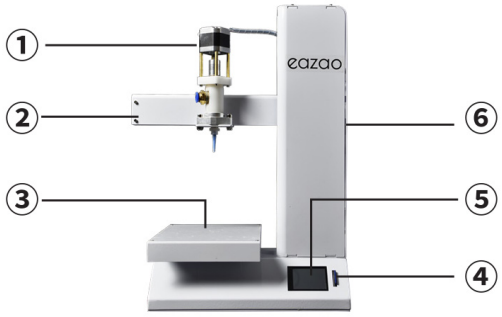
Basics to Clay 3D Printing- Overview 3a

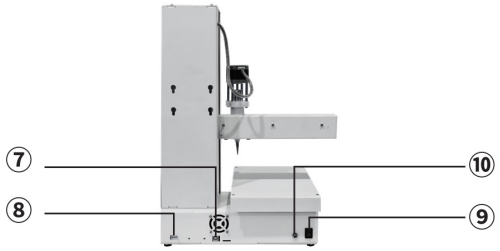
The utilization of ceramics goes back over 20,000 years ago during the Paleolithic Era. It has flourished by the hands of artisan over the many years. As technology has progressed and 3D printing emerged it was not long that the two crafts were blended into a new and exciting era of not only ceramics but the other disciplines it applies to, like architecture. The combination of this technology and these materials enables the ability to create complex geometries that are not possible with the traditional ceramics techniques. Not only that but they allow for more cost effective, faster, and less material then traditional ceramics techniques. In this module you will explore the intersection of 3D printing and ceramics using the Eazao Ceramic Printer and the unique properties that come with the materials. You will be guided through the how to prepare material and the machine.

Eazao Ceramic 3D Printer

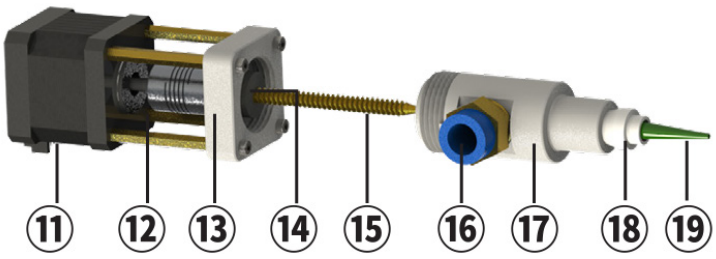
1. Extruder
2. X-Axis Beam
3. Y-Axis Printing Platform
4. Full Color Touch Screen
5. SD Card Slot
6. Z-Axis Column



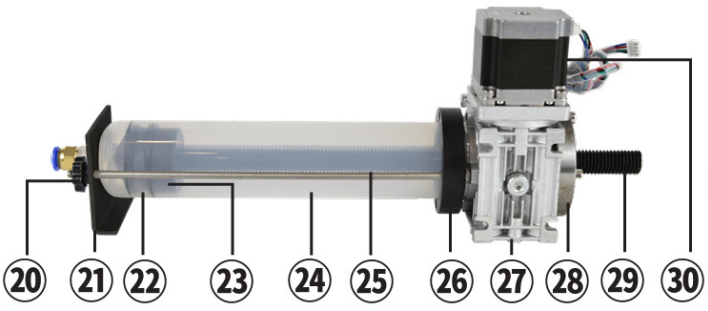
7. USB Port
8. Electric Putter Cable
9. Power Switch
10. Power Socket



11. Extruder Motor
12. Coupling
13. Extruder Tailstock
14. Seal Ring
15. Extruder Screw
16. Tube Quick Connection
17. Extruder Housing
18. Nozzle Adapter
19. Nozzle



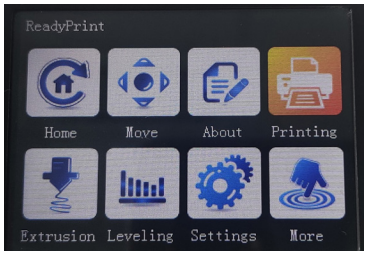
20. Finger Nut
21. Front Stop
22. Rubber Piston
23. Thrust Block
24. Cartridge
25. Fixed Screw Rod
26. Cartridge Fixing Ring
27. Reducer
28. Anti-Rotation Flange
29. Threaded Push Rod
30. Stepping Motor



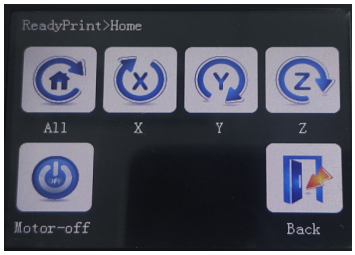
Basics to Clay 3D Printing- Interface 3b

