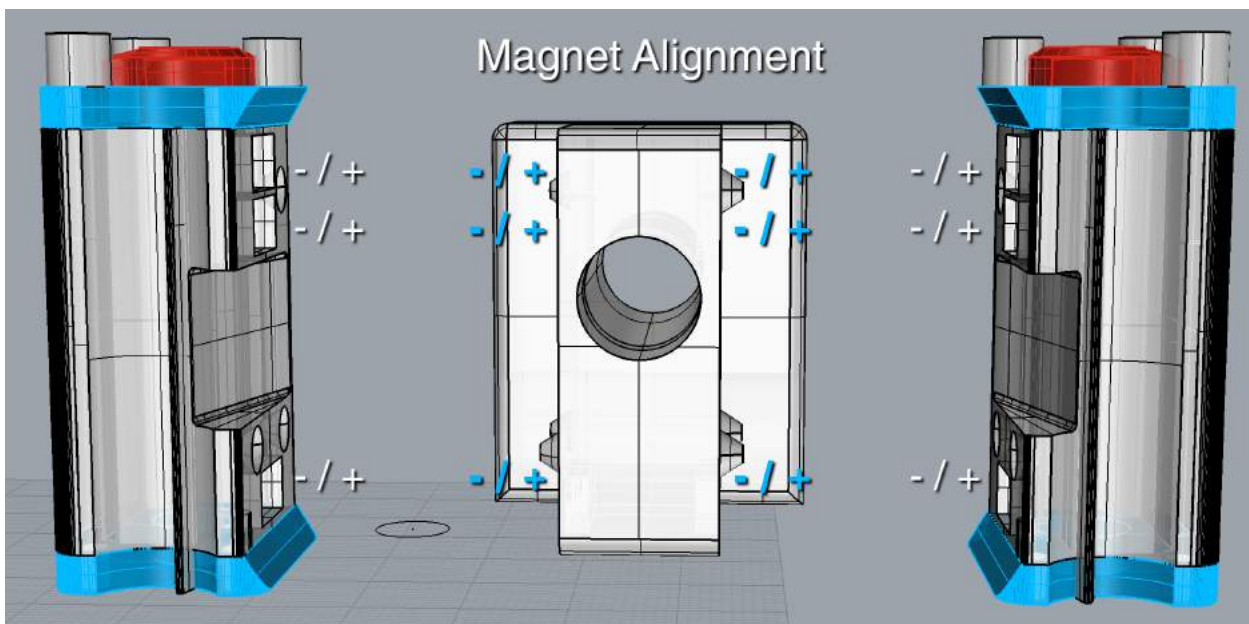
If you use the Option B, it will be a bit easier to make the two upper magnets to stay in it's place, but unless you prepare everything really really nice, you might get confused. Try to paint or mark the area of the magnets you will use that will be glued and the area that will be to the air.

Software / Firmware

This is a work-in progress area. So take this as a starter guide.

Remember, BEFORE each print. Place the 2 heads on it's hangar and move the Clamp away so it can do X home without hitting the hangars. Also remember that the 'home' option on the default firmware will 'crash' your hangars.

Starting G-code (CURA AND SIMPLIFY3D)

M218 T0 X0 Y0 ; Tells to the Ultimaker that the Extruder 0 it's 0/0
M218 T1 X-35.75 Y-0.18 ; Alignment. YOU WILL HAVE TO TUNE THIS
G28 X0 ; Go check home on X
G0 F10000 X40 ; Move to the right to avoid hitting the hangar
G28 Y0 ; Go check home on Y
G0 F10000 Y40 ; Move inside to avoid any collision and prepares to home Z
G28 Z0   ;move Z to min endstops
G0 X40 Y40 Z15 F3000 ; Lower Bed to prepare purge
G92 E0 ; zero the extruded length
T1 ; Extruder a bit on T1 so prepare it for to print
G1 F200 E4 ; purge nozzle with 2.5mm of filament
G1 E-2.5 F2400 ;retract to be print ready latter on.
G92 E0 ; zero the extruded length again
T0 ; Usually this tool starts first, so it won't retract.
G1 F200 E3 ; purge nozzle with 2.5mm of filament
G92 E0 ; zero the extruded length again

