USER MANUAL

MICROMOLDER®

by: shopbotix

CONTENTS:

SAFETY:

SAFETY FIRST

Warnings: The use and operation of this machine poses many hazards. Please read and understand all warnings and hazards outlined in this manual. Always wear the appropriate personal protection equipment when operating this machine. To ensure the safety of you and those around you, always be aware of your surroundings and pay close attention to the current operating state of the machine.

Although this machine is equipped with many safety features and functions it should always be considered highly dangerous. Before performing any operation or movement of the machine always check that safety sensors and functions are operational, that machine guards are in place where applicable, and that you the operator has a clear understanding of the user input - machine output relationship.

Never disable a safety feature on this machine.

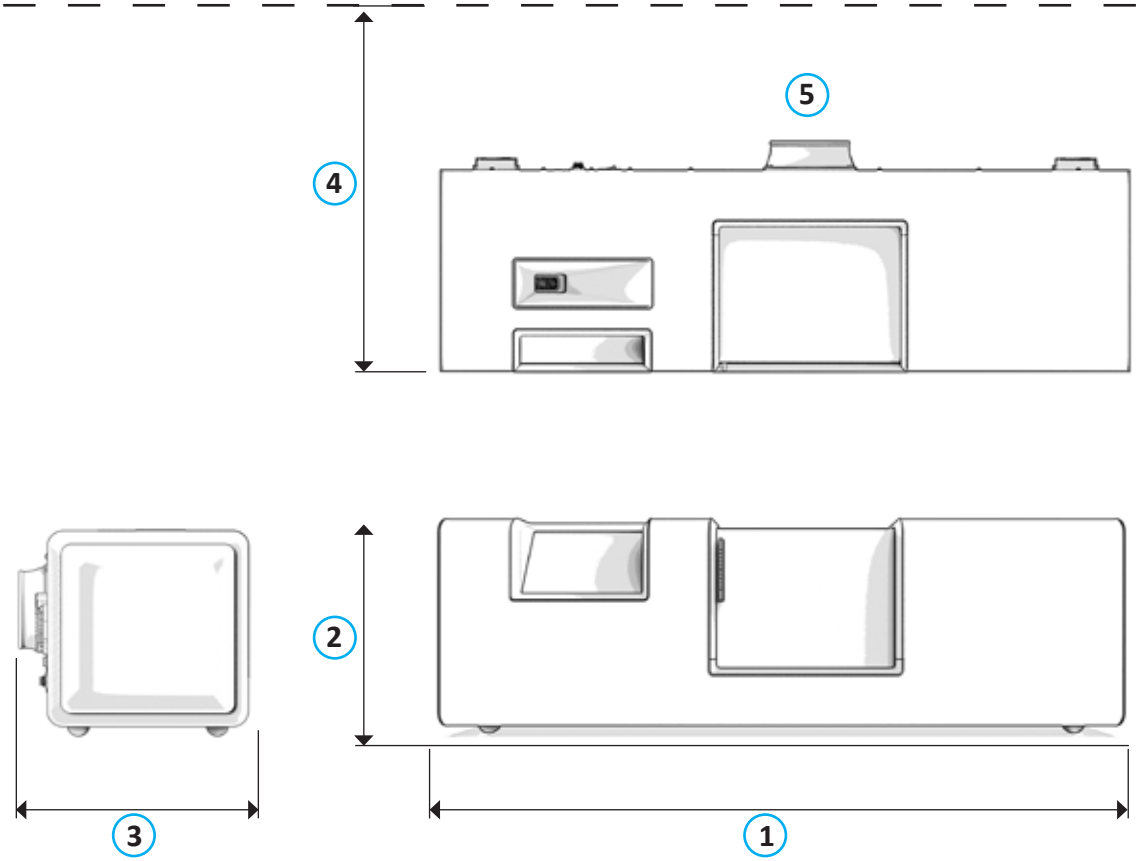
Never allow operation of this machine by un-trained or under-trained personnel.

Never allow children to interact with any part of this machine... Ever!

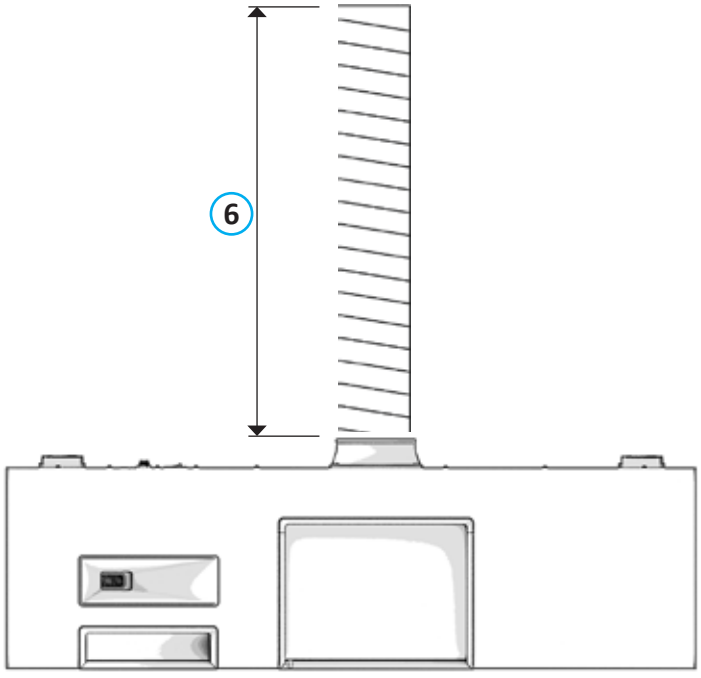
Maintenance and or repairs should be performed by qualified personnel only.

Never perform any maintenance task on this machine until the proper precautions have been met

PLANNING FOR INSTALLATION:

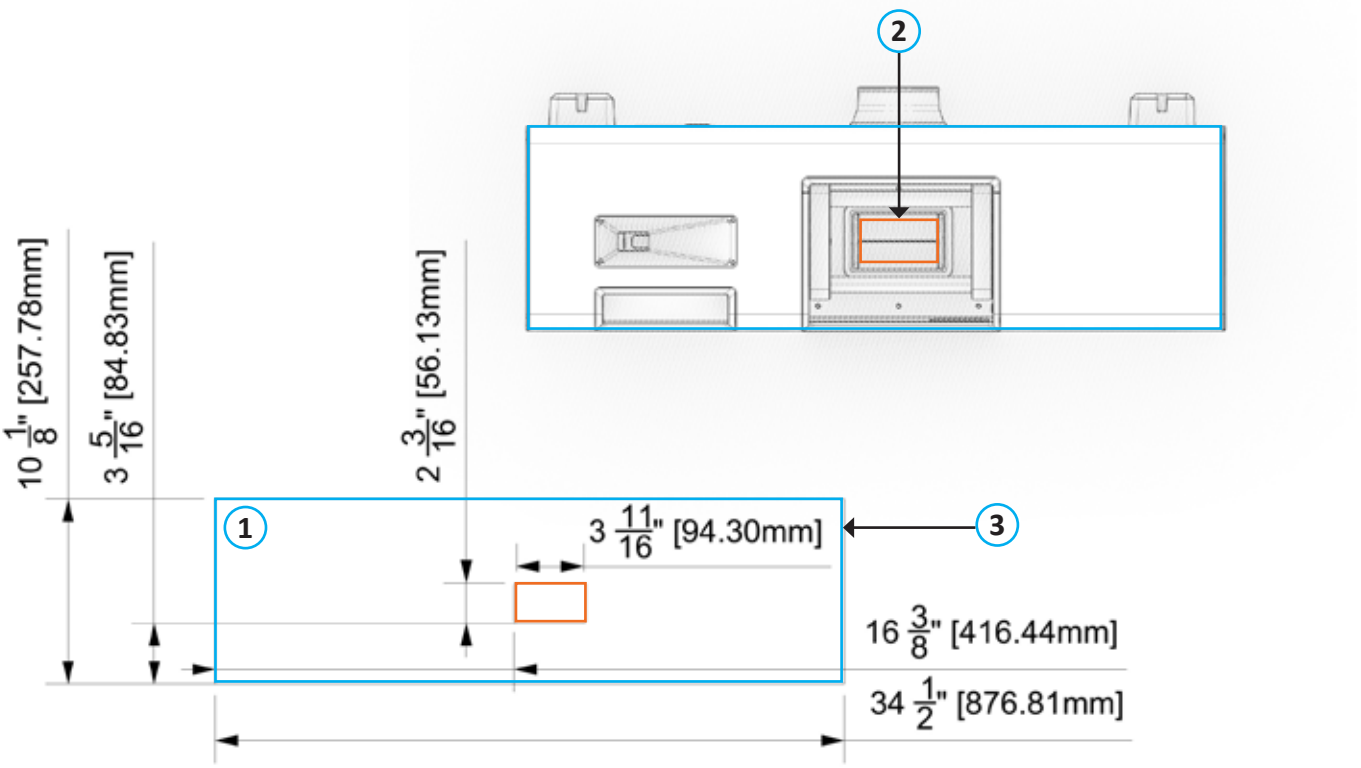


1. 34.73in (882.14mm)
2. 10.14in (257.68mm)
3. 12.07in (306.69mm)
4. Recommended Wall Clearance
   18.00in (457.20mm)
5. 4” O.D. Standard Exhaust Vent
6. Exhaust Fan Ducting
   Requirements:



If run length of exhaust ducting is greater than 6ft (1.82m) it is recommended that an in-line fan be used to supplement the on-board exhaust fan

PLANNING FOR INSTALLATION: CONT.



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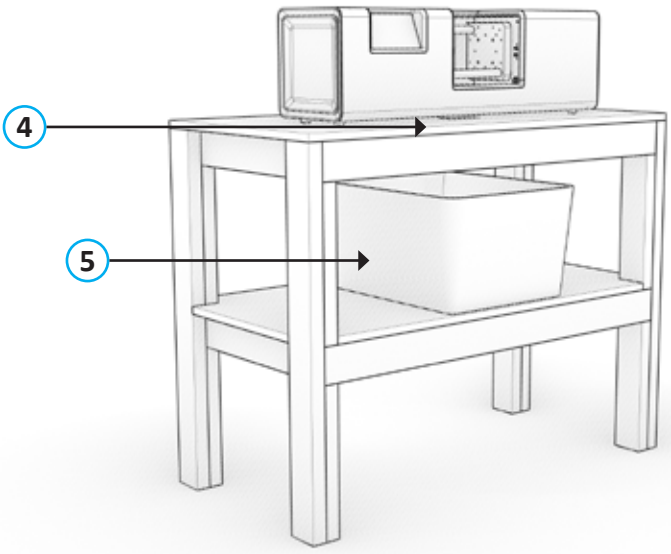


Note: The workbench pictured is 24”W x 48”L x 36”H

Note:
If run length of exhaust ducting is greater than 6ft (1.82m) it is recommended that an in-line fan be used to supplement the on-board exhaust fan

MACHINE SPECIFICATIONS:

CHASSIS
- 34.5” L x 10.0” W x 10.0” H (87.63cm x 24.5cm x 24.5cm)
- Weight 90lbs (36.28 kg)
- Power 120VAC 60 Hz(North America) or 220VAC 50 Hz(EU, Asia, etc)

WORKING AREA
- 6.00” max opening between platen plates
- 5.75” x 5.75” platens with universal bolt down clamp positions

INJECTION PARAMETERS
- Dual heat zones injection barrel
- Tool temperature and heater connection ports (24vdc and 80 watt max)
- Compressed air inlet
- 1.0 oz max shot size (1.8^3”) (29.57^3 cm) for 3D printed tooling
- 0.75 oz max shot size (1.35^3”) (22.18^3 cm) for aluminum tooling
- Clamping: ~ 1.5 tons applied force ~ 8 tons clamping force
- Standard injection molding nozzles (user replaceable)
    - 7/8”-14 thread, 1/2” rear opening, and a nominal 1/2” spherical radius

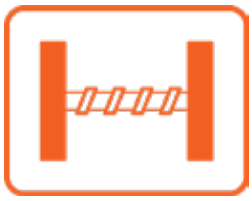
CONTROLS
- Powered by a LattePanda
    - 1.8 GHZ Quad-Core, 2 GB Ram, 32GB Flash Memory
    - Windows 10 OS
    - WiFi, Bluetooth 4.0
    - USB 3.0
- 7-inch touch screen graphical user interface
- Factory installed and calibrated control program and firmware

MACHINE FEATURES
- Optical part counter
- Injection error and part jam detection
- Automatic sleep and shutdown modes
- Plastic pellet hopper level detection
- Single Cycle or Auto Run modes
- Savable tool settings library
- Fume exhaust
- On screen touch and external mechanical emergency stops
- Safety door
- Over temperature shutdown
- Fully enclosed working area

MACHINE SENSORS AND SENSOR FUNCTIONS:

EJECT: Counts parts when in Auto Run mode
- Detects injection errors if present
- Indicates error on GUI screen
- Unattended for >3 minutes, heaters are shut off and machine is put into an e-stop mode

HOPPER: Detects presence of plastic pellets
- Indicates error on GUI screen
- Flashes LEDs



CLAMP: Clamping pressure control Jam detection
- Indicates error on GUI screen

INJECTION: Detects jams
- If a jam is present in the injection system power is cut to prevent the motor from drawing excess current and on on screen indicator becomes active.

TEMP: Controls temperatures from all heating zones
- Over temp range detection
- Indicates error on GUI screen
- Turns off all heaters

DOOR: Open door detection
- Stops machine motion if opened while running
- Prevents machine motion if open before starting
  *User override required for experimental tooling that requires the door to be opened.

UNBOXING:

What's Included:

(x1) MicroMolder Evo Machine
(x1) External E-STOP button
(x1) E-Stop cable
(x1) AC power cable (6ft)

Before You Begin:

-At 90+ Lbs, this box is not lightweight. Get help when carrying the package to avoid damaging contents.

-Check that all accessories listed are included in packaging.

-After opening the top of the box, cut front of box as shown in (fig 3). Use a short blade, cut on or near the corner and be careful not to cut into the machine itself.

-Opening the package in this way will make it much easier to remove the machine from the carton.

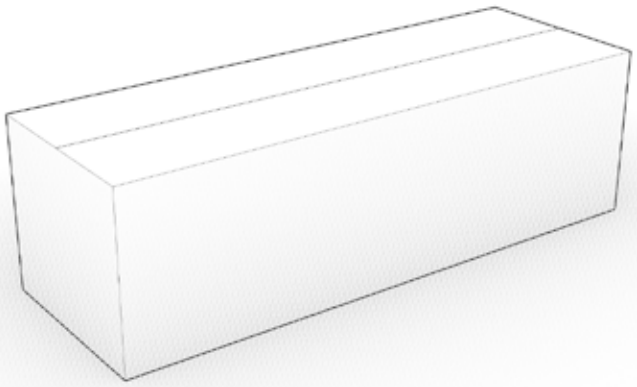


Fig1

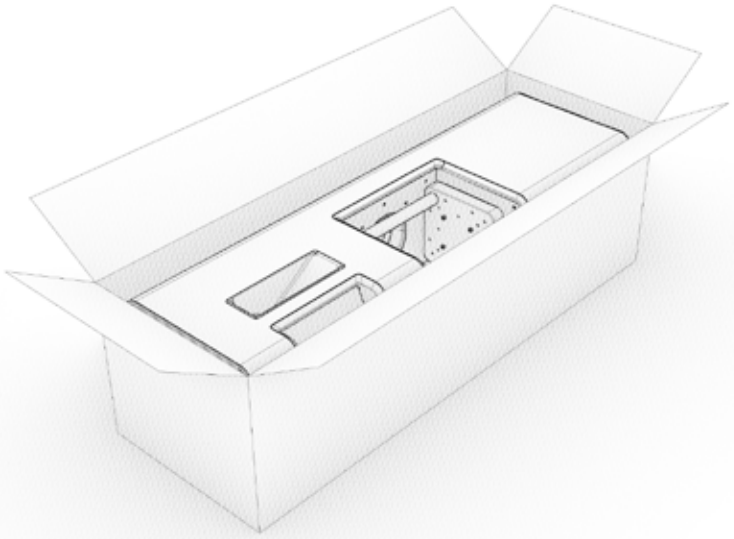


Fig2

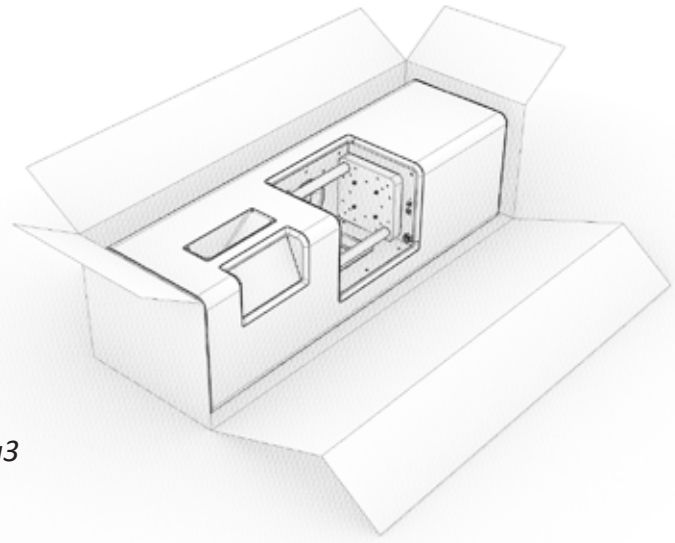
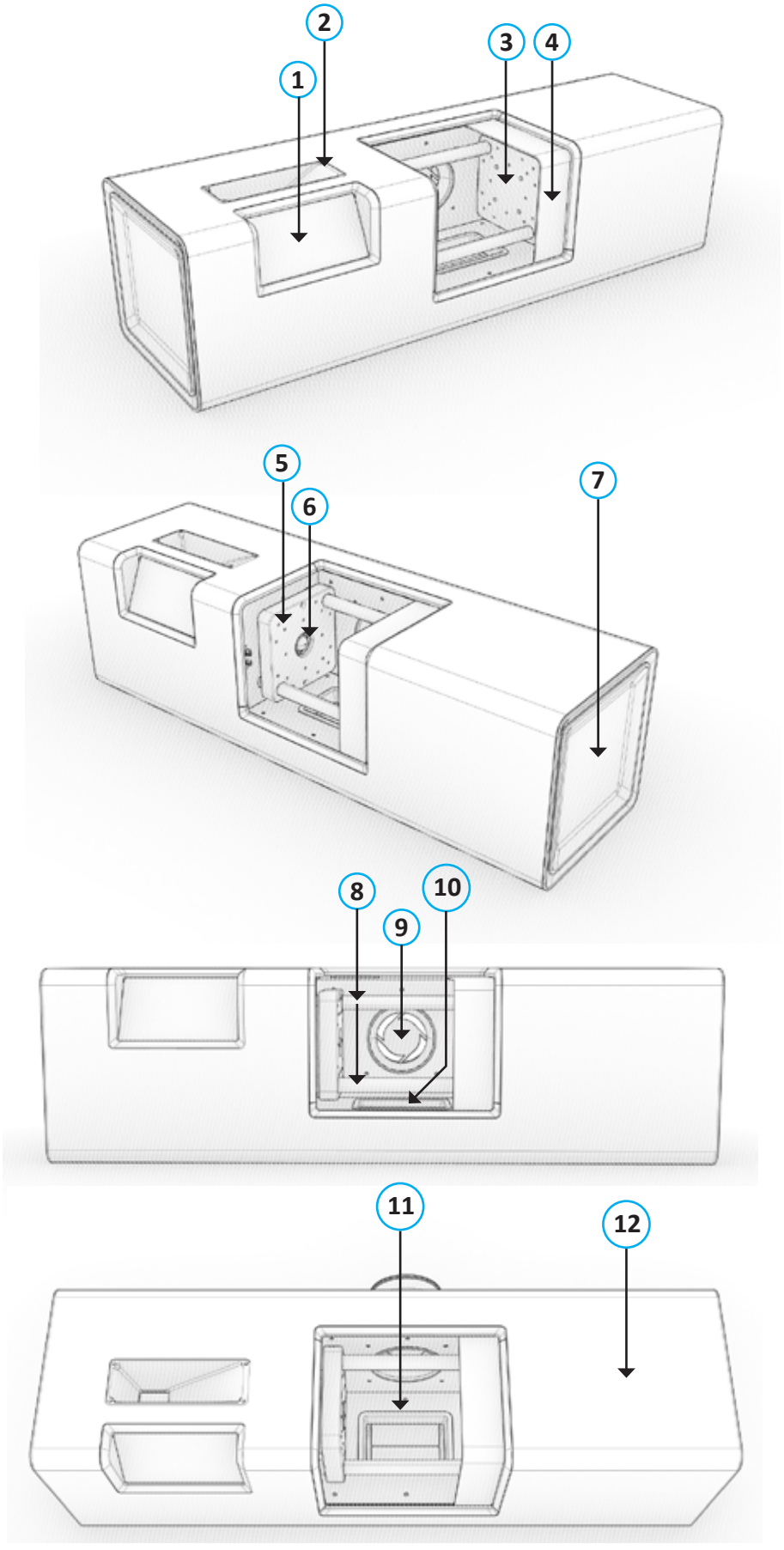