In this assignment, you will review some basic knowledge of the Eazao ceramic 3D printer its mechanics and operation, the materiality of clay, and how to 3D print ceramics. After reviewing the parts and mechanics of the Eazao you will need to understand how to navigate the interface. The Eazao interface is user-friendly and approachable in its simplicity. Understanding these different menus will help aid in the operation of the machine as it can be touchy to operate with a successful outcome. These pages should provide the necessary basics and walk-through that should give you the best chance for a successful outcome. Make sure to follow these guides thoroughly while attempting this module. Keep a trial and error attitude as this can take a couple of attempts to achieve a successful ceramic 3D print as you learn about the material and its limitations.

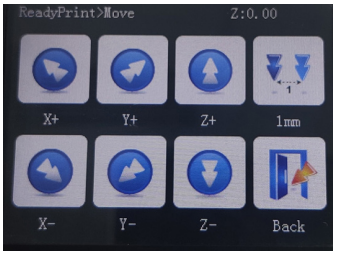
Main Interface



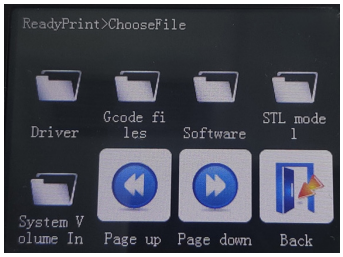
Home



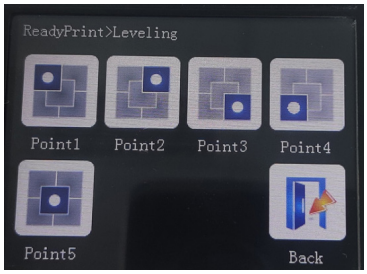
Move



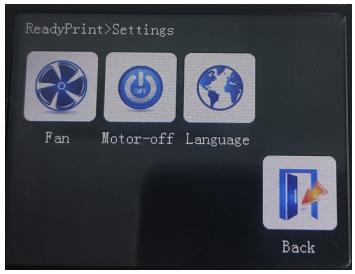
Printing



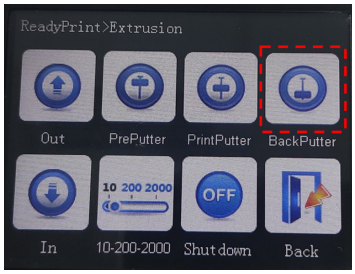
Leveling



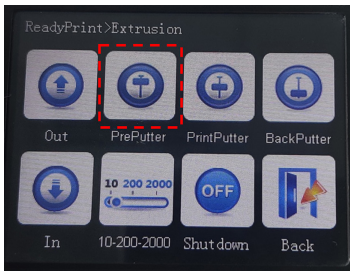
Settings



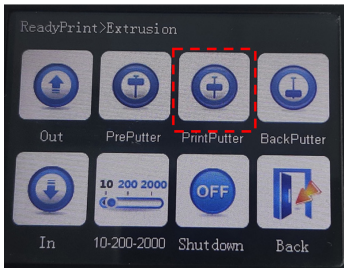
BackPutter



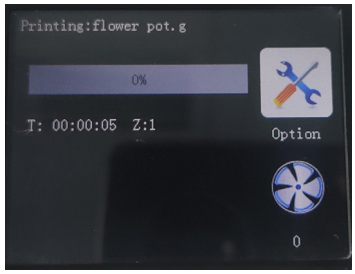
PrePutter



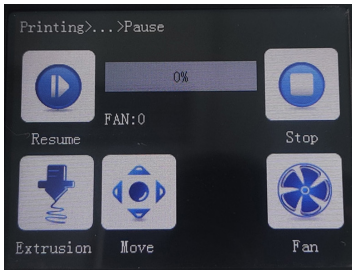
PrintPutter



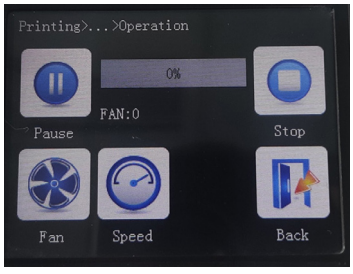
Active Printing Main



Pause



Operation



Basics to Clay 3D Printing- Electric Putter 3c

In this assignment, you will review the mechanical basics of the Eazao ceramic 3D printer's electric putter and how to assemble it. Unlike many of the module within this series you have to assemble some operational parts as you compete this assignment. It is a simple mechanical device with only a couple of pieces of accessible construction. This device only uses a handful of screws and large screw rod that is moved in and out of a syringe to extrude the clay with a single motor. A simple set of instructions are listed below with diagrams of each of the steps to assemble this mechanical part of the Eazao ceramic 3D printer. If you need a more clear image of this process you may download the manual at the CAP FAB LAB MAKERCORPS website at: (insert link). Before assembling these parts make sure that each piece is clean and clear of clay or any residue that may hinder the operation of the printer.