Tool Change G-Code (For Simplify3D)

{IF NEWTOOL=0}T0 (Forces T0 so the X/Y coordinates are 0/0)
{IF NEWTOOL=0}G0 F10000 X6 ;Moves near the 0
{IF NEWTOOL=0}G28 X0 ; Home X yo be sure that the X stays align. You can remove this after you do some checks that this X/Y data fits your setup.
{IF NEWTOOL=0}G0 F10000 X6 Y50 ; Prepare to Park 1 on Left Hangar
{IF NEWTOOL=0}G0 F10000 X6 Y0 ; Park 0 on Left hangar
{IF NEWTOOL=0}G28 Y0
{IF NEWTOOL=0}G0 F10000 X176.8 Y5 ; Go Kiss Extruder 0 on Right Hangar
{IF NEWTOOL=0}G0 F10000 X176.8 Y50 ; Extruder 0 ready

{IF NEWTOOL=1}T0 (Forces T0 so the X/Y coordinates are 0/0)
{IF NEWTOOL=1}G0 F10000 X176.8 Y50 ; Prepare to park 0 on Right
{IF NEWTOOL=1}G0 F10000 X176.8 Y0 ; So long a thanks for all the fish.
{IF NEWTOOL=1}G28 Y0
{IF NEWTOOL=1}G0 F10000 X6 Y5 ; Searching Extruder 1 on Left Hangar
{IF NEWTOOL=1}G0 F10000 X6 Y50 ; Extruder 1 ready
{IF NEWTOOL=1}G28 X0

If you use CURA

Enable 2 extruders. And on the Gcode 'preSwtichExtruder.code' Write something like this:
;WAKA
On PostSwitchExtruder.gcode do:
;WAK0

Make the Gcode and now

Search and replace
;WAKA

T0
;WAK0

for:
T0 Changes to Tool0 So the X/Y coordinates are 0/0)
G0 F10000 X6 ;Moves near the 0
G28 X0 ; Home X yo be sure that the X stays align. You can remove this after you do some checks that this X/Y data fits your setup.
G0 F10000 X6 Y50 ; Prepare to Park 1 on Left Hangar
G0 F10000 X6 Y0 ; Park 0 on Left hangar
G28 Y0
G0 F10000 X176.8 Y5 ; Go Kiss Extruder 0 on Right Hangar
G0 F10000 X176.8 Y50 ; Extruder 0 ready