Fig3

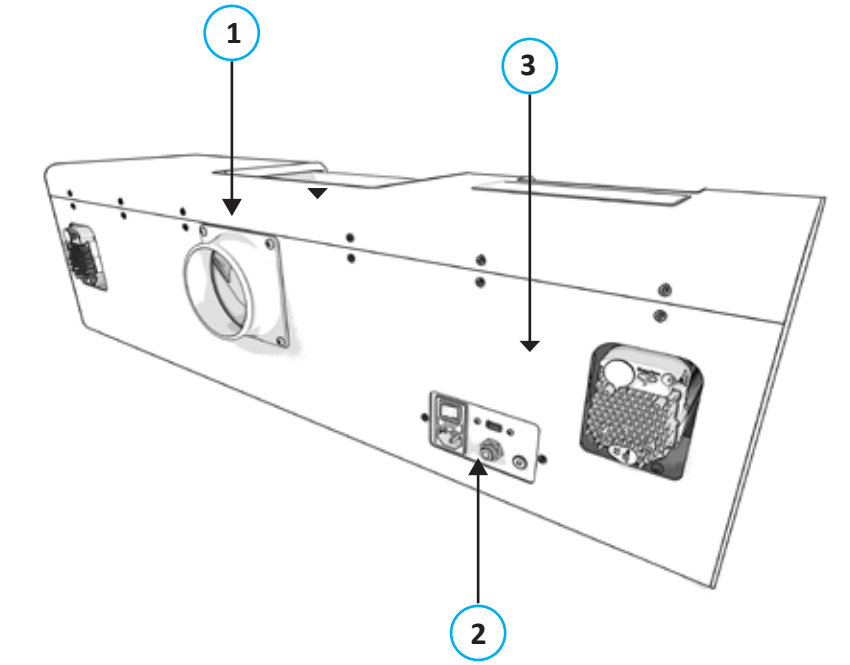
ANATOMY OF MACHINE:

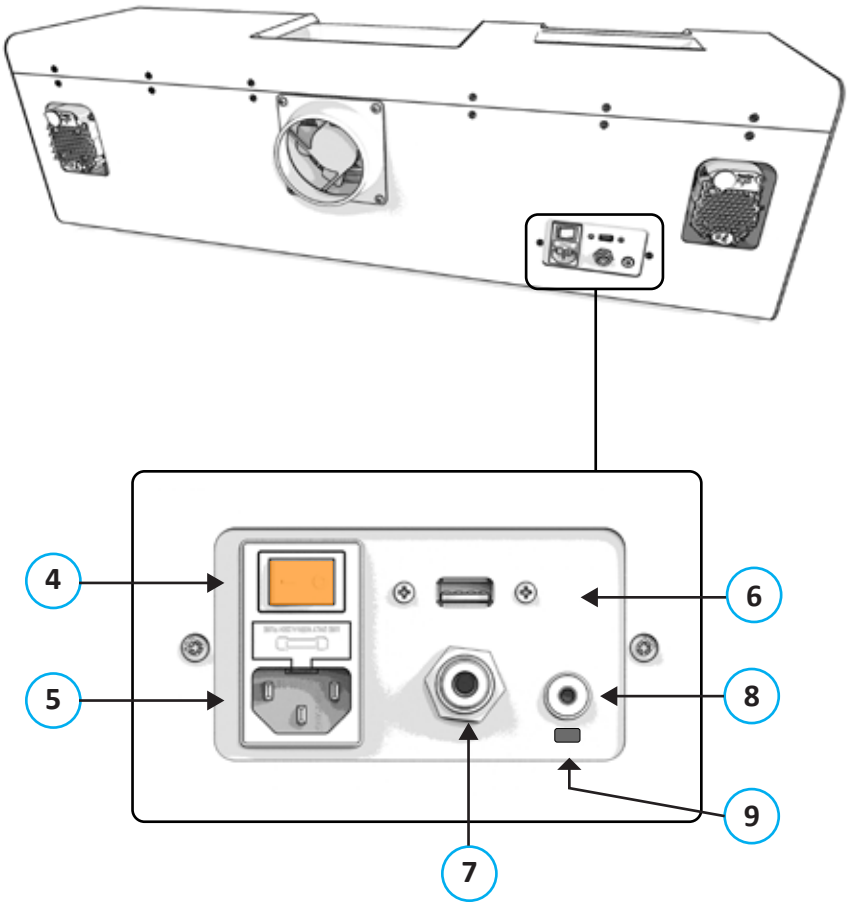
1. LCD Touch Screen
2. Material In-feed Hopper
3. B Side Platen Plate
4. Window
5. A Side Platen Plate
6. Injector Nozzle
7. End Cap
8. Linear Rail
9. Exhaust Fan
10. Part Out-feed Chute
11. Part Counter
12. Top/Front Cover



ANATOMY OF MACHINE: CONT.

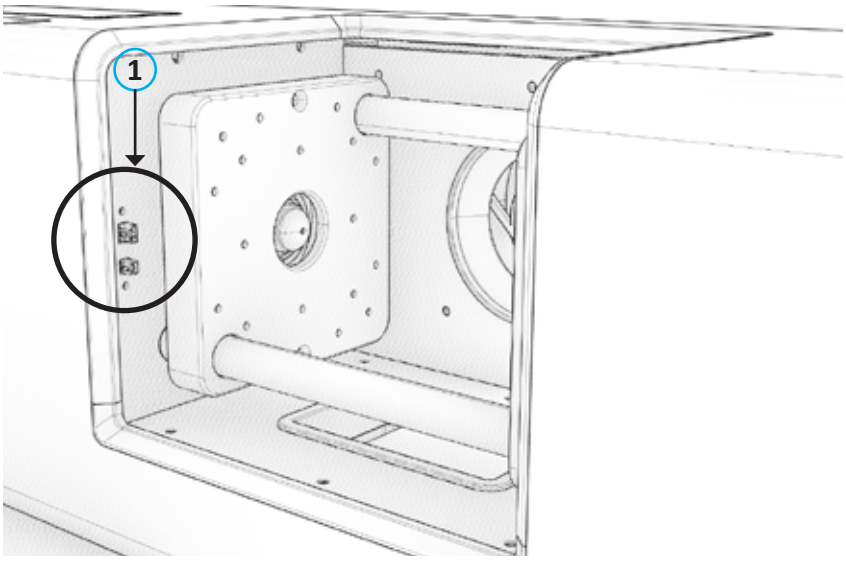
1. Exhaust Shroud
2. Electrical Connection / Power
3. Back/Bottom Cover
4. Power Toggle Switch
5. 120/220VAC Power Connection
6. USB 2.0 Connection
7. Compressed Air Inlet Fitting
8. E-Stop Connection Port
9. Computer Reboot/Reset Switch

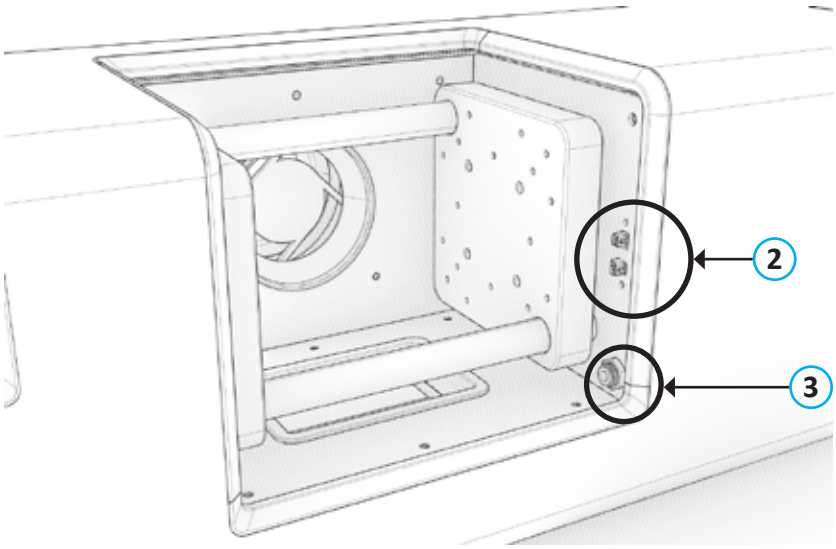


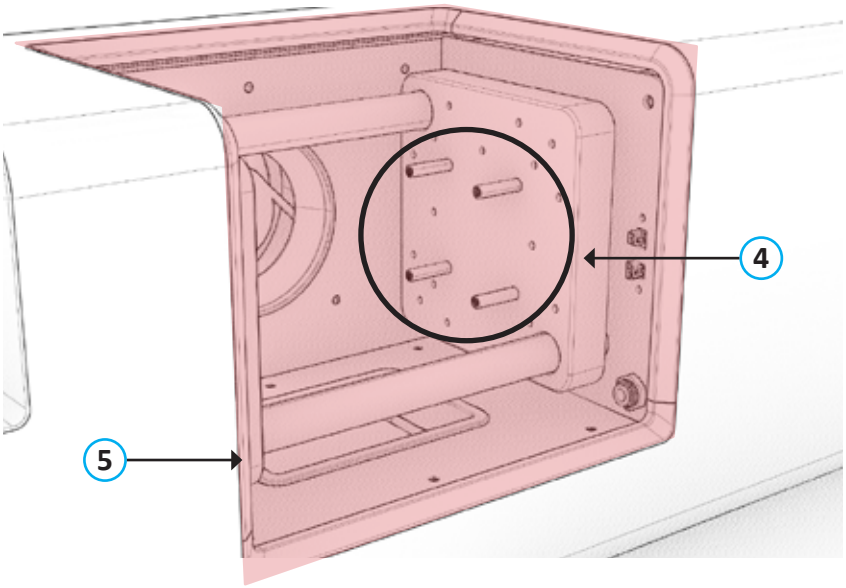


ANATOMY OF MACHINE: CONT.

1. A Side Tool Heater and Temperature Probe Connections
2. B Side Tool Heater and Temperature Probe Connections
3. Compressed Air Outlet Fitting
4. Ejector Plate Push Rods
5. CAUTION! Live Tooling Area







UNDERSTANDING MICROMOLDER EVO'S CAPABILITIES

Although MicroMolder is an extremely powerful and capable machine, it has its limitations.

The machine has been designed with performance characteristics specifically catered to the use of 3D printed tooling.

There are a few important distinctions between industrial equipment and a desktop solution worth noting:

The forces that can be applied to 3D printed tooling are significantly lower than those applicable to aluminum or steel tooling. The use of a MUD box is critical to the successful use of 3D printed tooling, as it helps distribute the forces applied during both clamping and injection.

Cycle times will significantly increase with the use of 3D printed tooling, as the material is an excellent insulator of heat.

Injected plastic must remain inside a 3D printed tool for a much longer period to cool and harden before the tool can open and the next injection cycle can begin.

Even large hydraulic equipment must be significantly tuned down to accommodate the use of 3D printed tooling.

Therefore, even if a machine can inject and clamp at extremely high forces, that extra force becomes unusable as it exceeds the 3D printed tool's capacity.

We position MicroMolder as “purpose-built” for 3D printed tooling, as it is more closely tailored to the requirements of 3D printed tooling than larger equipment.

When using 3D printed tooling, it is important to set the proper expectations regarding performance and capability (lower forces, longer cycle times, and shorter tool lifespan).

The advantages of 3D printed tooling greatly offset what some may perceive as drawbacks. It offers extremely fast tool lead times, the ability to iterate and solve tooling design challenges in real time, and a cost-effective way of producing short-run production-quality parts at an excellent rate of speed.

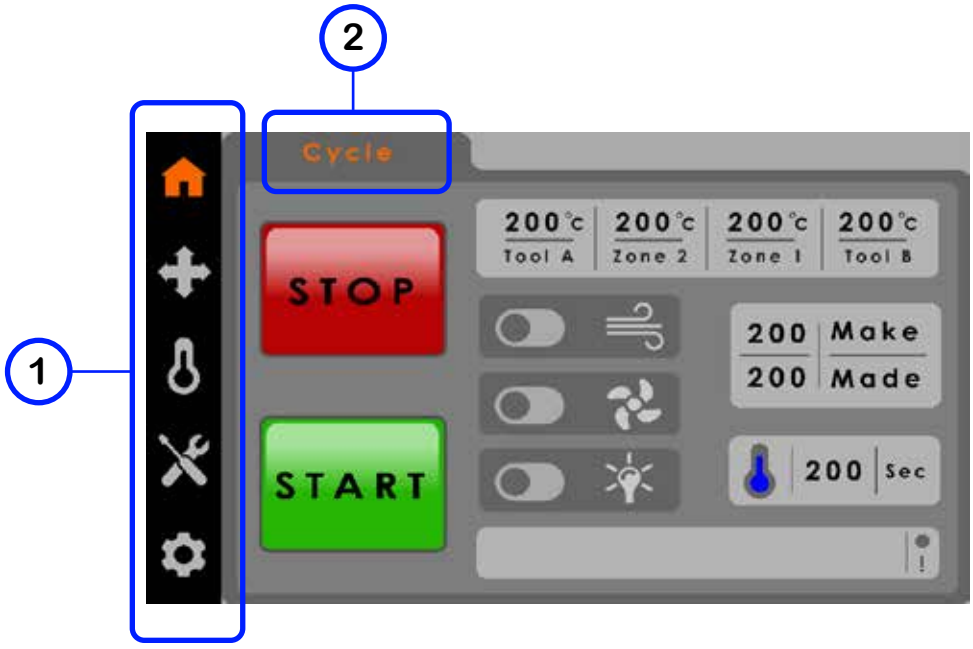
It is also worth mentioning that MicroMolder performs exceptionally well with aluminum tooling and is not limited to 3D printed tooling. This flexibility in tooling material allows users to be extremely creative in their tooling solutions.

USER INTERFACE

Navigational Structure

1) Main Menu
   - Cycle
   - Motion
   - Temperature
   - Tool
   - Settings

2) Page Tabs



Injection Cycle Page Functions

1) E-Stop/Cycle Stop

2) Cycle Start

3) Zone Temperature Readout

4) Compressed Air Relay Toggle

5) Fan On/Off

6) Work Area Light On/Off

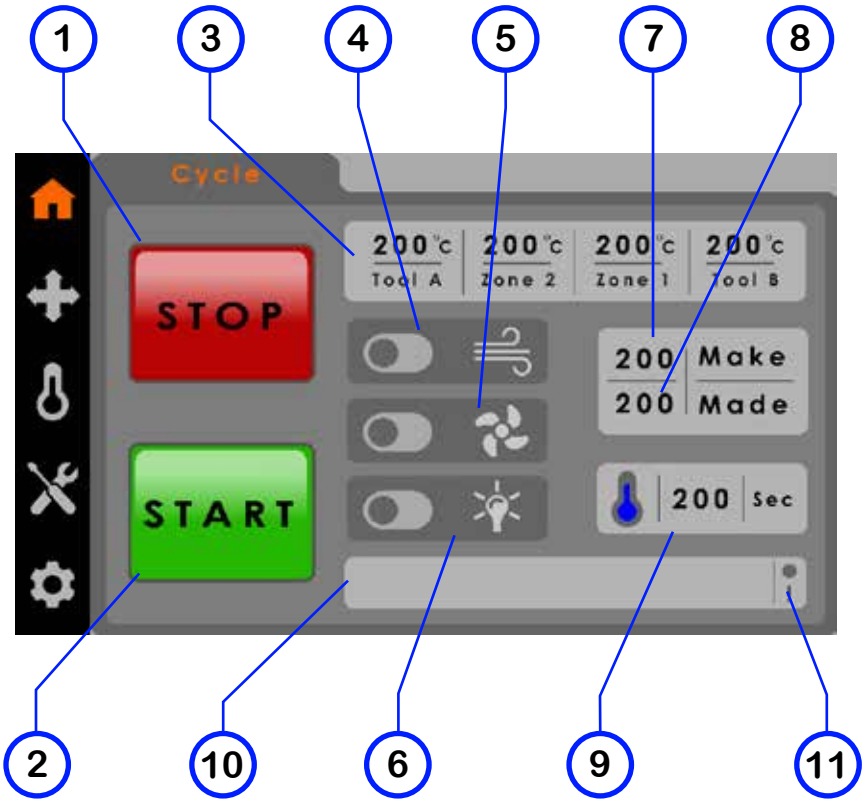
7) Part to Make Count

8) Parts Made Count

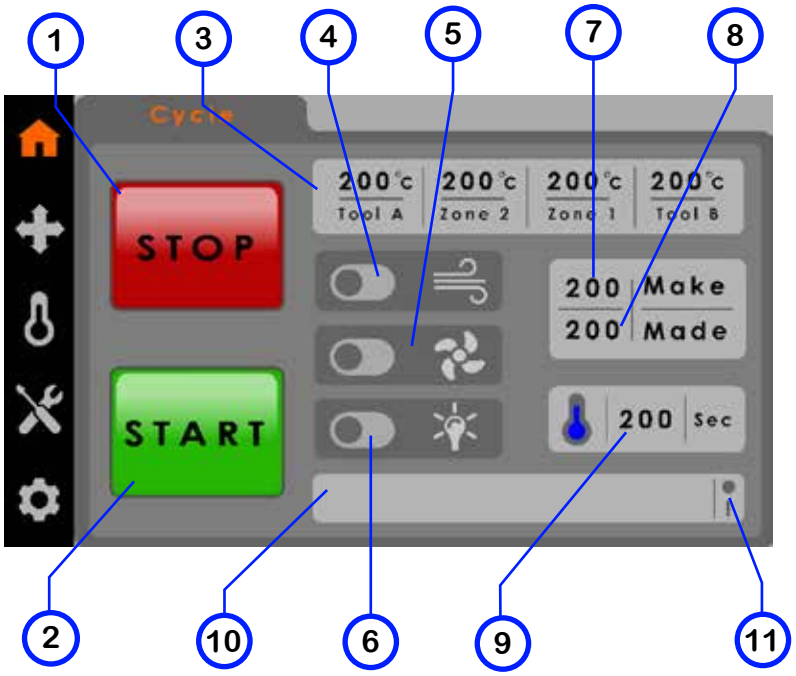
9) Tool Cooling Time

10) System Message Display

11) Warrning/Error Indicator



USER INTERFACE: CONT.



Injection Cycle page function definitions:

1) Stop/E-Stop Button
   Stops all motor movement when pressed.
   This is a latching type button. (When pressed it remains active until pressed again).
   When blinking, the button is latched and all machine movement is disabled.