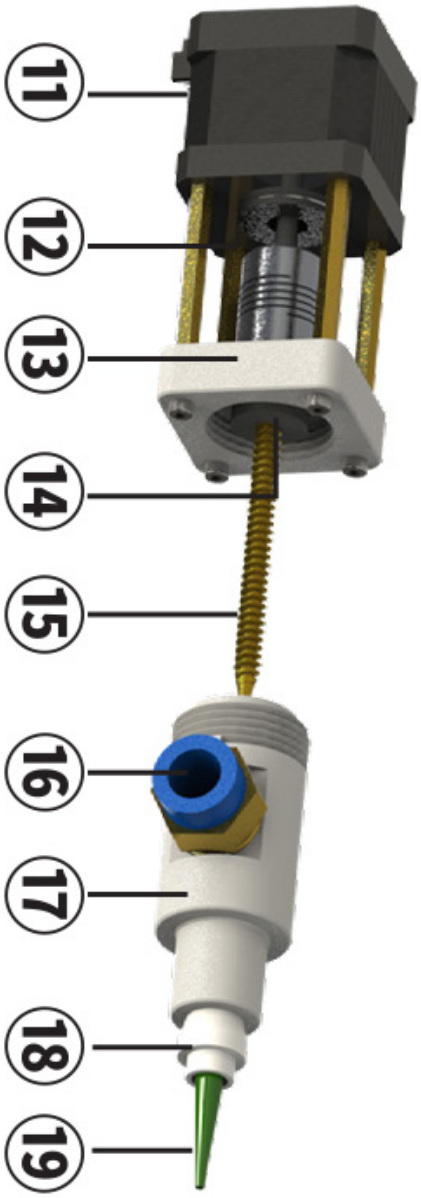
Assembly of Extruder

Step 1 - Install the extruder housing into the extruder motor by screwing it in

Step 2 - Install the blue and brass tube quick connection by screwing it into the extruder housing side

Step 3 - Install the nozzle adapter and nozzle to the end of the extruder housing by screwing it in

Step 4- Install the extruder head onto the 3D printer by screwing it into the extruder head plate.



11. Extruder Motor
12. Coupling
13. Extruder Tailstock
14. Seal Ring
15. Extruder Screw
16. Tube Quick Connection
17. Extruder Housing
18. Nozzle Adapter
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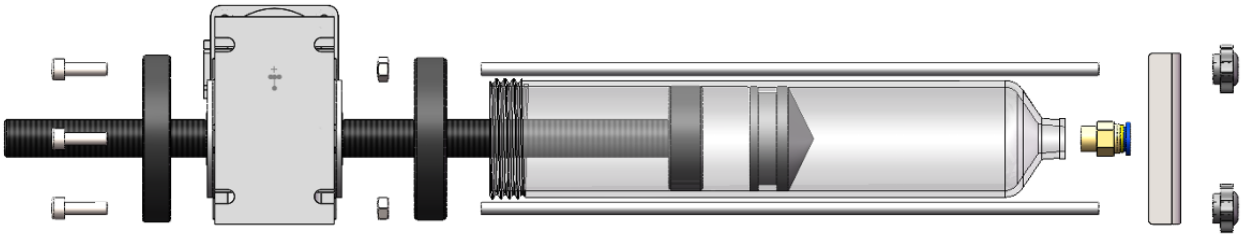
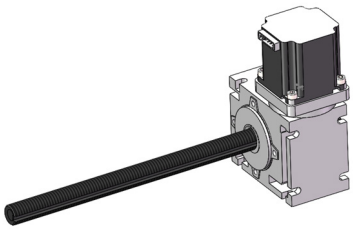
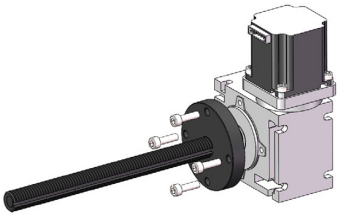