Also search and replace
;WAKA

T1
;WAK0

for
T0 (Forces T0 so the X/Y coordinates are 0/0)
G0 F10000 X176.8 Y50 ; Prepare to park 0 on Right
G0 F10000 X176.8 Y0 ; So long a thanks for all the fish.
G28 Y0
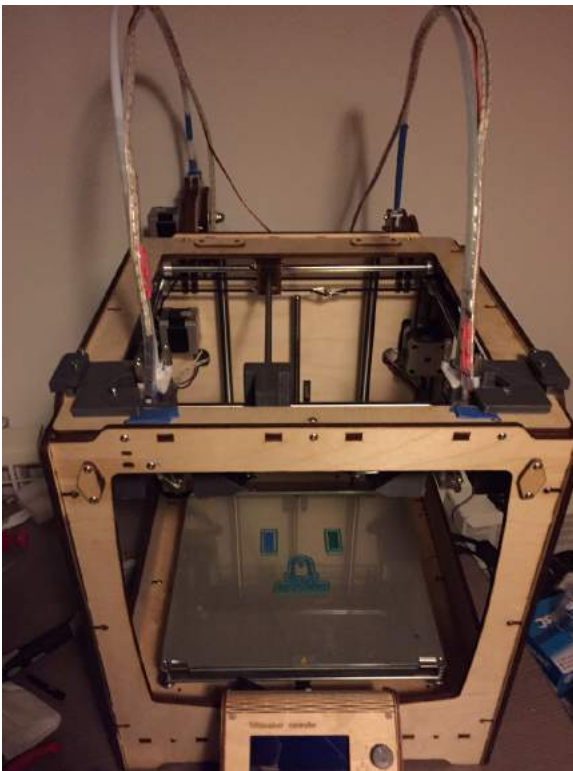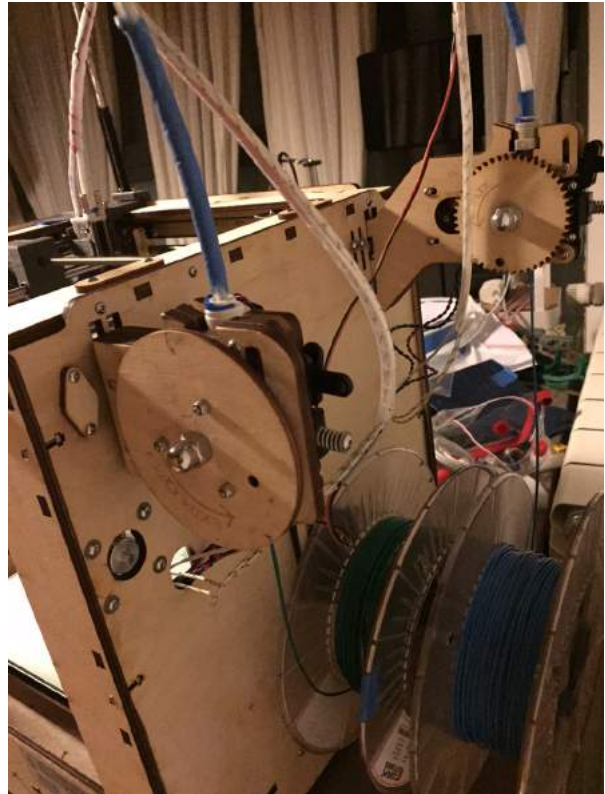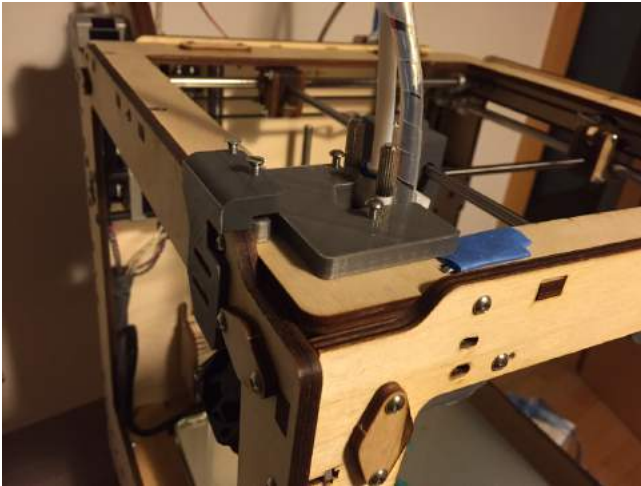G0 F10000 X6 Y5 ; Searching Extruder 1 on Left Hangar
G0 F10000 X6 Y50 ; Extruder 1 ready
G28 X0
T1 (changes to tool1)

Photos of my setup
Final notes

On Ultimaker Original Plus to make the Dual Extrusion work you will need:
- A Power Supply with 260W. I use a GS280A24-C4P (I changed the connector to use the same that the UMO+ uses)
- Dual Extrusion Experimental Kit
- A additional PT100B, because the Kit comes with the heat sensor that UMO uses, not UMO+
Read more info about this on https://ultimaker.com/en/community/view/8466-ultimaker-origional-and-dual-extruders?page=3

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Aditional notes

The hangar for the extruder 2 it's easy to remove, so the printing area for 1 head stays at a healty 194x184 (aprox) when removing the second extruder.

You will have to use a Endstop extender for Y like the one designed by @Ultiarjan https://www.youmagine.com/...witch-offset-bracket for the X endstop you might (more than probably) have to make a drill hole on the wood so the endstop stays nice. Check my photos for the frontal drill area.

Disclaimer

I take no responsability of any damages you can make to your printer while using this assembling guide. Read the info of any tool and use protective gear prior using any hazardous material. Good luck, and thanks for all the fish.

For any questions drop a msg at the Ultimaker Communty forums
https://ultimaker.com/en/community/view/10657-a-different-multi-extrusion-approach-um-tool-printhead-changer?page=1