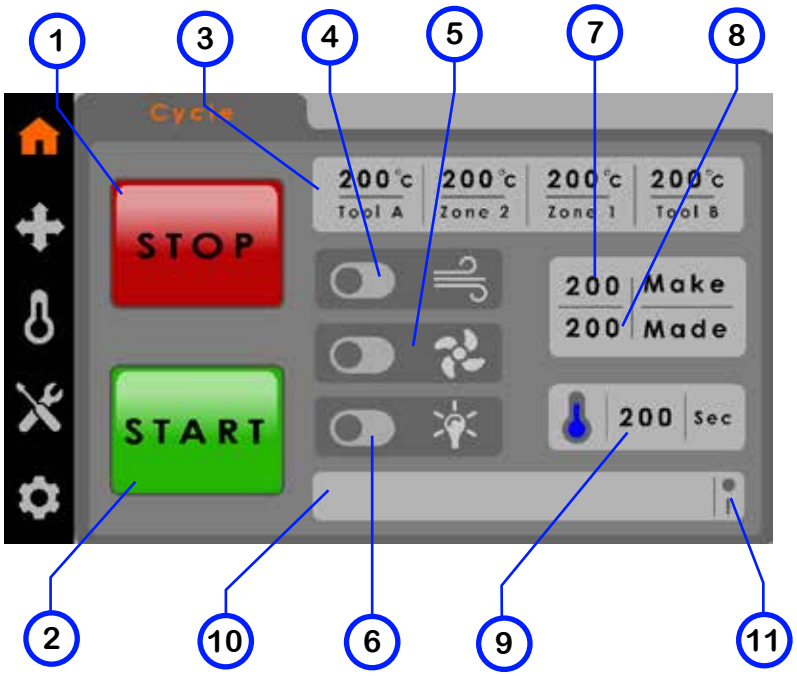
2) Start Button
   Starts injection cycle sequence
   The “Make” field must be grater than the “Made” field for an injection cycle to start

3) Heating Zone temperature readout
   Displays Zone and/or Tool heating temperatures (in Celsius).
   A red LED ▬ will blink indicating the control relay on/off status when heaters are active.

4) External air supply relay on/off button
   When compressed air is supplied to the machine this will toggle on/off the air flow.

5) Fan control button
   Opens a sub menu to turn on/off the exhaust fan and/or the injection system cooling fan

6) Work area light button
   Turns on/off platen work area light bar



Injection Cycle page function definitions: Cont.

7) Parts to Make input field

Manually populated via a keyboard or click the “make” font to bring up a numeric keypad.

8) Parts Made counter field

Tabulates completed parts as they pass through the drop doors.
When “Made” is > “Make” the “Make” field will automatically be set to zero.
Pressing the “Made” text area will set any tabulated count to zero.

9) Cooling time indicator

Indicates time remaining in the cooling sequence of an injection cycle.
The cooling time value is set on the Tool Settings menu and not in this field.

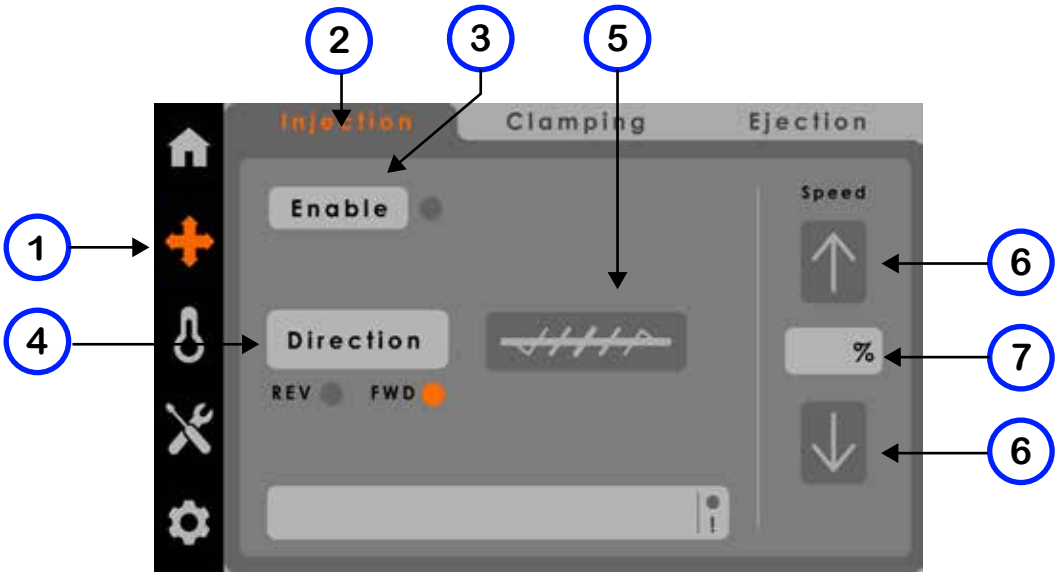
10) Message Box

System warning and status messages are displayed in this field when they occur.

11) Warning and/or error indicator LED

LED ● will blink if a warning or error has been triggered in the system.
Pressing on the LED when it is blinking will take the user to the Status Page

USER INTERFACE: CONT.



Machine Motion page function definitions:

1) Page menu button
   Opens the Machine Motion main page

2) Motion function tab
   Each tab in the Machine Motion menu opens the specific motor control page, Injection, Clamping or Ejection

3) Motor Enable button
   Button press enables or disables machine motor
   An orange LED will illuminate to indicate that the motor is enabled.

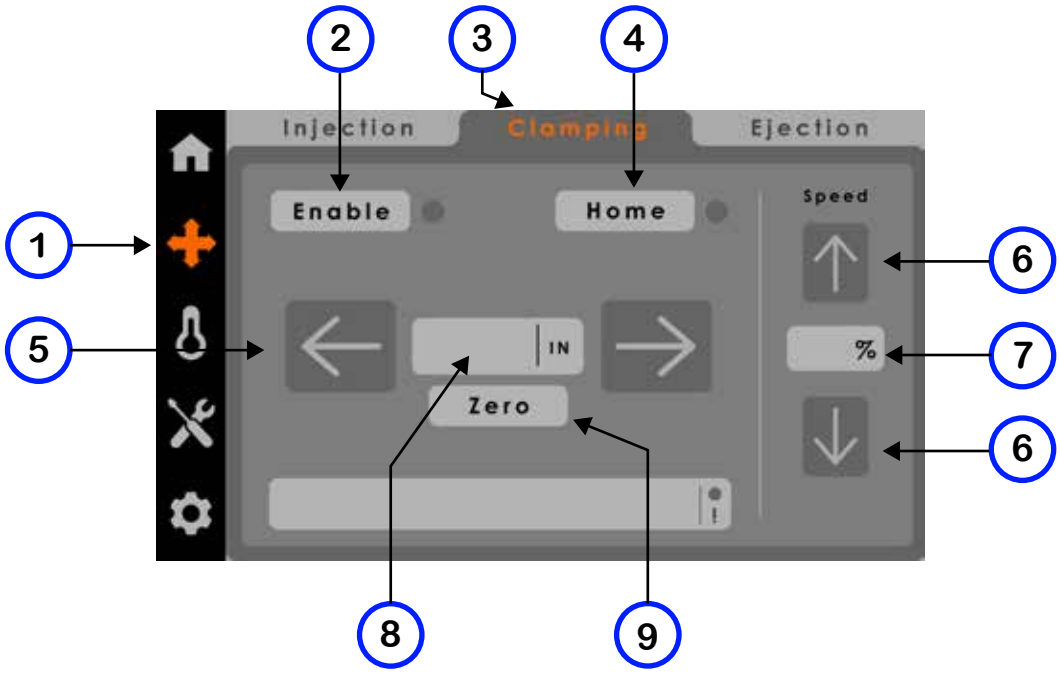
4) Motor rotation direction button
   Button press will change the direction of motor movement of the injection screw

5) Motor rotation button
   Button press will cause the motor to rotate
   Motor must be enabled to activate rotation
   Motor will rotate in the selected direction

6) Motor speed increase/decrease buttons
   Button press will increase/decrease motor speed by 5% for each press of the button. 0% to 100% are the limits

7) Motor speed percentage value
   Displays the motor set speed

USER INTERFACE: CONT.



Machine Platen Clamp Movement:

1) Page menu button
   - Opens the Machine Motion main page.

2) Motor Enable button
   - Button press enables or disables platen clamp motor
   - An orange LED ● will illuminate to indicate that the motor is enabled.

3) Motion Function tab
   - Opens the Platen Clamping Page.

4) Motor Home button
   - Button press will initiate the motor to move away from the nozzle to the “home” switch.
   - Once the machine has homed the LED will turn orange indicating that the machine now has a home reference coordinate.
   - Homing the Platen Clamp must be done on each new machine startup.

5) Motor Movement buttons
   - Button press will move the clamp motor in the direction of the arrow on the button.
     = toward the nozzle
     = away from the nozzle

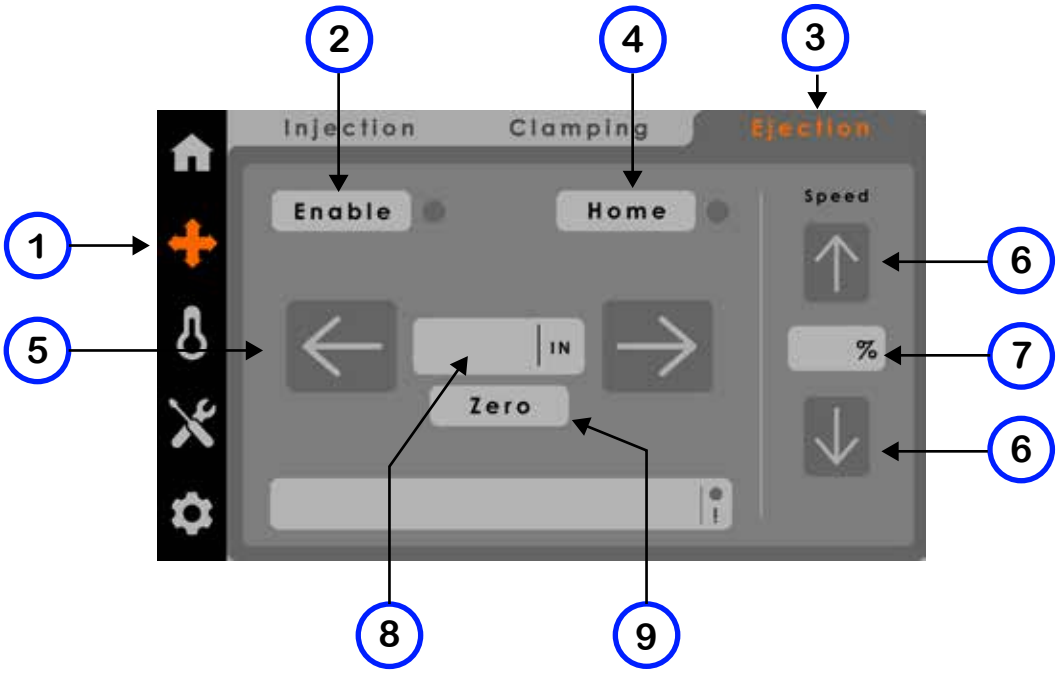
6) Motor Speed increase/decrease buttons
   Button press will increase/decrease motor speed by 5% for each press of the button. 0% to 100% are the limits

7) Motor Speed Percentage Value
   - Displays the motors current set speed

8) Linear Distance Readout
   - The numbers displayed in this readout are the inch or millimeter distances that the clamp system as moved.

9) Zero button
   - Button press will zero out any current measured linear value displayed.

USER INTERFACE: CONT.



Machine Ejection Rod System Movement:

1) Page menu button
   - Opens the Machine Motion main page.

2) Motor Enable button
   - Button press enables or disables Ejection Rod motors
   - An orange LED ● will illuminate to indicate that the motors are enabled.

3) Motion Function tab
   - Opens the Ejection Rod Page.

4) Motor Home button
   - Button press will initiate the motors to move away from the nozzle to the “home” switch.
   - Once the machine has homed the LED will turn orange indicating that the machine now has a home reference coordinate.
   - Homing the Ejection Rod System must be done on each new machine startup.

5) Motor Movement buttons
   - Button press will move the ejection rod motors in the direction of the arrow on the button.
     = toward the nozzle
     = away from the nozzle

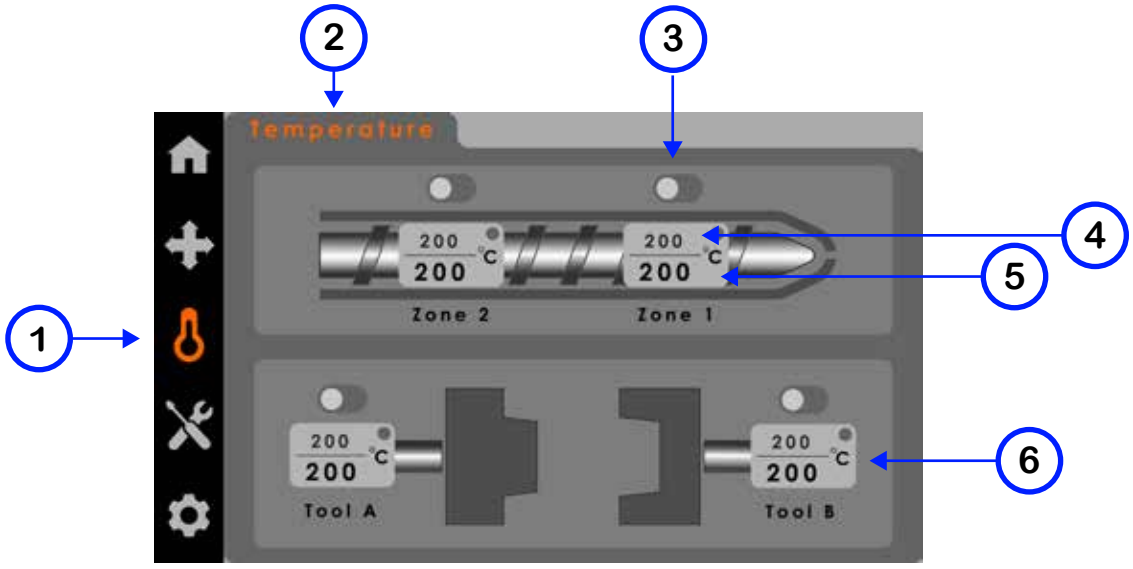
6) Motor Speed increase/decrease buttons
   Button press will increase/decrease motor speed by 5% for each press of the button. 0% to 100% are the limits

7) Motor Speed Percentage Value
   - Displays the motors current set speed

8) Linear Distance Readout
   - The numbers displayed in this readout are the inch or millimeter distances that the ejection system as moved.

9) Zero button
   - Button press will zero out any current measured linear value displayed.

USER INTERFACE: CONT.



Temperature Control:

1) Page menu button
   - Opens the Temperature main page.

2) Temperature Function tab
   - Opens the temperature control tab.

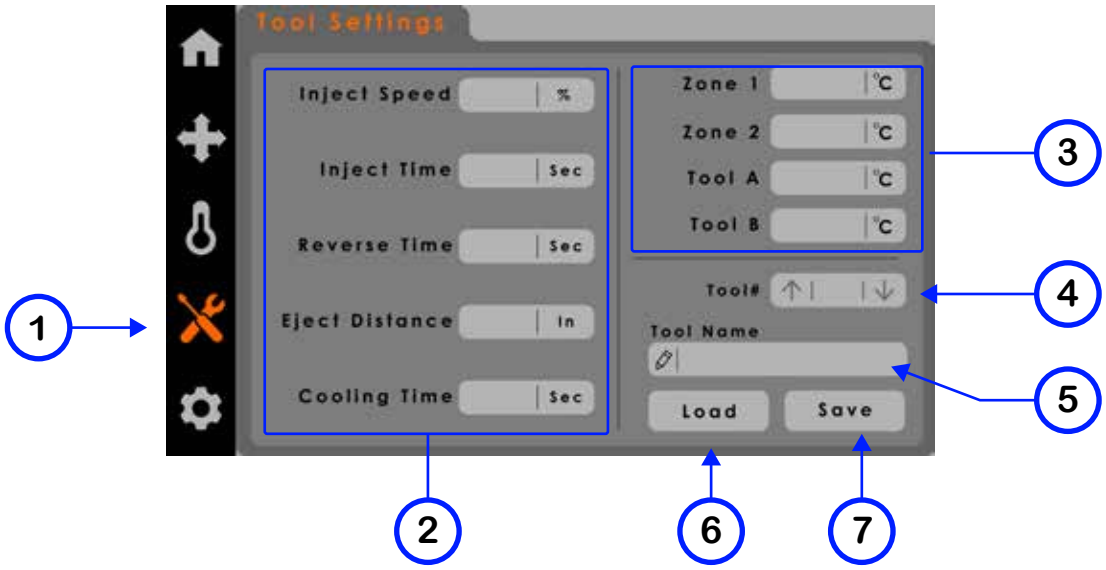
3) Heater control buttons
   - Button press will enable or disable each specific heating zone. Switch will illuminate orange when on.
   - The setpoint temperature must be greater than the realtime temperature reading for that zone to activate the heater.

4) Setpoint temperature readout
   - Value displayed in this field correlates to the temperature setting value assigned on the Tools menu page.
   - Setpont temperature values are not assigned on this page.

5) Realtime Temperature readout
   - Displays the current temperature of each specific heat zone area. (Zone 1, Zone 2, Tool A, Tool B)

6) Solid State Relay status
   - Heating control for MicroMolder is done via independently running PID algorithms preset in the firmware of the machine.
   - The PID control system regulates heat by turning on/off the heaters at measured intervals to achieve the desired heat setpoints.
   - The red LED will blink randomly when this system is activating and deactivating the machines heating elements.

USER INTERFACE: CONT.



Tools Settings:

1) Page menu button:
   - Opens the Tools Settings main page.

2) Tool (mold) settings parameters:
   - **Inject Speed**
     - Controls the speed of the injection system motor in percentage from 0 to 100%.
   - **Injection Time**
     - Controls the time duration that the injection system motor runs for during injection (in seconds).
   - **Reverse Time**
     - Controls the time duration that the injection system motor runs in reverse after injection.
   - **Eject Distance**
     - Sets the linear stick out distance of the ejector push rods (if utilized in a tools mechanical design).
   - **Cooling time**
     - Sets the time duration that the tool (mold) remains closed after injection.

3) Zone temperature settings:
   - Zone 1 & 2 are related to the injection system barrel temperatures.
   - Tool A & B are related to external tool heating controls. (optional)

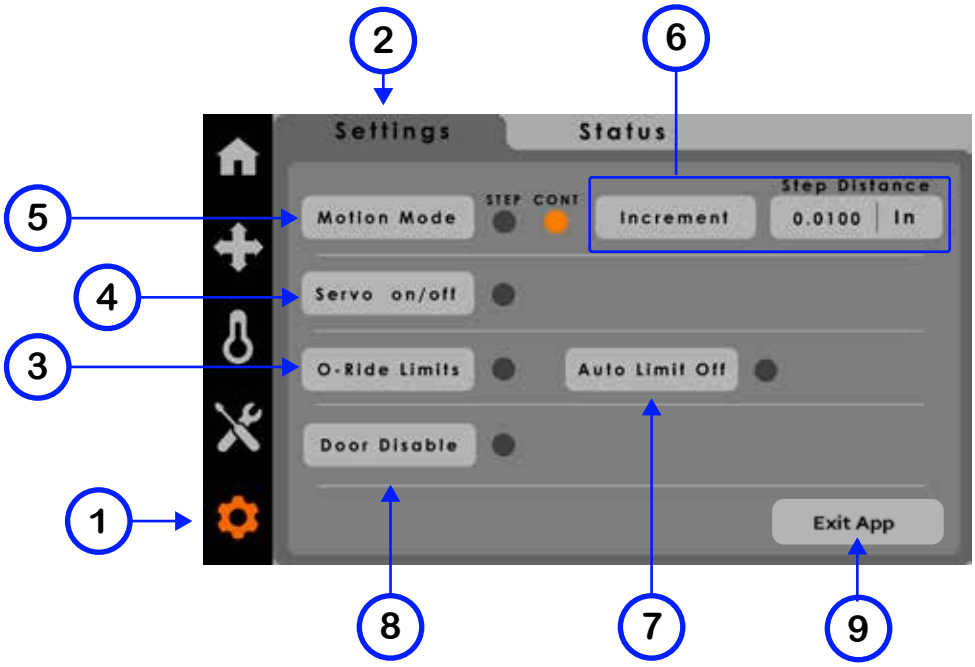
4) Tool # selection:
   - Tool number field.