Assembly of Electric Putter

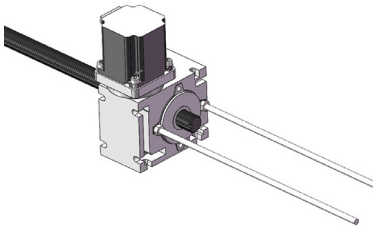
Step 1 - Install the screw rod



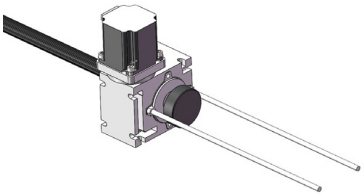
Step 2 - Install the anti-swibel groove flange and install the anti-swibel groove glange screw



Step 3 - Screwing the M6 screw rod and tighten with nuts

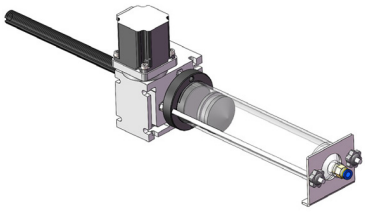


Step 4 - Install the thrust block on the front end of the screw

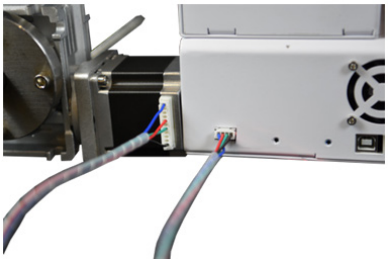


Step 5- Put the rubber piston into the cartridge fixing seat is rotated and installed on the cartridge

Step 6- Thread the cartridge assembly into the M6 screw rod and install the front fixed flange and tighten the hand nut and install the quick joint of the cartridge



Step 7 - Connect the electric push rod to the printer



Step 8- The switch in this figure shows that the device switch is in the off state at this time, and the power adapter is connected to the device.

Basics to Clay 3D Printing- Leveling 3d

In this assignment, you will review an absolutely crucial component to 3D printing which is bed leveling. Why it is such an integral part of 3D printing with clay is that it needs even layers to create structural stability, adhesion, and avoid layer collapse or floating printing. The process for bed leveling on the Eazao is very similar to FDM 3D printing. It has screws under the build plate for adjustment and a auto leveling sequence with an approachable user-interface. A simple set of instructions are listed below with diagrams of each of the steps to level the build plate of the Eazao ceramic 3D printer. Make sure to have at least one removable build plate to remove your 3D print from the printer once it is finished. It is a good idea to level the bed after each print as even a slight change can cause an unsuccessful print. The extra build plates will be located in the shelving next to the printer.

Bed Leveling Process

Note- Make sure that all cables are connected correctly, turn on the machine, and clamp the printing bed on the printing platform with the supplied clip. Level the bed to ensure that the print is stuck on the printing bed.

Step 1 - Select the "Leveling" option on the main page, and level 5 points in sequence. Note: These points correspond to the numbers on the touch screen.

Step 2 - Level the first point and place a piece of A4 paper between the printing bed and the nozzle.

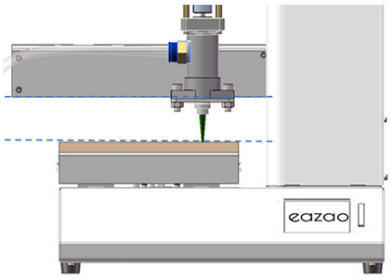
Step 3 - Adjust the distance between the printing bed and the nozzle by rotating the leveling nut at the bottom of the printing platform.

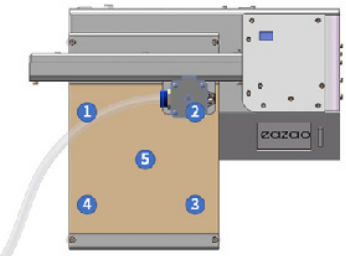
Step 4 - Keep adjusting until the nozzle on the A4 paper (0.1mm) has a slight resistance.

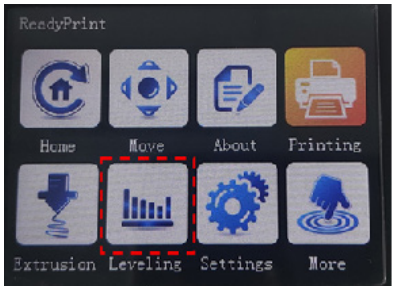
Step 5- Click on the second point, and level the second point according to the above steps. Use the same method to level the third, fourth, and fifth points. When all points are leveled, go to the next step.