5) Tool name:
   - Names can be assigned to tools in addition to the tool number assignment.
   - Tool names are not required but can be helpful in identifying your stored tool lettings
   - Pressing the icon will open a text field where you can assign (keyboard connection to the machine required) the tool name.

6) Load:
   - Opens the stored tool settings associated with the tool number displayed in the Tool # field.

7) Save:
   - Saves all the current values entered on this menu page to memory.

USER INTERFACE: CONT.



Machine Settings:

1) Page menu button:
   - Opens the Settings main page.

2) Settings main menu tab:
   - Opens the settings control tab.

3) Override Limits button:
   - Pressing this button when a limit switch is triggered will allow you to move off/away from the triggered switch.
   - This is a temporary override and will deactivate once the limit switch is no longer triggered

4) Servo on/off button:
   - Enables or disables the servo motors.

5) Motion Mode:
   - Toggles the motion mode from continuous motion or incremental motion.
   - Continuous motion is the primary mode to be used. Incremental can be used for determining eject distance settings.

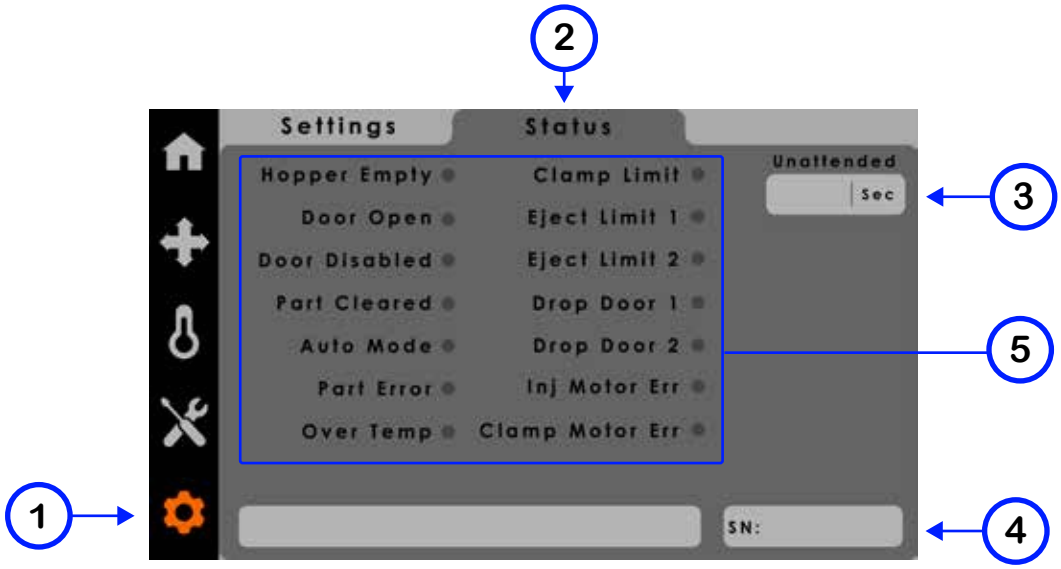
6) Incremental Motion Step Distance:
   - Toggles the step distance resolution between 1.000 through 0.0001.

7) Automatic Limit Off button:
   - Pressing this button will deactivate triggered limit safeties and automatically allow motion to proceed after a limit is triggered.

8) Door Disable button
   - Pressing this button will disable the door sensor allowing for machine functions to operate with the door open.
     ** This is only recommended when for troubleshooting or when external tool heating accessories are used.
     *** It is important to understand the safety precautions and risks when operating the machine with the door open. Failure to do so can result in injury.

9) Application Exit button:
   - Closes MicroMolder control application.

USER INTERFACE: CONT.



Machine Status:

1) Page menu button:
   - Opens the Settings and Status main page.

2) Status main menu tab
   - Opens the status control tab

3) Unattended Counter field:
   - Timmer that counts to 160 seconds (3 minutes) when a part error occurs.

4) Machine Serial Number field:
   - Each machine has a unique serial number

5) Sensor and system status dashboard:

Hopper Empty:
Blinks when the hopper is empty. Orange endcap plastic bezel covers will also blink with a 2 second interval when the hopper is empty

Door Open:
Indicates that the safety door is open

Door Disabled:
Indicates that the door sensor override is active.

Part Cleared:
Indicates that a complete injection molded part has fallen through the drop doors

Automatic Mode:
Indicates that multiple parts to “Make” is active

Part Error:
Indicates that a part did not complete injection and that an error has occurred someplace in the injection cycle.

Over Temperature Error:
Indicates that the system has reach an over temperature state.

Clamp limit trigger:
Indicates that the clamp limit sensor has be activated.

Eject Limit 1 and 2
Indicates that the ejection system limits 1 and/or 2 have been activated.

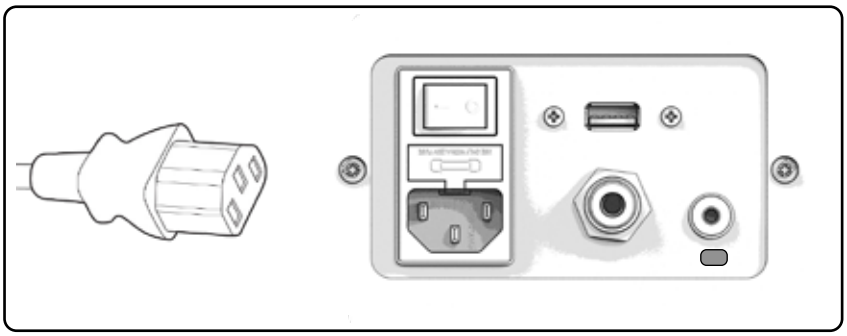
Drop Door 1 and 2
Indicates that drop doors 1 and/or 2 have been triggered

Injection Motor Error
Indicates that the injection servo motor has detected a fault condition

Clamp Motor Error
Indicates that the clamp servo motor has detected a fault condition

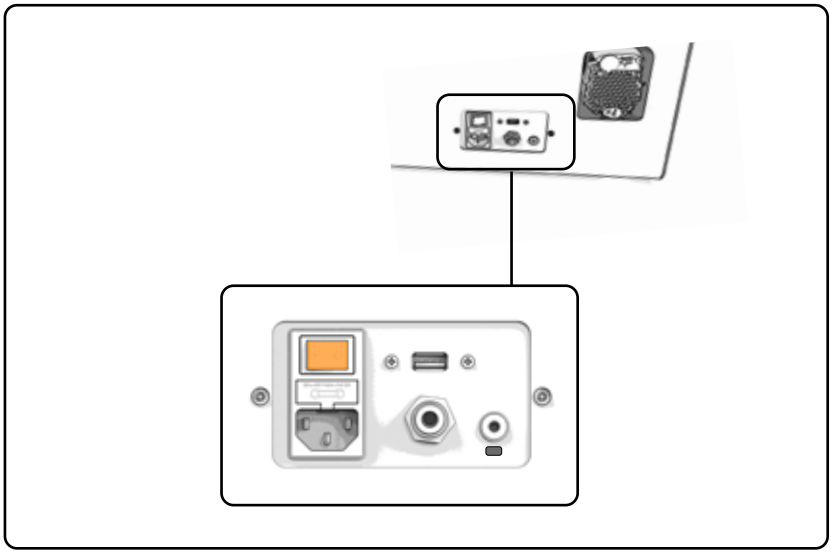
STARTUP PROCEDURE:

Begin by plugging the machine into an appropriate outlet, note the power requirements listed on the specifications page.
Plug in the external E-Stop.



Turn the machine on by pressing the toggle switch located directly above the power cord.
Once the on-board computer has booted, you will see the standard windows desktop on the Display screen.

Now is a great time to pair your wireless keyboard and mouse. This can be accomplished by plugging in a unifying receiver directly into the USB 2.0 jack located on the electrical connection panel or by connecting via Bluetooth. Bluetooth Setup can be found by navigating to Windows Settings > Devices > Add Bluetooth or Other Device. Although not necessary to operate the machine, having a wireless keyboard and mouse will make entering machine settings much easier.



STARTUP PROCEDURE: CONT.

Navigate to the MicroMolder application and click to launch. The first screen to appear will be the session profile screen. Select MicroMolder Evo - inch or MicroMolder Evo - metric and click OK.

The shopbotix splash screen should now appear as the software and machine plugins are loaded. This can take some time and the screen may turn white for a minute while loading processes.

STARTUP PROCEDURE: CONT.

You will notice that the machine orange end cap LEDs turn on and the MicroMolder splash screen appears. Click anywhere on the screen to advance to the warning pages.

The first page presents a list of machine hazards that the operator must be aware of when operating the machine.

The second page presents you with a list of safety precautions to adhere to when operating the machine.

Once you have read the warnings and agree to continue click the I understand these warnings button to advance. Note that there are two warning pages.

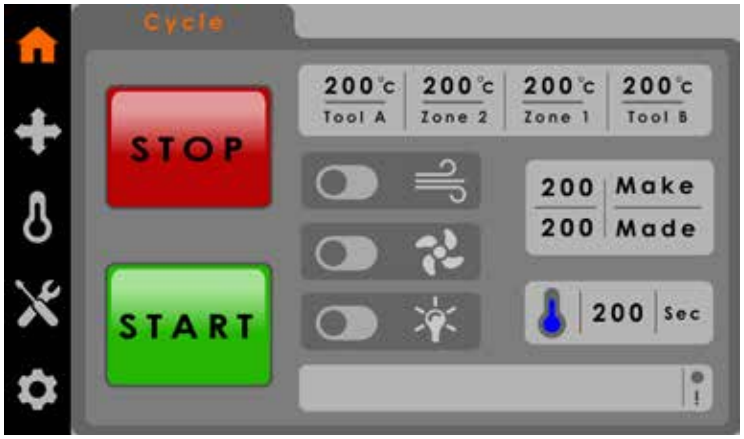
STARTUP PROCEDURE: CONT.

You are now by default directed to the cycle tab of the machine controller software. Note that the E-Stop Button is triggered on launch indicated by the blinking “stop” button.

It is highly recommended to have an external E-Stop button installed, depressing the external E-Stop will trigger the on screen E-Stop Button. Depress the external E-Stop any time your are working within the live tooling area.

Before continuing to interact with the machine, please refer to the system check section of this manual. It is highly recommended that you perform a system check at every startup of the machine to help ensure that all basic features and safety functions are operating correctly.

If you are unfamiliar with the functions and organization of the machine controller software, please refer to the GUI Overview part of this document before continuing.

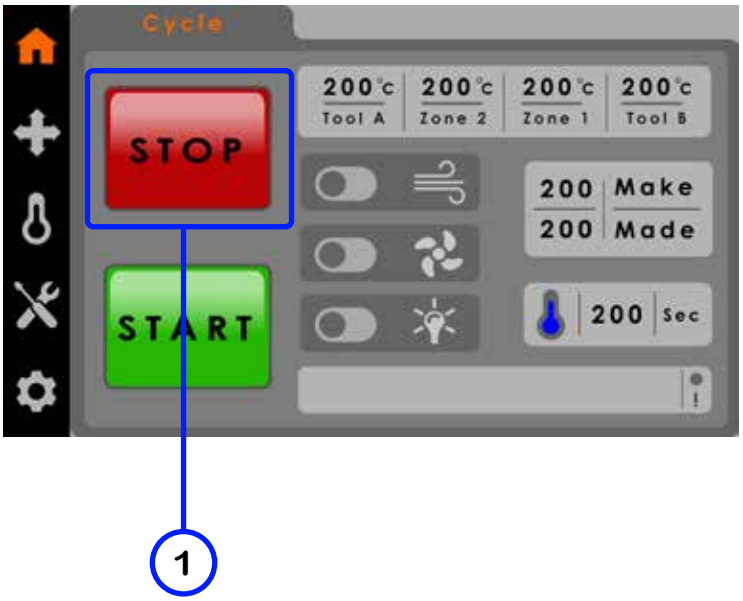


STARTUP PROCEDURE: CONT.

Before performing this series of checks it is extremely important to put the machine into E-Stop Mode. This will prevent any machine movement during your interaction with the machine's live tooling area.

1) To put the machine into E-Stop Mode, navigate to the user tab and click the "STOP" button. The Stop Button should be blinking red and the status bar should read "ESTOP BUTTON PRESSED"

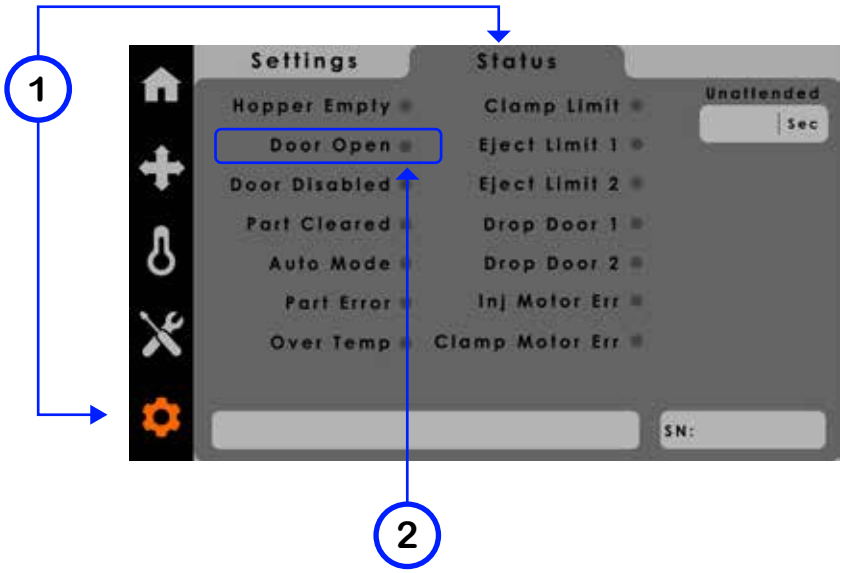
If The E-Stop was active before pressing the stop button it will deactivate it. If this is the case simply press the button again and confirm that the status bar reads "ESTOP BUTTON PRESSED"

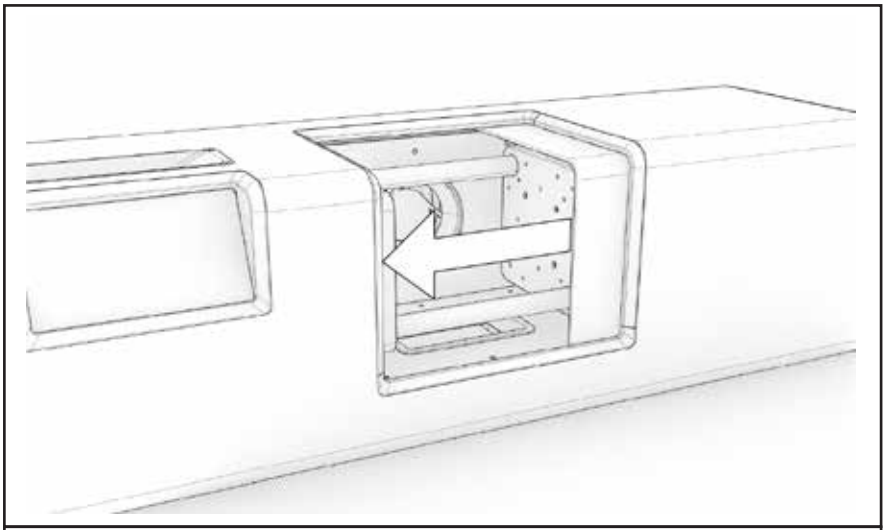


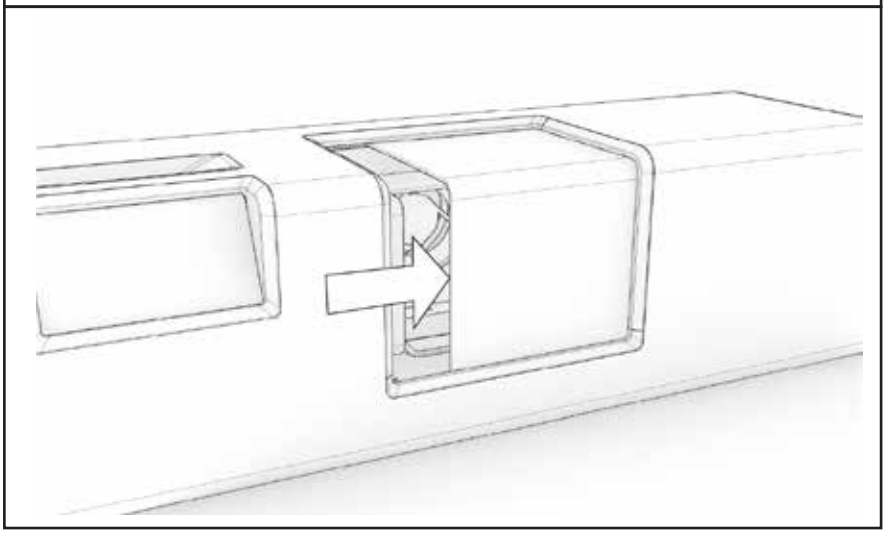
SYSTEM CHECK: DOOR OPEN

1) Navigate to the Status Tab by clicking on the gear icon on the main navigation menu. Then click on the “status” tab header at the top of the screen.

2) Observe the outlined section of this tab and take note of any active indicator lights.
Gently close the window until it stops and note the change of the “Door Open” indicator light. It should no longer blink when the door is in the closed position.
Open the window and note how the indicator light begins blinking.



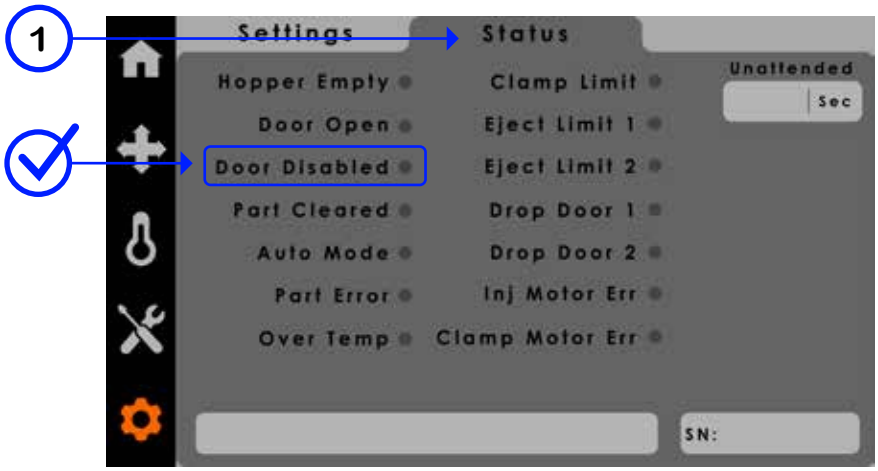




Note:
Although this may seem like a simple meaningless check, it is very important to ensure that the door safety switch is functioning properly as it can protect the operator and or onlooker from harm. If the machine is running and the safety window is opened, the machine will immediately be placed in E-Stop mode.

SYSTEM CHECK: DOOR OVERRIDE

1) While still on the status tab, we will perform another simple check of the status of the door override. The purpose of the door override is to allow the user to turn off the door safety switch in order to install and setup experimental tooling that may not fit with the door closed. Machine movement is allowed during door override only for this purpose.

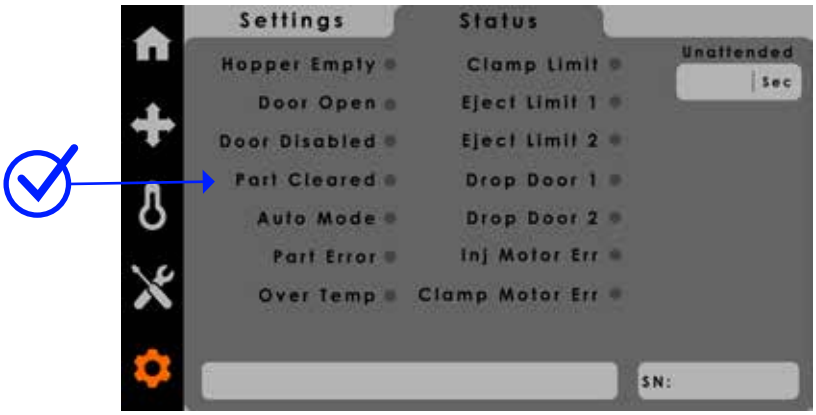


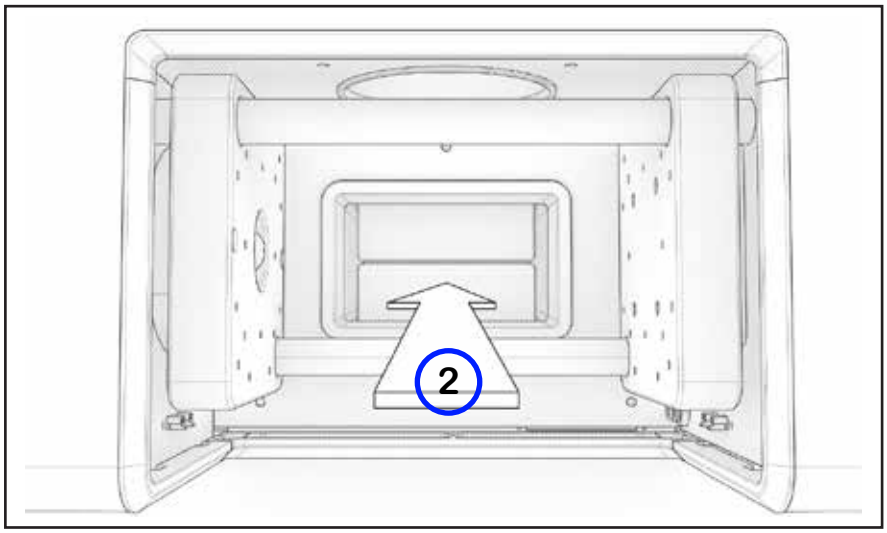
2) The door Override Indicator light should be off by default. If it is currently on, navigate to the Settings tab and click on the “Door Disable” button. Note that the indicator next to this button will also turn off indicating that the Door Disable is NOT active. Confirm this by returning to the Status tab and verify that the Door Disable indicator light is now off.

Note:
Great care should be taken to ensure that the you understand the operation of the door override feature and it’s intended purpose.

SYSTEM CHECK: PART COUNTER

1) To test the part counter's function, observe the indicator light labeled "Part Cleared". This indicator is activated by the movement of one or both of the drop chute doors.
Gently press against one of the doors and monitor the indicator light. As either door blocks the sensor, a green indicator light will appear next to the part cleared label and the door number being pressed.





2) Test both doors to ensure that both activate the indicator light when pressed independently of one another, and that light is not active when both doors are released.

Note:
The function of the drop chute door sensor is critical to trouble free operation while running the machine in auto mode. It is also a critical feature in part error detection during the injection cycle.

MACHINE MOVEMENTS: CLAMP HOMING SEQUENCE

The Clamp Platen moves along two linear rails allowing it to open and close the tool that is mounted to it.

It is important at the beginning of every session to home the clamp platen and the ejector plate so that the machine knows its position.

To home the clamp platen close the safety window and go to the “Cycle” page and disable the E-Stop Button if blinking.

Now navigate to the Machine Motion Menu. Then to the “Clamping” tab page.

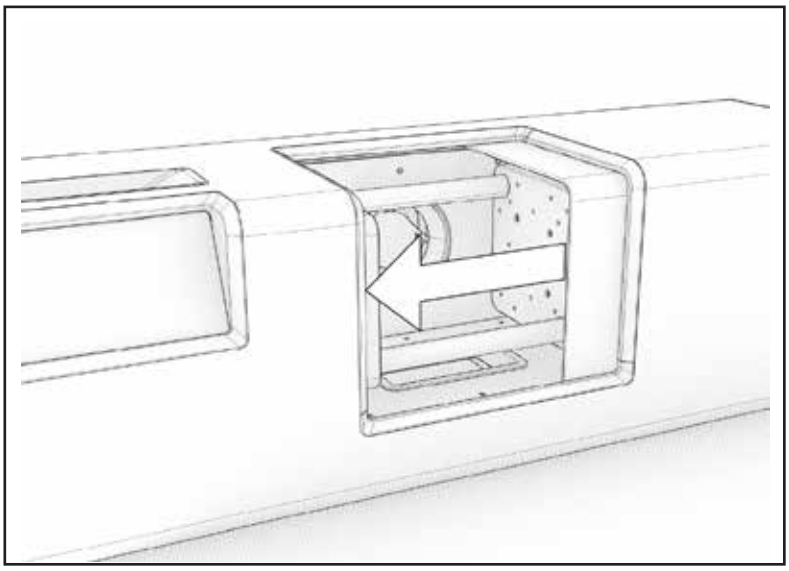
Enable the Clamp Motor by pressing the “ENABLE” Button

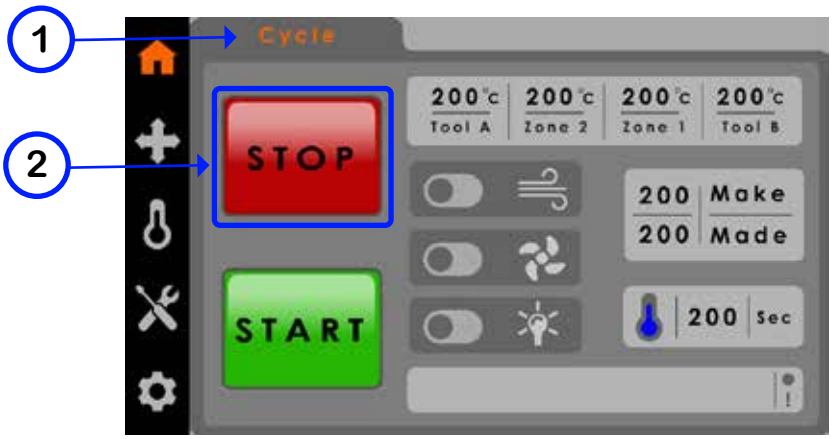
Press the clamp Home button

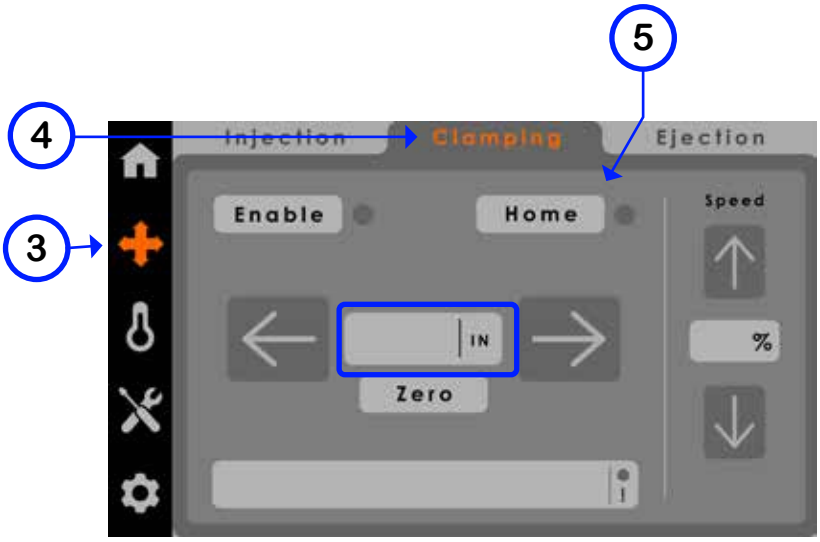
The machine will drive the clamp platen to its limit and offset back to the tooling area. The orange LED ● next to the home button will illuminate to indicate the machine has been homed.

The travel distance value should read 0.000 once homed.

*NOTE: this homing procedure must be performed on each new machine startup session for both Clamp and Eject!







MACHINE MOVEMENTS: EJECTOR PLATE HOMING SEQUENCE

The Ejector Plate moves in and out on linear rails allowing the operator to set the ejector pin depth.

To home the ejector plate, navigate to the Machine Motion page and then the Ejection tab.

Press the Home Button.

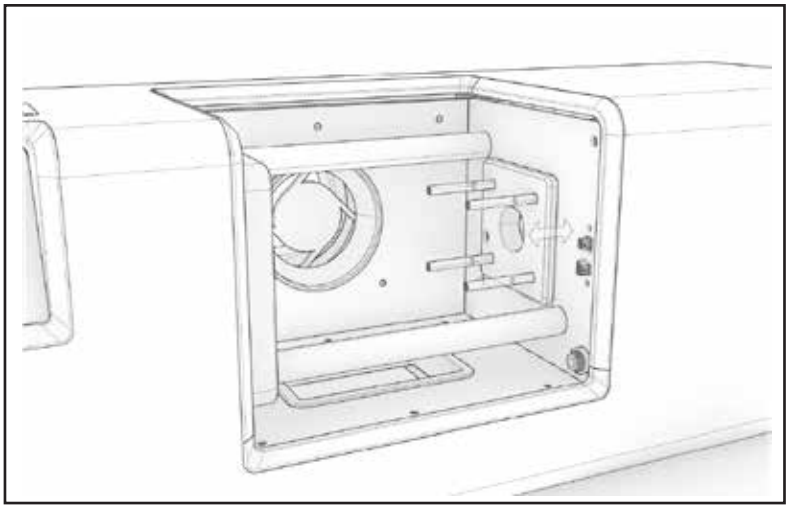
The Machine will drive the ejector plate to its home position and stop.

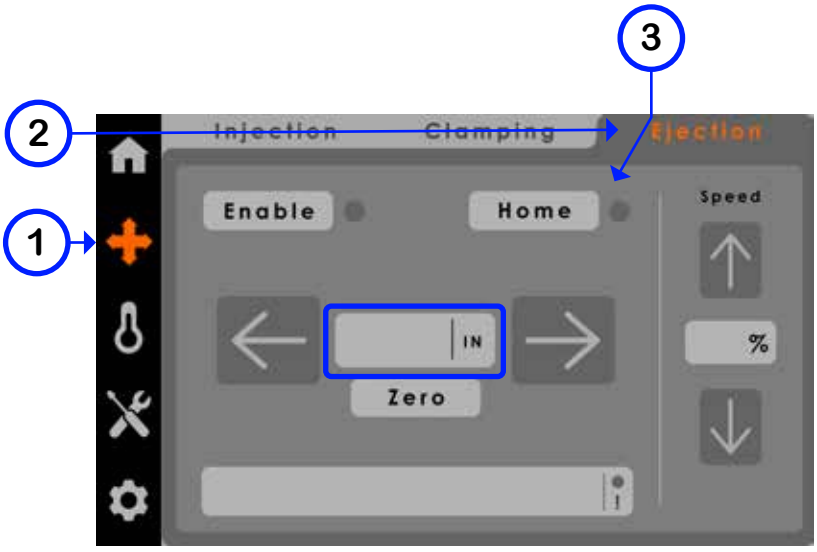
The orange LED ● next to the home button will illuminate to indicate the machine has been homed.

The travel distance value should read 0.000 once homed

The Ejector Plate has now been successfully homed.

*NOTE: this homing procedure must be performed on each new machine startup session!





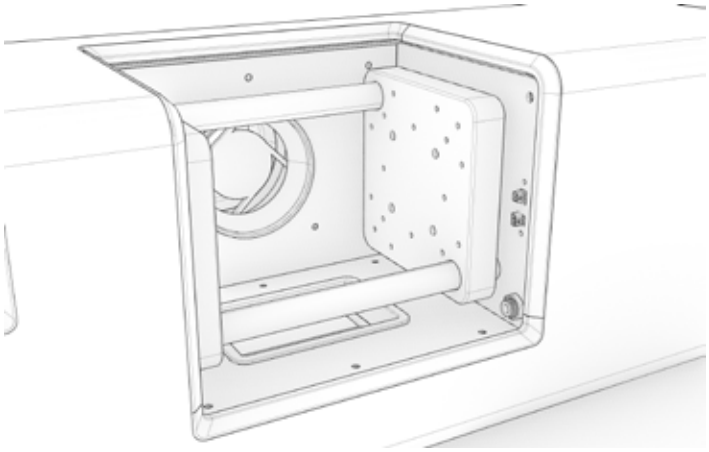
It is critical that when tooling is being installed and the clamp platen is being positioned that the ejector plate be placed in it's home position. If tooling mounted on the clamp platen comes in contact with the ejector plate rods say during clamp platen homing, sever machine damage will occur.

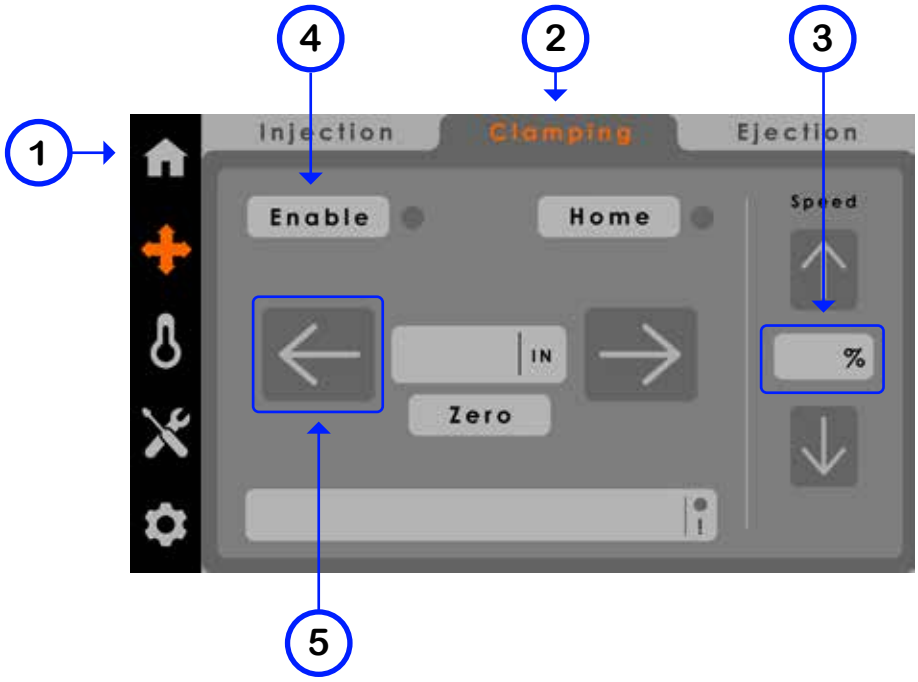
Always disable the ejector plate motor when not adjusting push rod positioning.

MACHINE MOVEMENTS: MANUAL JOGGING CLAMP PLATEN

To manually jog the clamp platen, first complete the steps outlined in the Clamp Homing Sequence section then follow the following procedure:

Navigate to the Machine Motion page and then the Clamping tab. Set speed to 50%. Enable the clamping motor by pressing the Enable button, the orange LED will illuminate when the motor is enabled. Manually jog the machine by pressing the Left Arrow button, this will drive the clamp platen away from its home position at 50% of the maximum motor speed.





Note:
The orientation of the arrow relates to the corresponding movement direction of the clamp platen. With the left arrow corresponding to a Positive direction and the right arrow corresponding to a Negative direction.

MACHINE MOVEMENTS: MANUAL JOGGING CLAMP PLATEN: CONT

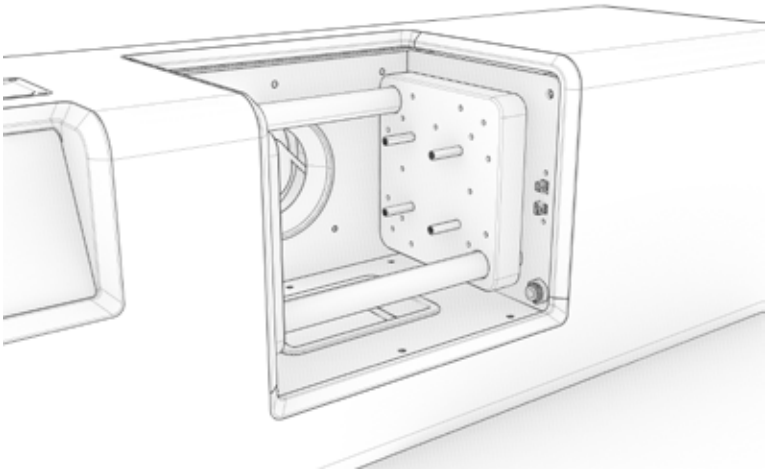
If you manually jog the Clamp to it's negative limit, the machine will automatically be placed in E-Stop Mode. If this occurs, you must first disable the ESTOP, manually jog the platen away from the limit (positive direction) and re-home the machine.

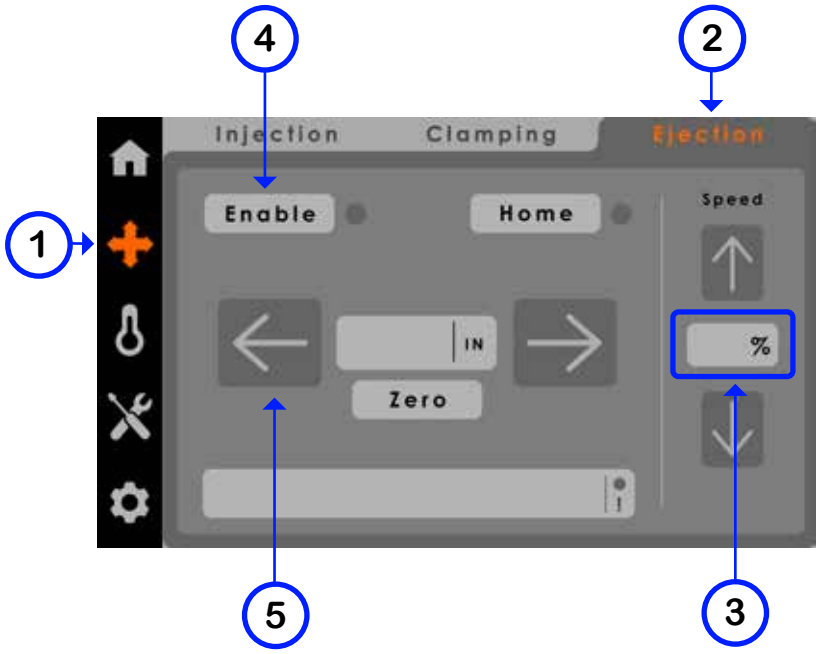
Do not attempt to drive the Clamp passed the limit, machine damage will occur.

MACHINE MOVEMENTS: MANUAL JOGGING EJECTOR PLATE:

To manually jog the ejector plate, first complete the steps outlined in the Clamp Homing Sequence section then follow the following procedure:

Navigate to the Machine Motion page and then the Ejection tab. Set speed to 50%. Enable the Ejection motor by pressing the Enable button, the orange LED ● will illuminate when the motor is enabled. Manually jog the machine by pressing the Left Arrow button, this will drive the ejection plate away from its home position at 50% of the maximum motor speed.