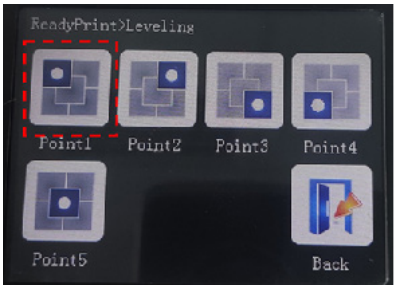
Step 6- About the leveling distance

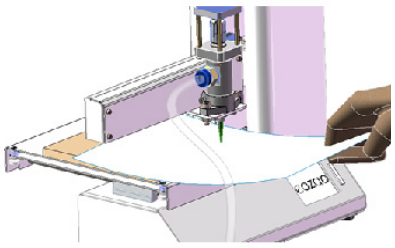
Note- Due to the particularity of the printing material clay, the clay can be deformed, and the distance between the nozzle and the printed board can be appropriately widened. It is not necessary to meet the distance of A4 paper. The leveling distance is not necessary to be 0.1mm. When the line of sight is level with the printed board, and the nozzle is observed to be close to the board, it is considered leveling at this time.

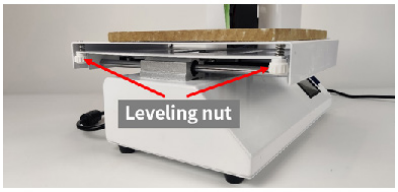


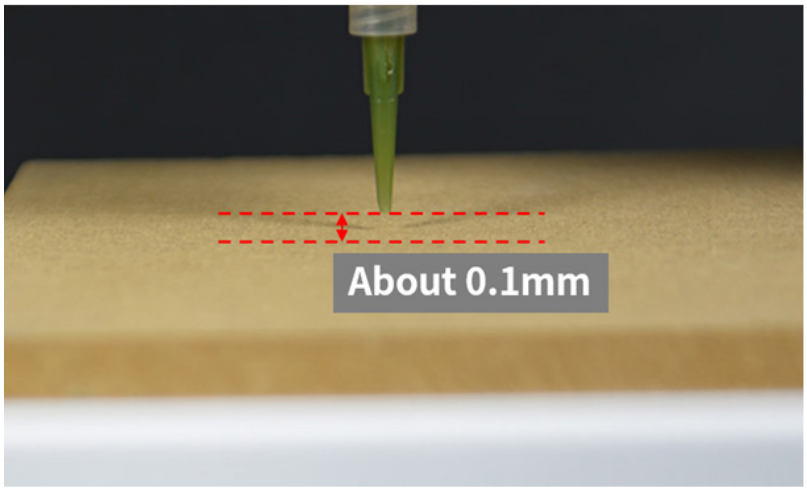












Basics to Clay 3D Printing- Leveling 3d

In this assignment, you will review an absolutely crucial component to 3D printing which is bed leveling. Why it is such an integral part of 3D printing with clay is that it needs even layers to create structural stability, adhesion, and avoid layer collapse or floating printing. The process for bed leveling on the Eazao is very similar to FDM 3D printing. It has screws under the build plate for adjustment and a auto leveling sequence with an approachable user-interface. A simple set of instructions are listed below with diagrams of each of the steps to level the build plate of the Eazao ceramic 3D printer. Make sure to have at least one removable build plate to remove your 3D print from the printer once it is finished. It is a good idea to level the bed after each print as even a slight change can cause an unsuccessful print. The extra build plates will be located in the shelving next to the printer.

Extreme Leveling Process

Note- When replacing printing bed with different thicknesses or replacing nozzles with different lengths, you need to adjust the printing bed again for leveling.

Note- When adjusting the leveling nut can not meet the requirements of the distance between the nozzle and the printed bed, you can adjust it through the Z-axis limit bolt on the side of the Z-axis. When adjusting the Z-axis limit bolt, you need to loosen the locking nut of the limit bolt.

A- When the distance between the nozzle and the printing bed is too large, you can turn the Z-axis limit bolt counterclockwise and move the Z-axis limit bolt upward. The distance between the nozzle and the printing bed can be greatly shortened when leveling.

B- When the distance between the nozzle and the printing bed is too small, you can turn the Z-axis limit bolt clockwise and move the Z-axis limit bolt down. The distance between the nozzle and the printing bed can be greatly increased when leveling.

C- When the limit bolts cannot meet the requirements of the distance between the nozzle and the printed bed, the Z-axis reset state can be adjusted by adjusting the position of the Z-axis limit switch fixing bolt.

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Bed Leveling Process

Note- When you finish the leveling and start to print the model in the SD card, you can judge whether the leveling status is normal from the following figure, and make corrections. The printing effect of the first layer is very important and needs to meet the normal state in the figure.

Low Level- The first layer of clay has not been compacted, and the clay appears to be warped.

A - The distance between the nozzle and the printing platform is too large. At this time, it needs to be leveled again to reduce the distance between the nozzle and the printing platform when the nozzle is reset to zero.

B- If the pressure in the barrel is not enough, re-select the pre-extrusion, increase the pre-extrusion movement stroke, and ensure the smooth extrusion of the pre-extrusion slurry.

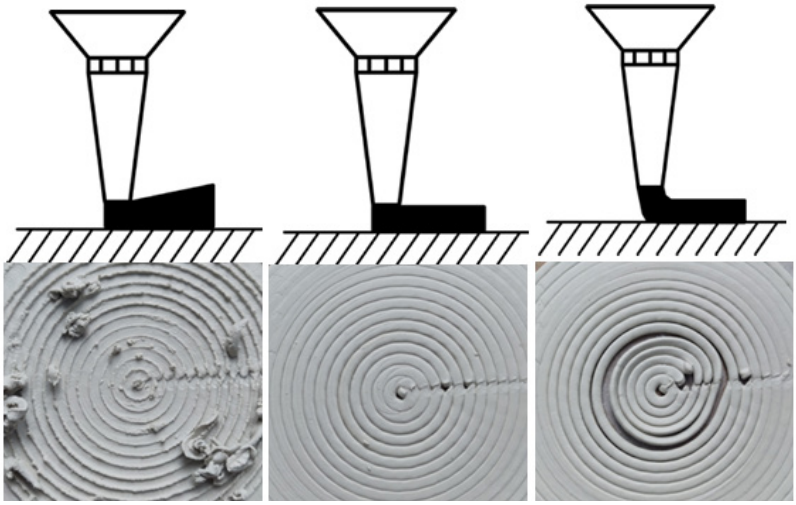
C- The clay is too hard. At this time, the push rod motor may produce a clicking sound at the same time. At this time, the clay should be reconfigured to make the clay soft.

High Level- The first layer of clay has been squeezed out too much and the clay has overflowed.

A- The first layer of clay has been squeezed out too much and the clay has overflowed.

B- The pressure in the feed tube is too high, pull the feed tube out of the side of the extruder, and after the clay is extruded, perform the pre-extrusion setting again.

A- The clay is too soft. At this time, the filling clay should be reconfigured to increase the hardness of the clay.



Low Level- The distance between the nozzle and the printing bed is too small, or the clay is too soft, or the pre-extrusion is too much, which will cause this over-extrusion.

Normal Level

High Level- The distance between the nozzle and the printing bed is too large, or the clay is too hard, or the pre-extrusion is insufficient, which will result in too little extrusion.

Basics to Clay 3D Printing- Clay Testing 3e

In this part of the assignment, you will learn the most vital element to whether your clay 3D print is successful or not regardless of all of the mechanical and programming being correct. The keystone element is clay viscosity and softness testing as it will determine whether you have a even and consistent clay extrusion. Too hard or too soft you will begin to experience complications that are very difficult to resolve after you have filled a tube with clay. Luckily there are some simple testing techniques and equipment that allow you to get a accurate assessment of the clay and solutions to aid in troubleshooting issues you may run into with the clay. We will walk you through the best methods to developing the correct clay viscosity and softness for optimal 3D printing. Below will be a set of steps to do the testing and a link to the video that accompanies it.

Viscosity and Softness Testing

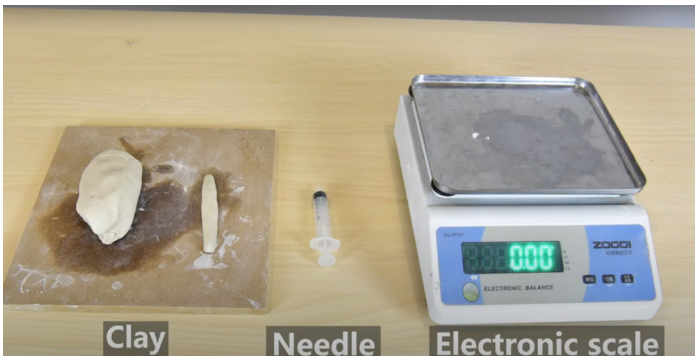
Step 1 - Gather equipment: clay, syringe, and a scale

Step 2 - Roll the clay into a strip and put it into the syringe. Spray some water if the clay is too hard or add more clay if it is sticking to your hands.

Step 3 - Pre-extrude some clay with your hands to make sure that there is no blockage or that the clay is not too hard.