Note: the orientation of the arrow relates to the corresponding movement direction of the clamp platen. With the left arrow corresponding to a Positive direction and the right arrow corresponding to a Negative direction.

MACHINE MOVEMENTS: MANUAL JOGGING EJECTOR PLATE: CONT.

If you manually jog the Ejector Plate to it's negative limit, the machine will automatically be placed in E-Stop Mode. If this occurs, you must first disable the ESTOP, manually jog the platen away from the limit (positive direction) and re-home the machine.

Do not attempt to drive the Ejector Plate passed the limit, machine damage will occur.

MACHINE MOVEMENTS: MANUAL JOGGING INJECTION SCREW:

To manually jog the Injector Screw:

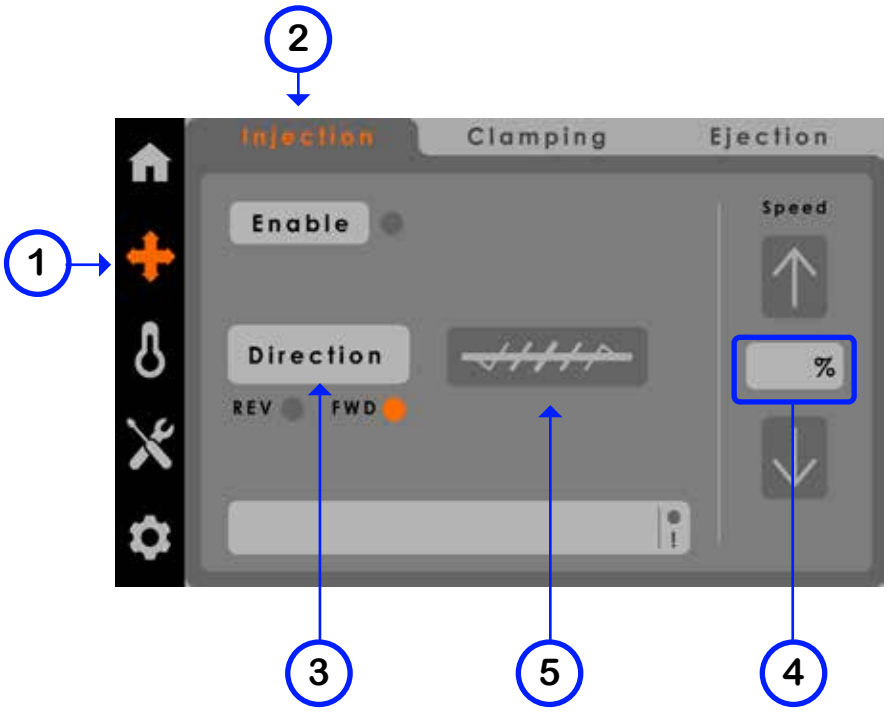
1. Navigate to the Machine Motion Page.

2. Injection tab.

3. Set the desired rotation direction by toggling the direction button. Note: The active direction is displayed to the illumination of an orange LED.

4. Set the desired rotation speed but toggling the up or down buttons (speed is in percentage of maximum motor speed).

5. Close the machine safety window, manually jog the injection screw by pressing the Rotate button, this will rotate the injection screw.



Note:
It is best practice to jog the Injection Screw manually only when the heaters are up to temperature. If plastic is present in the injection barrel and the heaters are off, the plastic will be solidified and will lock the injection screw in place. Any attempt to jog the injection screw during this state will cause the injection screw power supply to temporarily disable itself to prevent an over current condition.

Please refer to the Heating System section of this manual for information on enabling the heaters and setting heater temperatures.

MATERIAL HEATING SYSTEM:

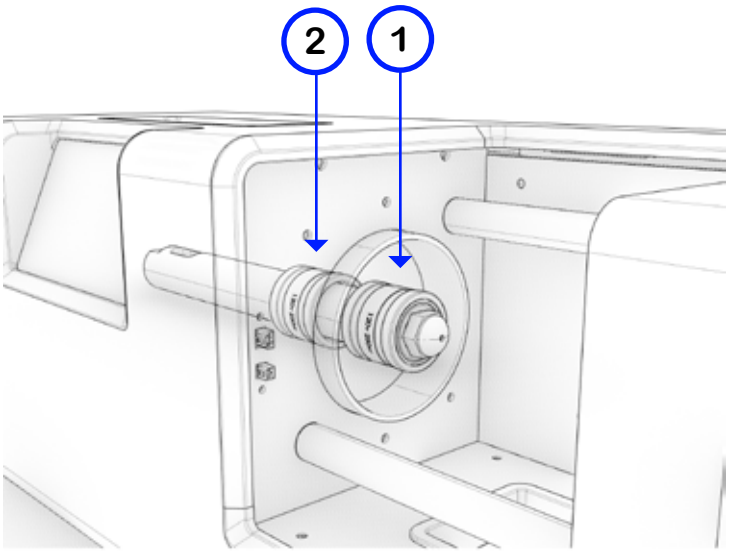
1) Zone 1 Heater

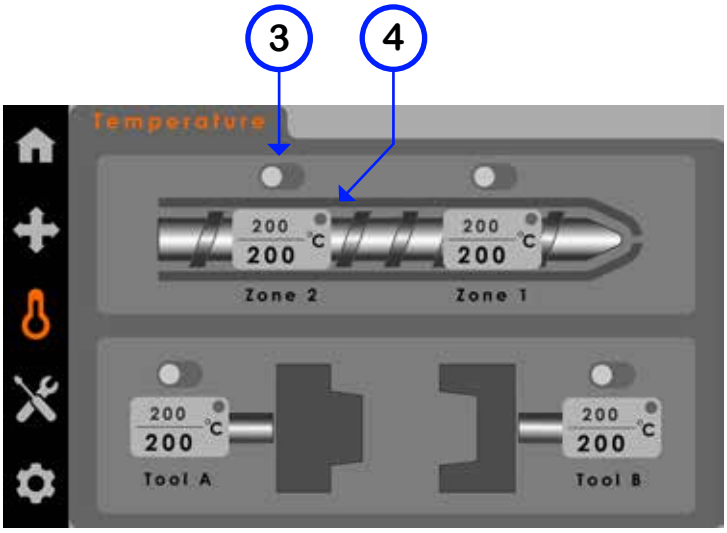
2) Zone 2 Heater

To enable one or both of the zone heaters, navigate to the Temp page. If you are unfamiliar with the layout of this page, please review the User Interface: Temp Control Overview of this document.

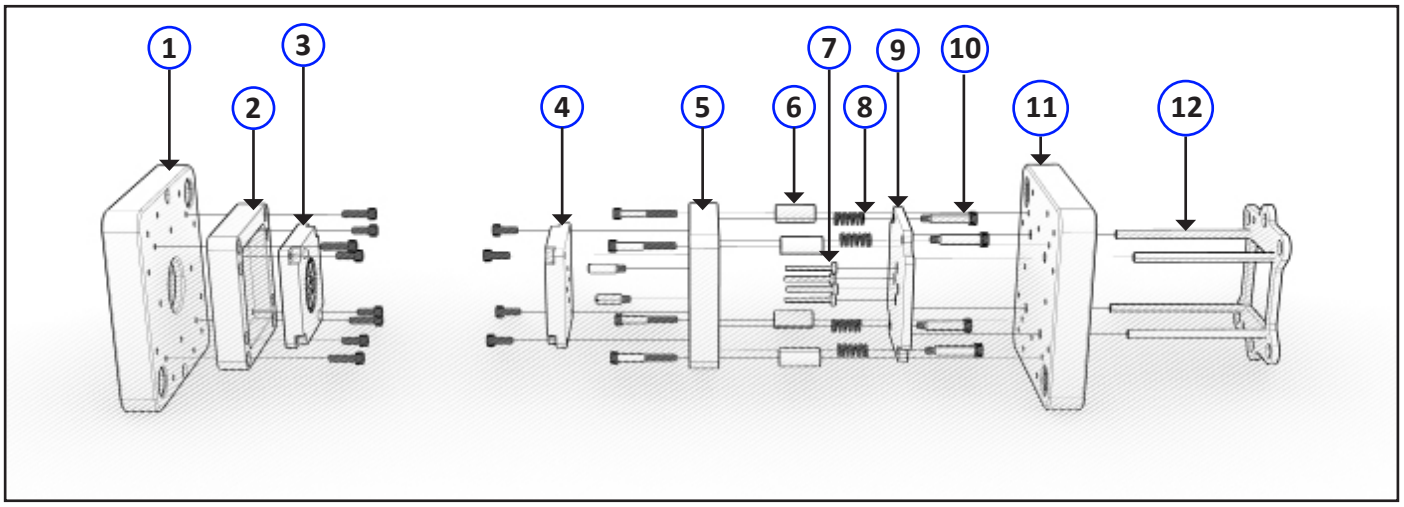
3) Cycle the heaters on by pressing the Slider Switch button over the temp Zones.

4) The indicator light ● will be illuminated next to the appropriate zone label as the heaters are cycled on and off to reach the set temp.

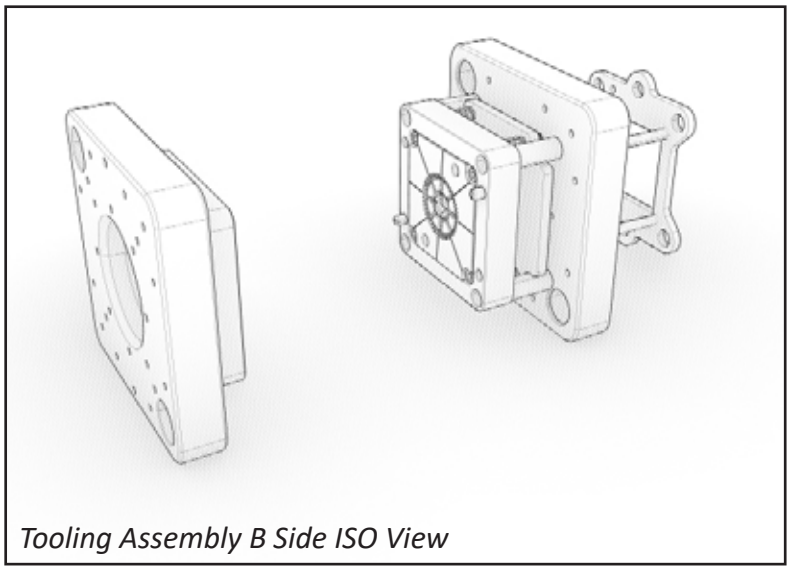




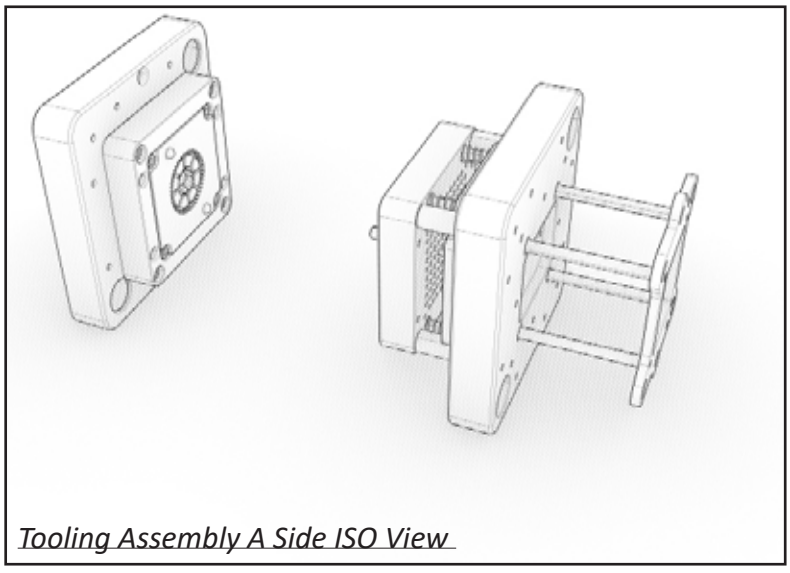
TOOLING SYSTEM: OVERVIEW



1. B Side Platen
2. B Side MUD Box
3. B Side Tool
4. A Side Tool
5. A Side MUD Box
6. Mud Box Standoffs
7. Ejector Pins
8. Push Plate Return Springs
9. Ejector Push Plate
10. Push Plate Linear Bearing Bolts
11. A Side Platen
12. Ejector Plate Push Rod Assembly



Tooling Assembly B Side ISO View



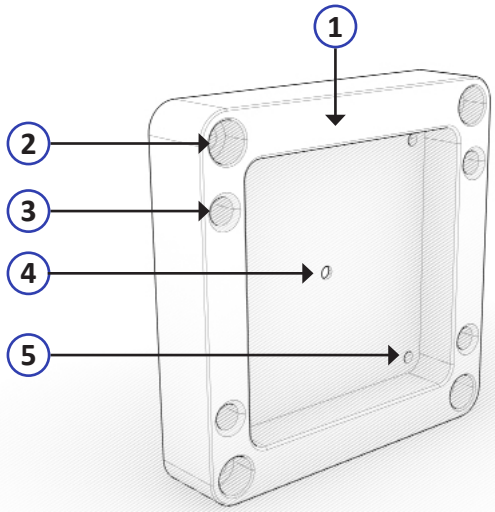
Tooling Assembly A Side ISO View

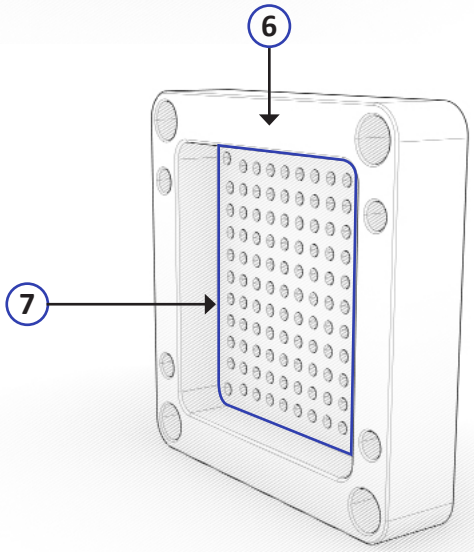
TOOLING SYSTEM: MULTI USE DIE BOX (MUD)

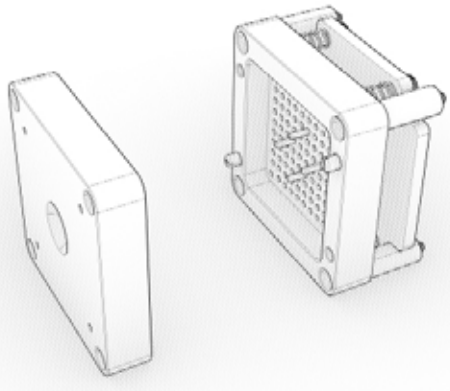
At the heart of the MicroMolder tooling system is the M.U.D. Box (Multi Use Die Box)

The MUD Box utilizes a standard tooling mounting scheme that allows the user to install tooling with varying part geometry and ejector pin placement into the same universal fixture.

1. A Side M.U.D. Box
2. MUD Box To Platen Mounting Hole
3. Alignment Pin Hole
4. Injection In-feed Hole
5. Tool to MUD Box Mounting Hole
6. B Side MUD Box
7. Ejector Pin Hole Array







MUD Box Assembly View

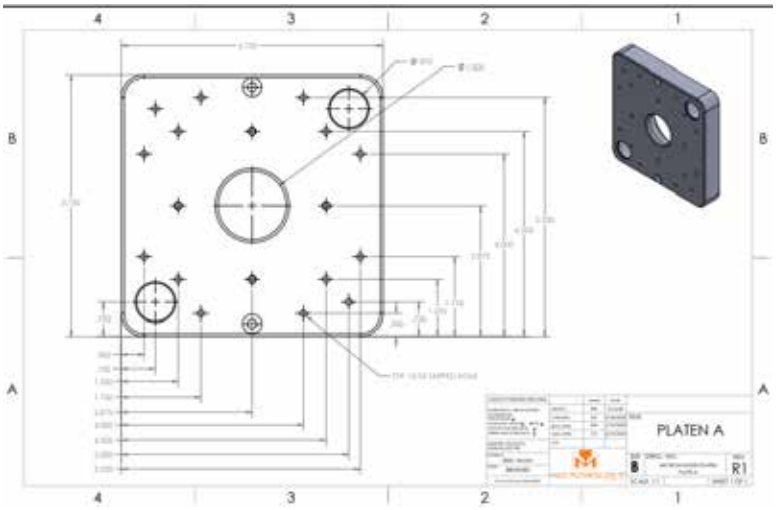
TOOLING SYSTEM: PLATEN

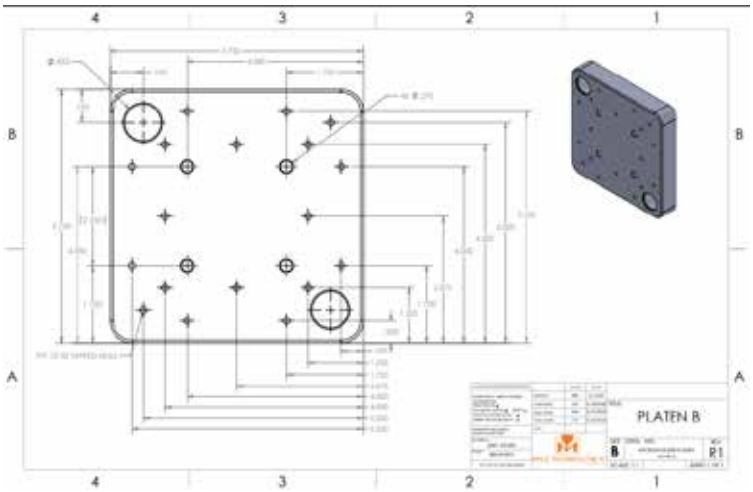
The MicroMolder Platen is a universal fixturing plate that allows for the installation of a variety of tooling fixtures and tooling die boxes.

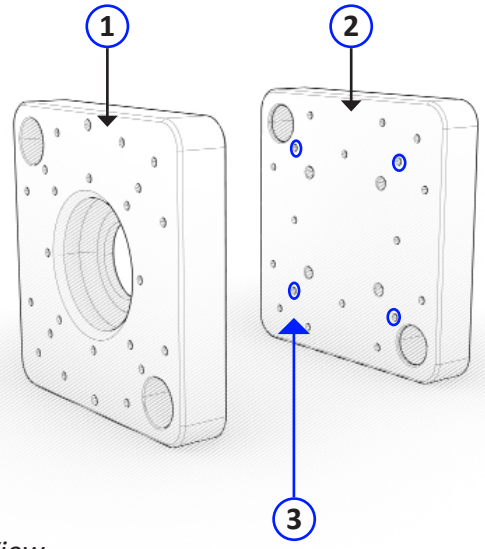
To download platen drawings please visit:

https://www.micro-molder.com/resources

Click on the “Downloads” link.



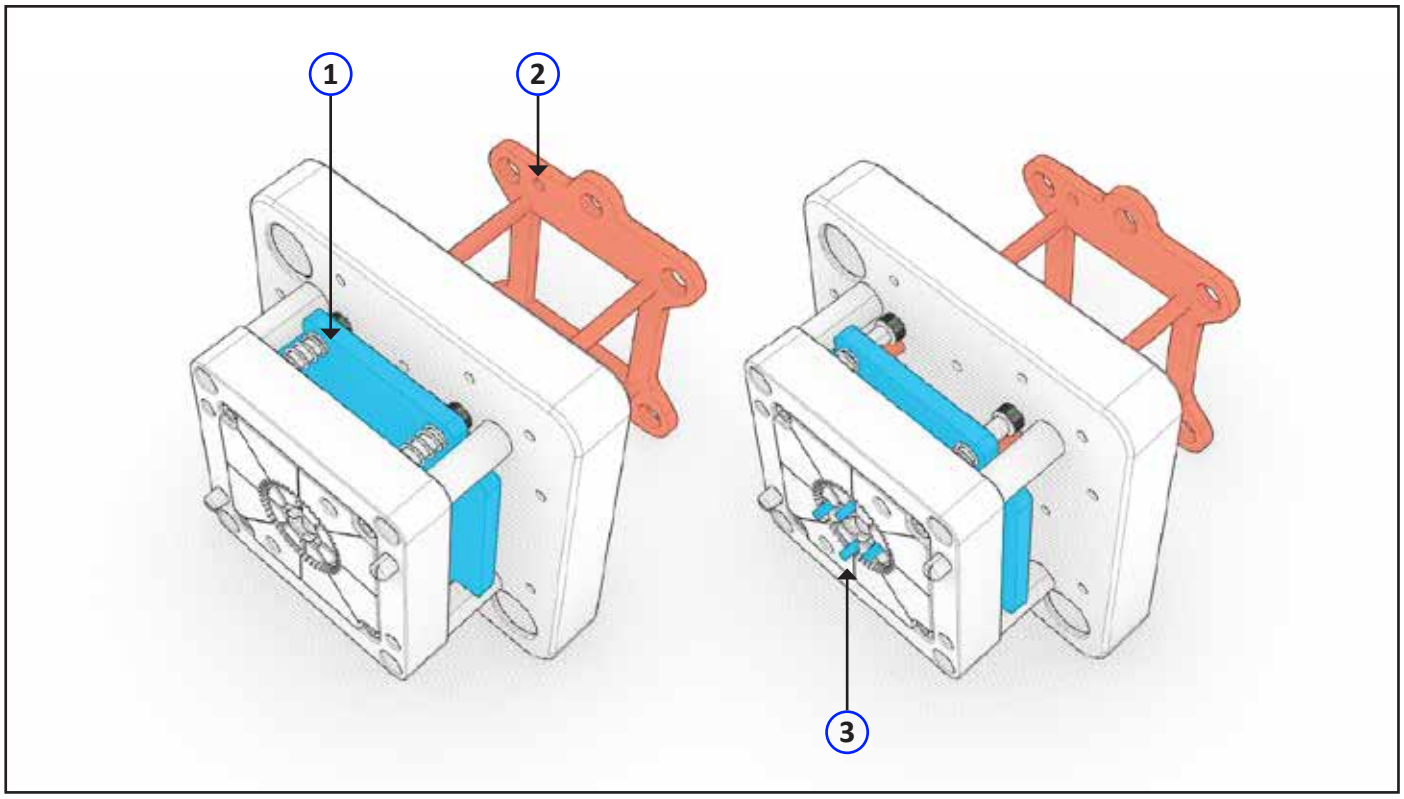




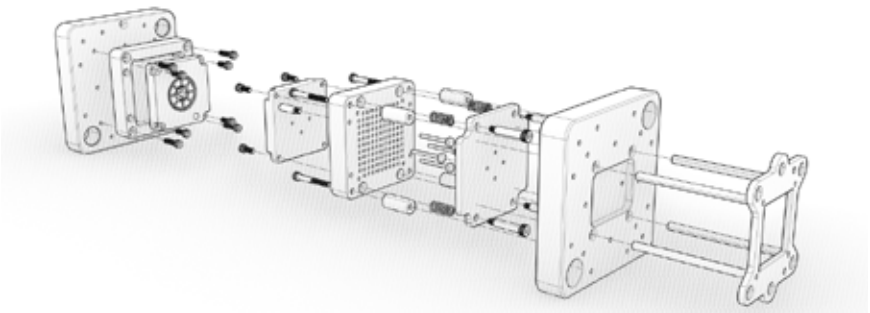
Platen ISO View

1. A Side Platen
2. B Side Platen
3. Standard MicroMolder MUD Box Mounting Holes

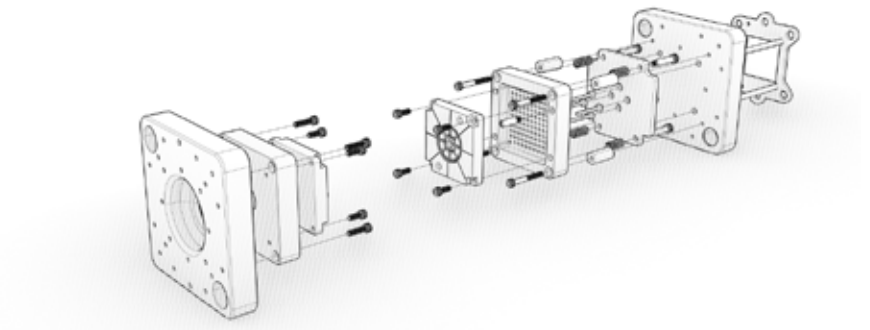
TOOLING SYSTEM: EJECTOR PUSH PLATE ASSEMBLY:



1. Ejector Push Plate
2. Ejector Push Rod Assembly
3. Ejector Pins

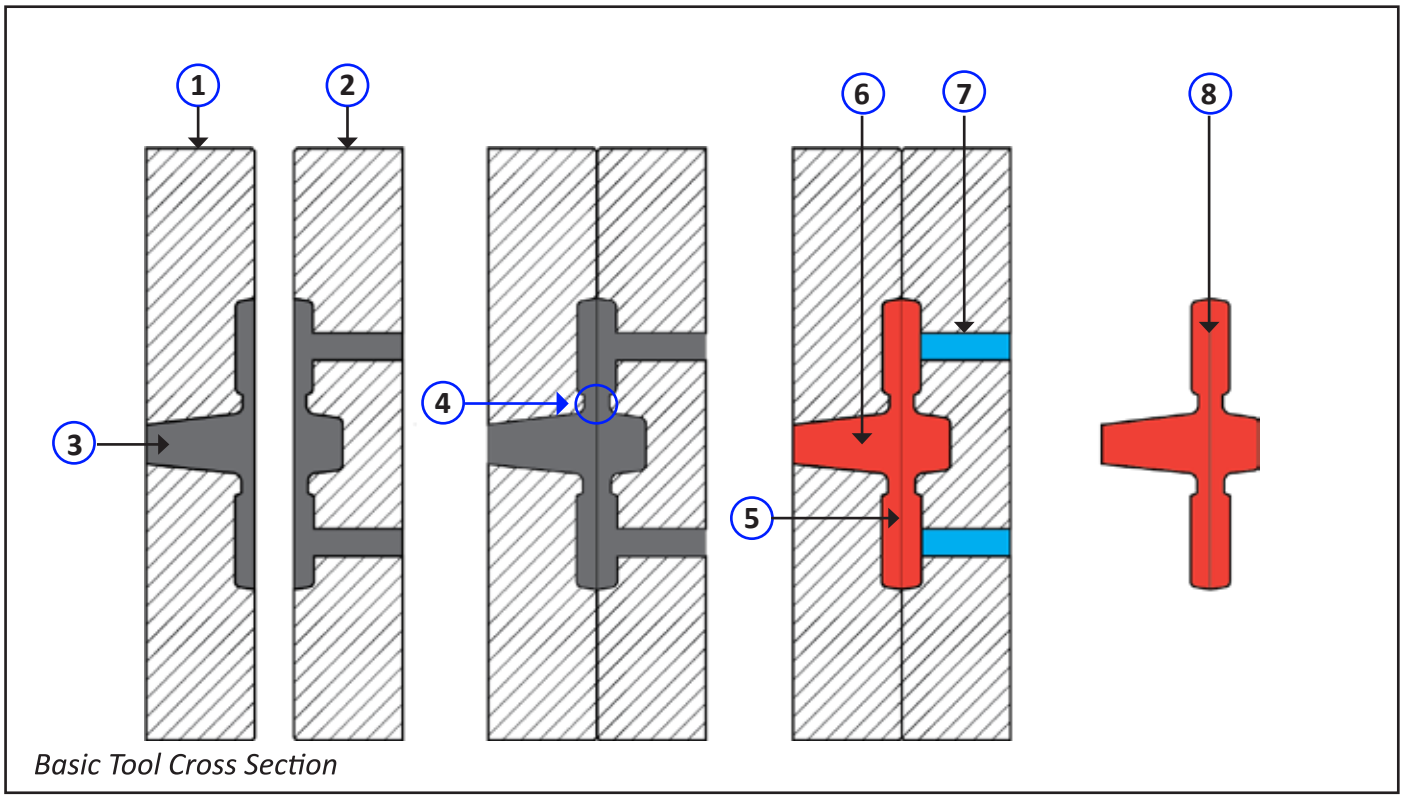


Alternate Exploded View: A Side



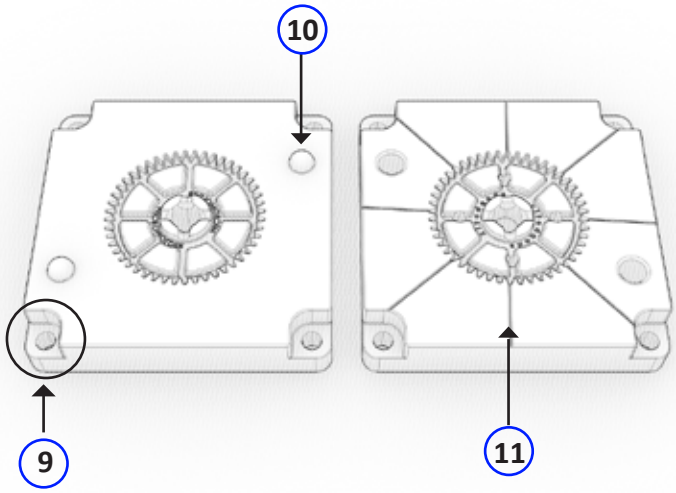
Alternate Exploded View: B Side

TOOLING SYSTEM: TOOL ANATOMY

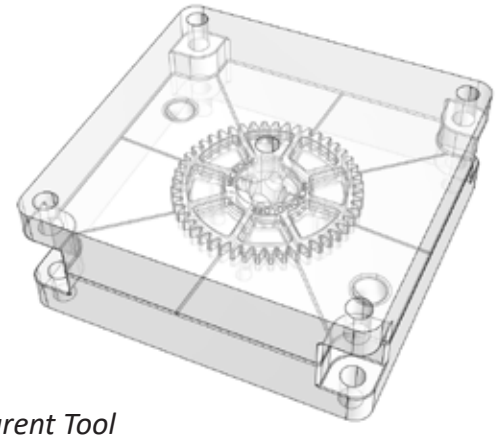


Basic Tool Cross Section

1. Tool A
2. Tool B
3. Sprue
4. Runner
5. Parting Line
6. Tool Cavity
7. Ejector Pin
8. Part
9. Tool to M.U.D. Mounting Feature
10. Alignment Feature
11. Vent



Other Tool Features



Transparent Tool

TOOLING SYSTEM: TOOL ANATOMY DESCRIPTIONS

COLD SLUG - The first material to enter an injection mold. So called because in passing through the sprue orifice it is cooled below the effective molding temperature.

COLD SLUG WELL - Space provided directly opposite the sprue opening and at the end of main runners to trap cold slug material.

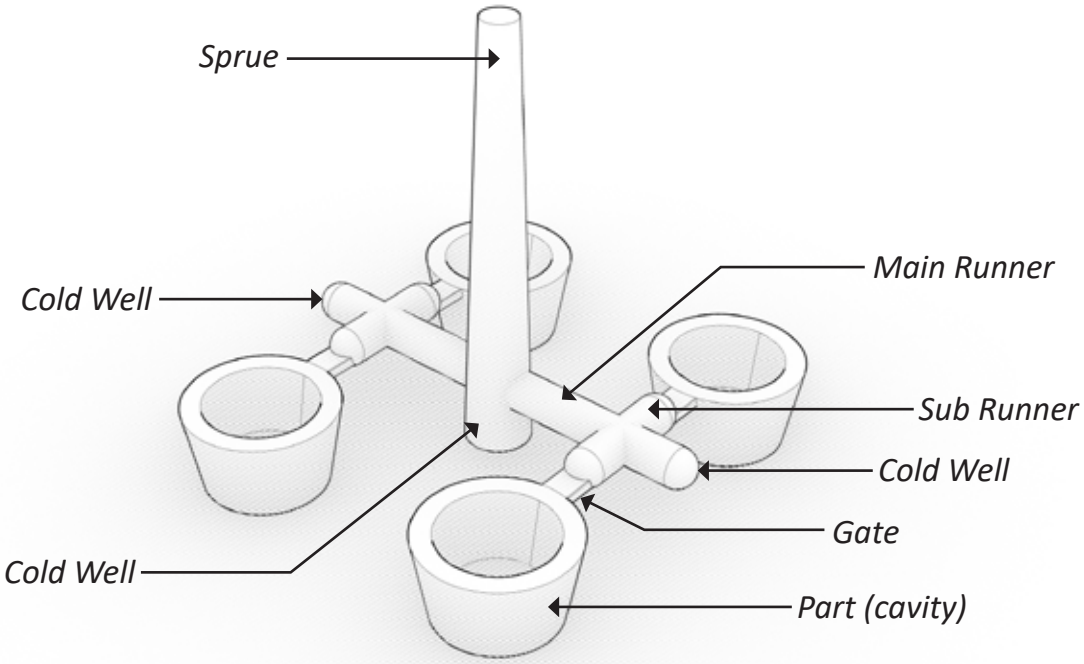
FAMILY MOLD - A multi-cavity mold where multiple parts are produced from the same tool.

GATE - The orifice through which injected plastic enters the tool cavity.

PARTING LINE - The point at which halves of mold meet in closing.

RUNNER - The channel that connects the sprue with the gate to the cavity.

SPRUE - The channel through which plastic is injected into the mold.



Example Family Mold:

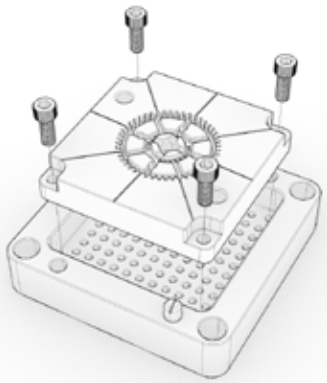
TOOLING SYSTEM: TOOL INSTALLATION

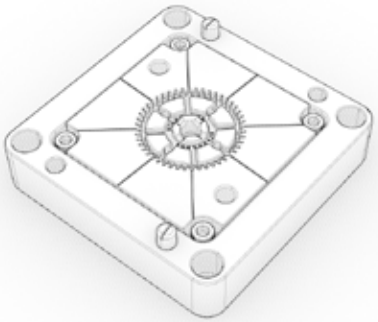
1. Install the A Side tool into the A Side M.U.D. using (x4) 1/2” 8-32 Socket Head Cap Screws.

2. Install the B Side Tool into the B Side M.U.D. using (x4) 1/2” 8-32 Socket Head Cap Screws.

Note: the orientation of the both tool haves during install to ensure that all tool alignment features will mate when the haves are closed.

1





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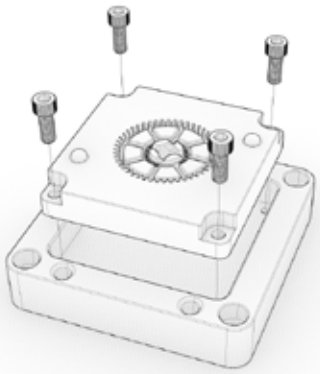
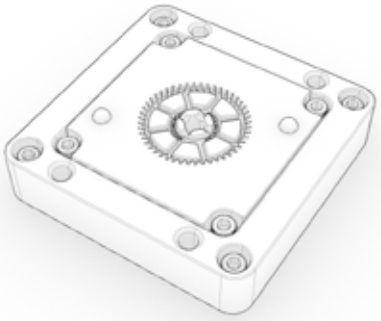




TOOLING SYSTEM: TOOL INSTALLATION

3. When applicable, install ejector pins into the push plate. We recommend using CA adhesive for this. If the pins need to be removed for any reason, apply heat to break the CA bond on metal push plates. Alternatively, compression springs or other mechanical systems such as a custom retention plate can be used to create a captive ejector pin situation.

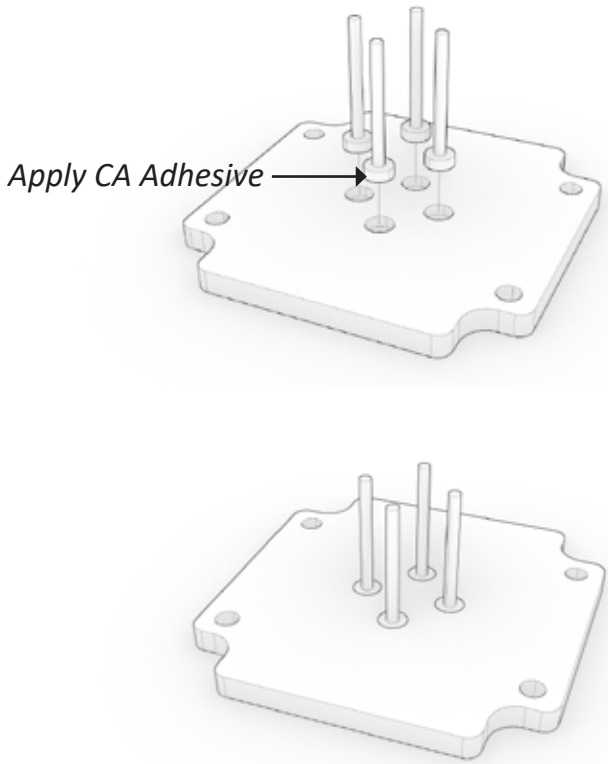
Always dry fit the assembly before gluing or using other methods to ensure placement and alignment of the pins is correct.

Note: Push plates are often tool specific as the location of the ejector pins will vary from tool to tool.

4. It is recommended to install the B Side Tool and M.U.D assembly over the push plate assembly before the adhesive sets up (if using adhesive). This helps ensure proper alignment between the tool and ejector pins.

Note: Use spacers between assemblies to help prevent excess adhesive from bonding the assemblies together.

3



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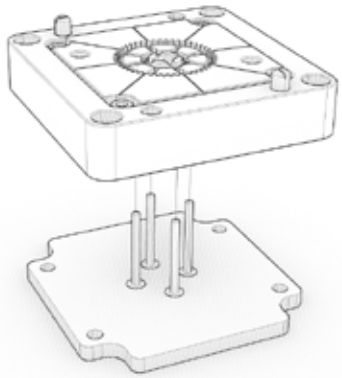
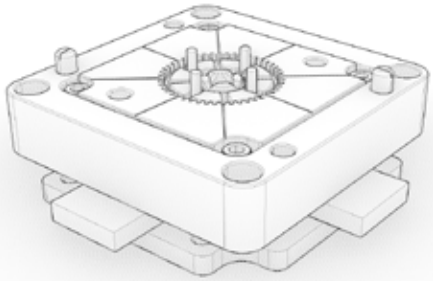




TOOLING SYSTEM: TOOL INSTALLATION

5. Once the adhesive has fully cured, rotate the assembly 180 degrees and install (x4) 1/4 x 1” shoulder length #10-32 Socket Head Cap Screws through the return springs as shown.

(Fastener shoulder length corresponds to standoff length, other sizes can be substituted based on your tooling needs.)

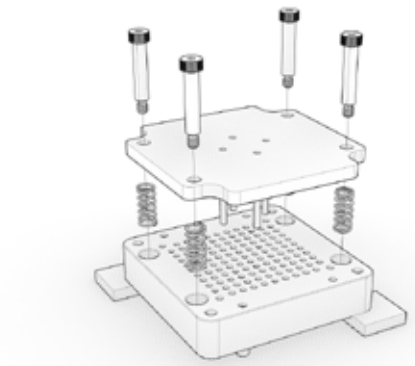
Using spacers as shown will help prevent the assembly from rocking on your workbench during install.