Step 4 - Now place the syringe plunger down on the scale to test for the force required to extrude clay. It should read optimally 2.5- 3 KG (2500- 3000 g).

https://www.youtube.com/watch?v=NYi6CyIB8_0&t=7s&ab_channel=EazaoCeramic3DPrinter



Basics to Clay 3D Printing- Clay Preparation 3f

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Clay Preparation

https://www.youtube.com/watch?v=yVTTjjOkcgs&ab_channel=EazaoCeramic3DPrinter

Step 1a- Too many cracks mean the clay is too hard and that you need to add water then knead

Step 1b- The clay is too soft if your hands are dirty and you need to add some harder clay then knead

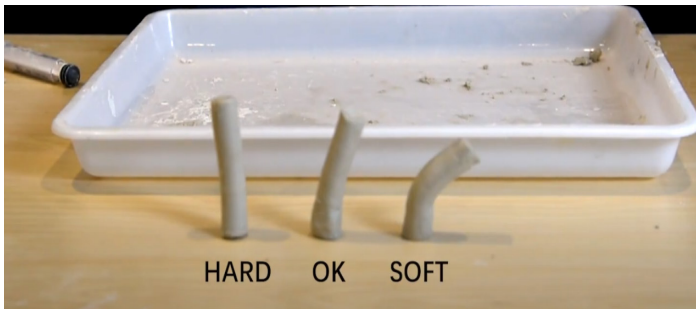
Step 2- Use a putty knife to remove the air bubbles by repeatedly scraping the with the knife

Basics to Clay 3D Printing- Clay Preparation 3f

In this part of the assignment, you will learn the most vital element to whether your clay 3D print is successful or not regardless of all of the mechanical and programming being correct. The keystone element is clay viscosity and softness testing as it will determine whether you have a even and consistent clay extrusion. Too hard or too soft you will begin to experience complications that are very difficult to resolve after you have filled a tube with clay. Luckily there are some simple testing techniques and equipment that allow you to get a accurate assessment of the clay and solutions to aid in troubleshooting issues you may run into with the clay. We will walk you through the best methods to developing the correct clay viscosity and softness for optimal 3D printing. Below will be a set of steps to do the testing and a link to the video that accompanies it.

Clay Preparation

Step 3- Next take your clay and roll into a strip and insert into a tube syringe with no needle end and test your clay softness. Make sure to make a large enough batch to fill the 3D printer tube.



Step 4- Once you have a large enough batch roll it into a log and insert it into the 3D printer tube. Make sure to avoid air bubbles and to leave room for the plunger.

Step 5- Once filled take the plunger or “piston”

Basics to Clay 3D Printing- Set Up 3g

In this assignment, after having set up your file and prepared your clay you will now need to set up the Eazao 3D ceramic printer with your tested clay filled tube. This process will take some time for the electric putter to move far enough into the tube to start extruding the clay through the nozzle. It will be difficult to tell whether the rod is actually moving even at the quickest speed. Patience is key, but you will eventually see the clay extrude into the bowden tube to the extruder head. If you at any point hear the motors start to make a clicking sound immediately stop the 3D printer. It means that your clay is too hard and you will not have much success with printing. You will then need to take reverse the putter and empty the tube then adjust the clay by adding some water and kneading. After adjusting the clay you will then need to refill the tube and try again.

Pre-extrusion Set Up

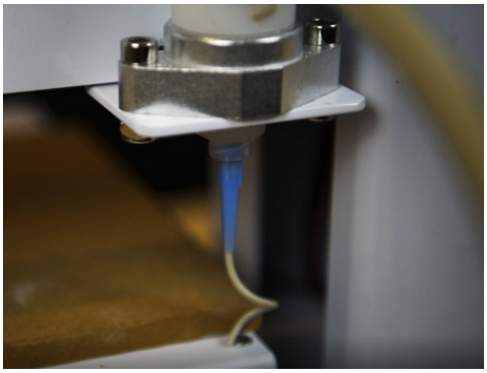
Step 1 - In the "Move "option, move the extruder to the position shown in the figure.

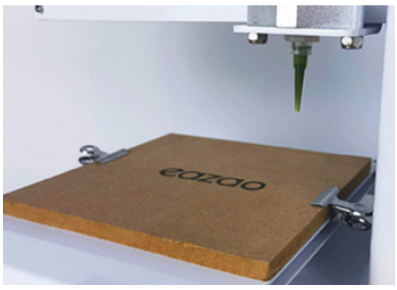
Step 2 - Select "Extrusion" → "BackPutter" → "10-20-2000" → "Out". The motor returns to the last position. The cartridge is fixed on the push rod motor. Tighten the thumb nut of the front stop of the electric putter.

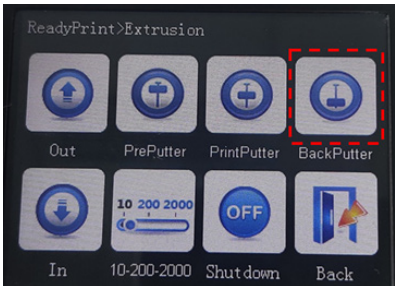
Step 3 - Click "10-20-2000" to select the moving stroke of the electric putter. When using for the first time, the electric putter may need to retract slightly. It is recommended to choose a smaller stroke. When a cartridge of clay is used up, the thrust block is at the farthest distance from the motor, and you can choose to retreat with a large stroke. Pay attention to when retreating, when the electric putter retreats to the end (a clicking sound will be emitted), before that, click the "Shutdown " option to manually stop in time.

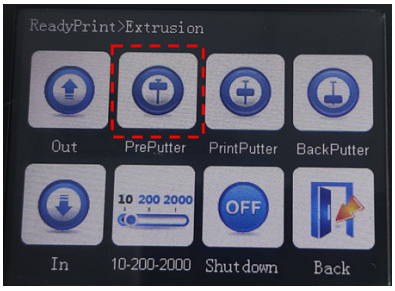
Step 4 - Use the feeding tube to connect the clay cartridge and the extruder to pre-extrude the clay. Select "Extrusion"→"Pre-extrusion"→"10-20-2000"→"Feeding". When the extruder can smoothly squeeze the clay and the flow of the clay is uniform and without disconnection, select "emergency stop", clean the nozzle and click back.

Step 5- Excessive PrePutter will cause too much pressure in the cartridge, and the motor will not move, making a clicking sound. At this time, click "Shutdown".









Basics to Clay 3D Printing- Housekeeping 3h

In this assignment, you have reviewed some of the basic knowledge for the Eazao Ceramic 3D Printer, including file preparation, assembly and parts, clay viscosity and softness testing, clay preparation, 3D printer set up, 3D printer operation, user-interface. Now you will continue to how to properly dismantle and clean your space and the 3D printer and its parts. You will need to completely dismantle each part to appropriately clean everything for future use. If you do not do so anyone after you attempting to use the equipment or space will have to clean up after you or may not be able to use the printer at all. If not cleaned the parts and 3D printer will be difficult to disassemble. It is possible it will ruin parts or hinder the printer itself. If you are found to not have cleaned up after yourself you will be asked to do so, lose privilege, and replace anything that is broken.

Electric Putter Dismantling

Step 1 - First you will need to set the putter back to the "Preputter" position to out to remove pressure from the tube to be able to dismantle and clean the parts.

Step 2 - Dismantle the electric putter by removing the bowden tube from the quick joint and the end plate and screws.

Step 3- Once the putter has reached the "Preputter" position you will need to unscrew the tube from the putter motor, remove any excess clay and put it back into the used clay bucket, remove the tube quick joint, put the plunger and the tube in the water bucket.

Step 4- Next you will need to remove the screw rods, tube fixing seat, and the thrust block while making sure they are clean.

Step 5- Final part to remove is the anti-swivel groove flange by undoing the four screws.

Extruder Head Dismantling

Step 6- Next remove the bowden tube from the extruder head quick joint and put it in the water bucket.

Step 7- Now you will need to remove the extruder head from the 3D printer.

Step 8- Remove the nozzle and nozzle adapter from the extruder housing and put it in the water bucket.

Step 9- Next remove the quick joint from the extruder housing and put it in the water bucket.

Step 10- Now you will need to remove the extruder housing from the extruder motor housing and put it in the water bucket.

Step 11- Finally you need to clean the extruder screw as best a possible.

Workspace

Step 12- Make sure to put any excess clay in the used clay bucket and that it is sealed when you leave.

Step 13- Make sure to clean up each part as much as you can before you leave.

Step 14- Make sure to clean up the workspace from any stray clay that is no longer usable before you leave.

Step 15- Make sure to put parts away in their proper location before you leave.

Step 16- Make sure to take the build plate that your print is on and place it in one of the shelves next to the printer to dry. Please make sure to put your name on a piece of tape with a sharpie then on the build plate with your vessel.

Step 17- Make sure that the lights are off and the doors are shut before you leave.

Note- Your vessel will be fired using clear glaze unless you provide an alternate. You may also take your vessel when it is dry and delicately paint it with glaze yourself and return it to be fired.