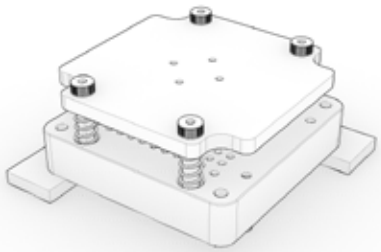
Hold this assembly with both hands and press against the push plate to ensure that there in no binding in the assembly.

6. Place 1/2 OD, 1.125” long aluminum standoffs upright on your workbench and rotate the assembly as shown, align standoffs with the through holes in the M.U.D. and drop in (x4) 2” #10-32 bolts. The B Side Tooling assembly is now ready to be mounted onto the B Side Platen.

Note: Hardware sizes listed apply to the example tool shown. If your tooling design requires different length standoffs, be sure to accommodate the required length in the shoulder height of the #10-32 Socket Head Cap Screws used to install the push plate, return springs, and standoffs to the M.U.D.

5





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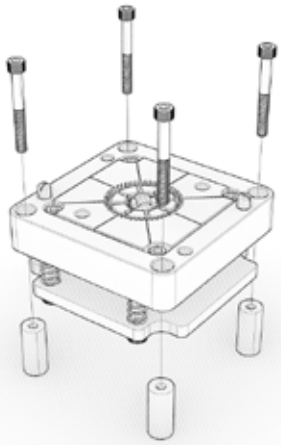
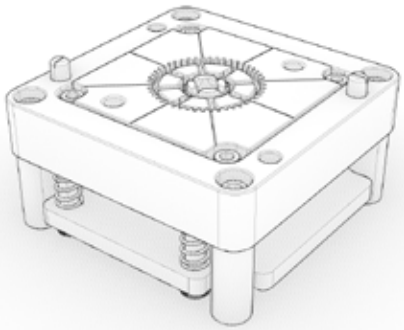




TOOLING SYSTEM: TOOL INSTALLATION

7. Place a shop towel over the linear bearing to help protect it in the event that the tooling is dropped or miss-handled during install.

Beginning with the B Side tooling assembly (it typically needs the most working room to install) align the standoffs and the 2” 10-32 bolts with the corresponding holes in the B side platen.

It is easiest to have the bolts and standoffs assembled to the M.U.D. during this step.

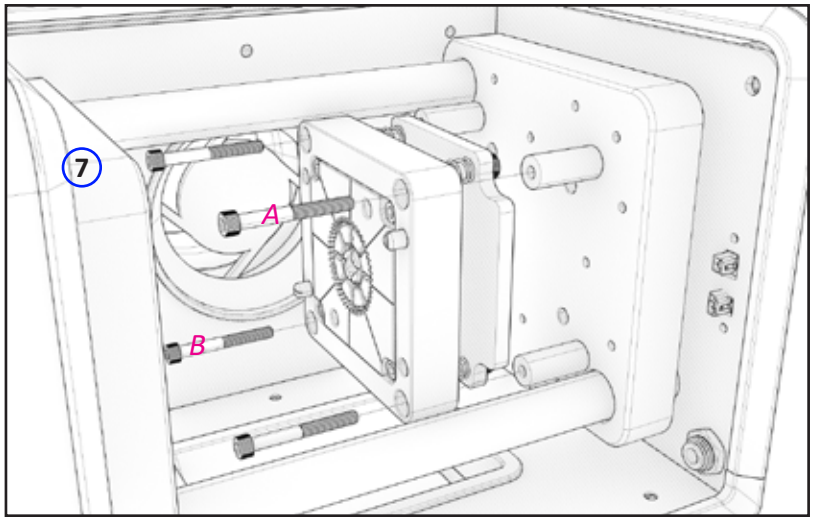
A. Start the most easily accessible bolt by hand until you have secured 3-4 threads.

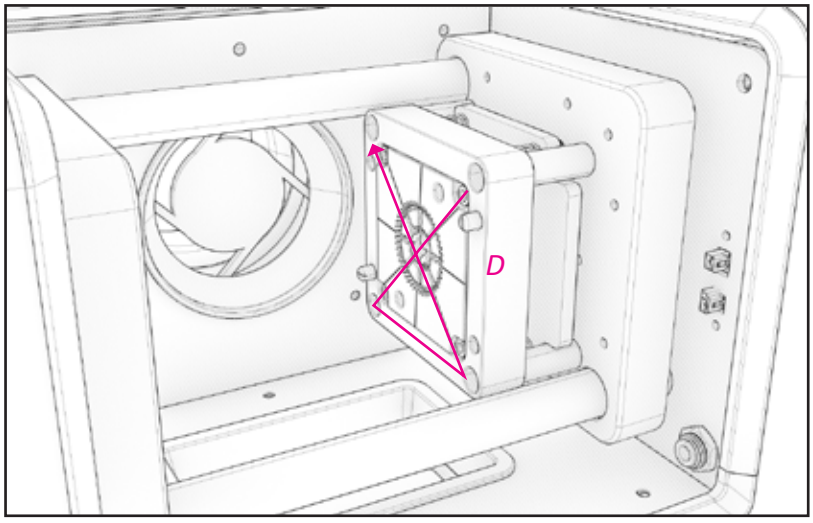
B. Move on the diagonal to the next bolt. While rotating the tooling assembly to align the holes, start this bolt.

C. Start the remaining two bolts by hand, ensuring that they are not cross threaded and turn freely.

Tighten all bolts by hand as far as you can before using an Allen Key to snug them in place.

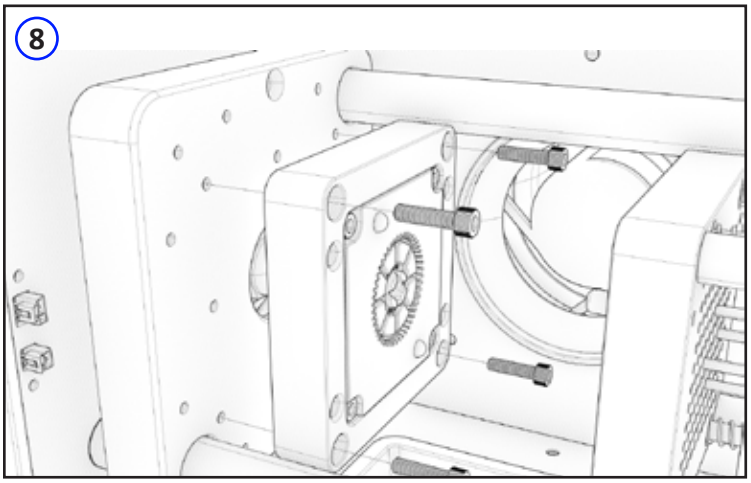
D. It is recommended to tighten these bolts by alternating between them in a criss-cross pattern tightening them a little at a time until they are snug. Do not over tighten, there is no advantage in doing so.

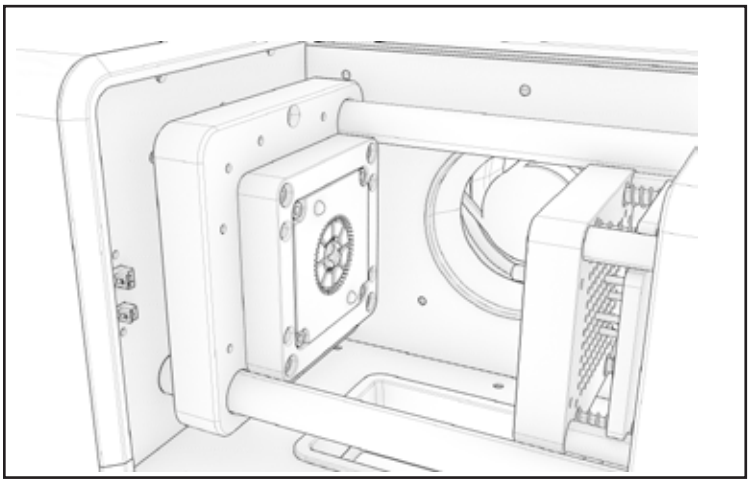




8. Following the same order of operations used to install the B Side tooling, install the A Side tool and M.U.D assembly to the A Side Platen.

Note: The injection barrel and nozzle may not be positioned perfectly concentric to the A platen plate (i.e. slightly hanging down or to the side). The barrel is designed to freely move/flex within the A platen cutout hole for the nozzle. This is to allow for any misalignment of the tool and the platen when bolted together. When a tool is not installed on the A platen plate it is not uncommon to observe rotational movement/wobble of the nozzle. Once your tool is attached to the platen plate the nozzle will self center with the nozzle interface cup of the tool or mud box.





TOOLING SYSTEM: SETTING EJECTOR PIN DEPTH

Note:
Ejector Pin depth is tool specific and must be set and verified upon every tool change. The outlined process is only applicable to tooling that utilizes an ejector pin system.

Follow the procedure outlined in the Machine Movements: Ejector Plate Homing Sequence section of this manual to enable, home, and clear the Ejector Plate.

Home the Clamp Platen

With Tooling installed, manually jog the ejector plate toward the ejector pin push plate. Switching the motion mode from continuous to incremental with a small travel distance selected can be beneficial during setup.

(Fig 1)

Fig1

Continue to jog the ejector plate a small distance at a time until it makes light contact with the ejector pin push plate.

(Fig 2)

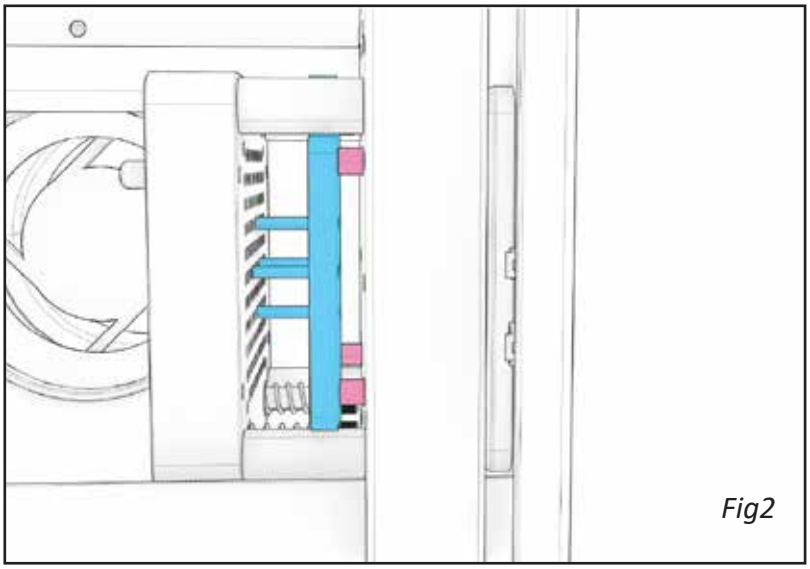


Fig2

Now as you continue to jog the plate forward in small increments you should see the distance traveled by the ejector pin push plate relative to the stick out depth of the ejector pins themselves. (Fig 3,4)

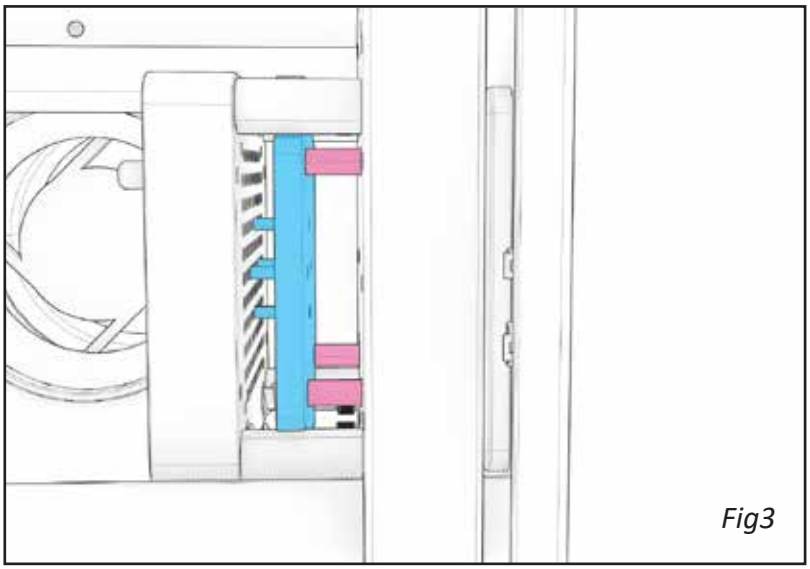


Fig3

TOOLING SYSTEM: SETTING EJECTOR PIN DEPTH

CAUTION!

Be careful not to overdrive the ejector plate to the point that it bottoms out the ejector pin push plate against the B Side M.U.D. machine or push rod pin damage will occur. See Fig 5

Set the stick out depth of the ejector pins so that the pins extend beyond the face of the B Side tool at least the depth of the tool cavity. (Fig 6)
This is a good place to start but know that additional adjustments may be needed after initial test shots have been made.

Do Not Clear This Position, simply disable the ejector plate motors to prevent further movement.
Test the ejector pin push plate travel by manually jogging the clamp away from its home position and then back towards its home position in small increments.

Observe the travel and watch for any binding between the ejector pins and the B side tooling.

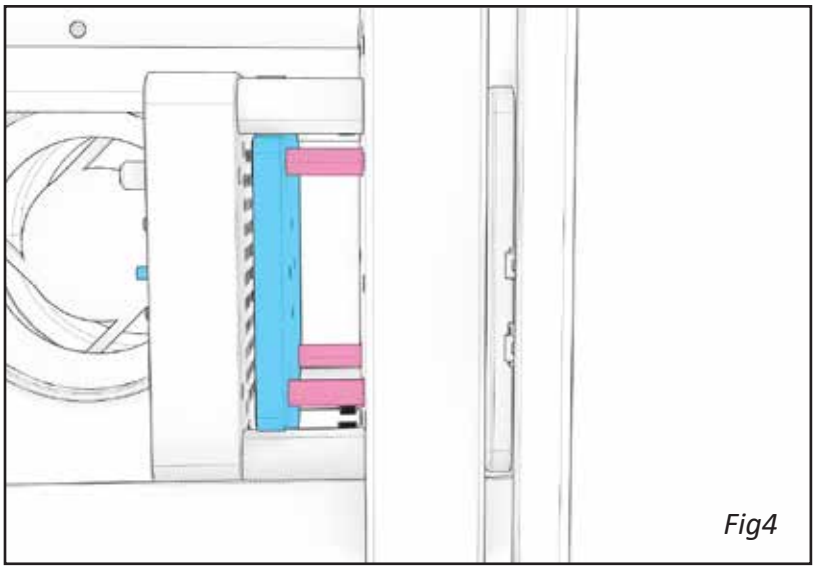


Fig4

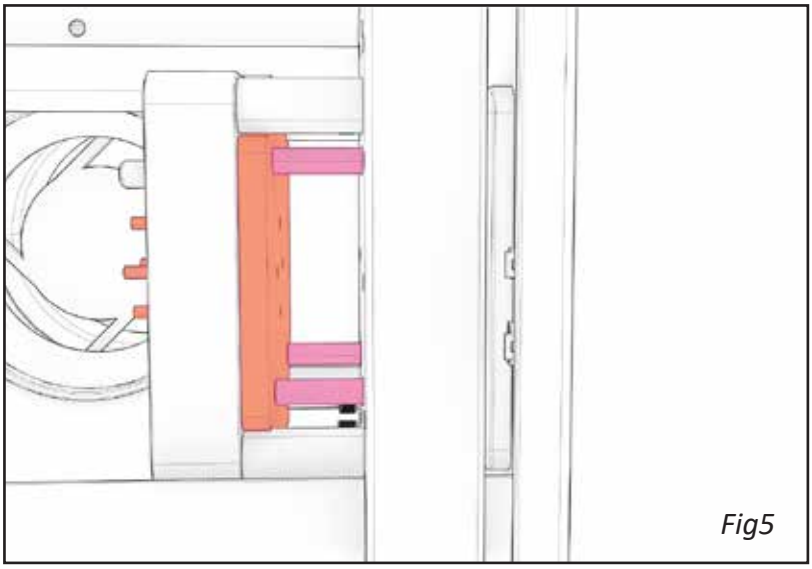


Fig5

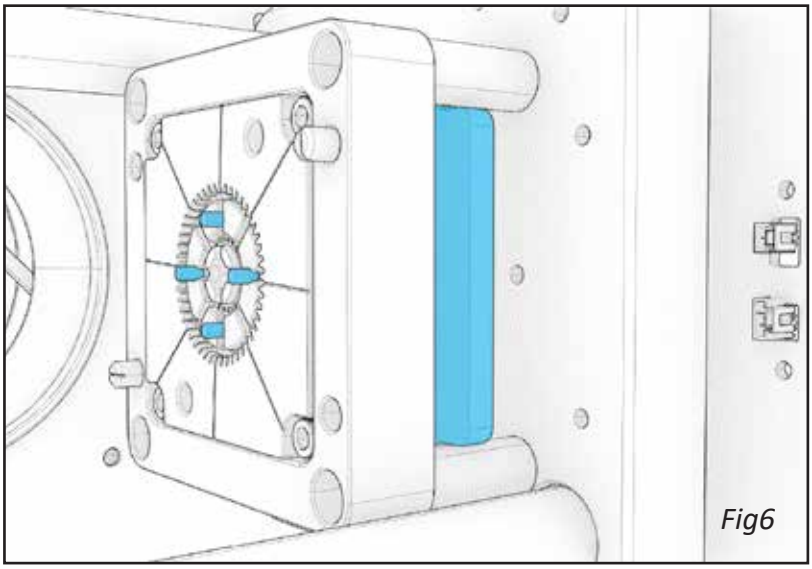
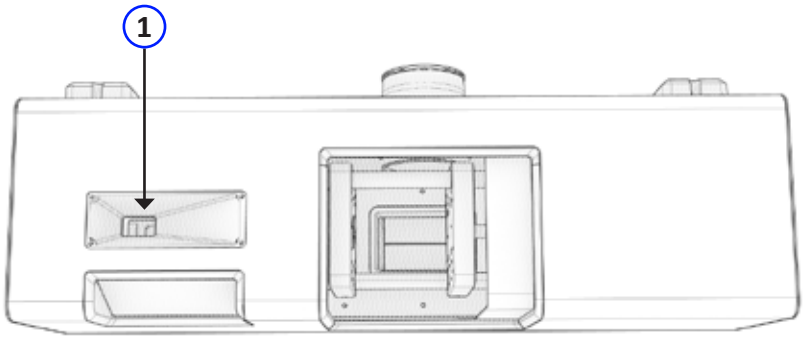


Fig6

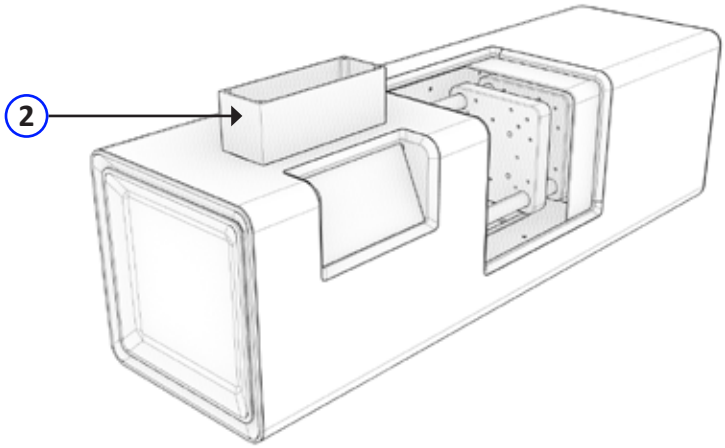
TOOLING SYSTEM: LOADING MATERIAL

1) Loading Material into MicroMolder Evo is very simple. Add The desired amount of plastic pellet to the hopper located above the display screen.



It is highly recommended to add small amounts of material at a time. It is much easier to add material bit by bit than it is to remove material from the system.

It is recommended to dedicate a small shop vac or hand vacuum to the task of material removal as it will allow you to re-claim pellet without contaminating it.

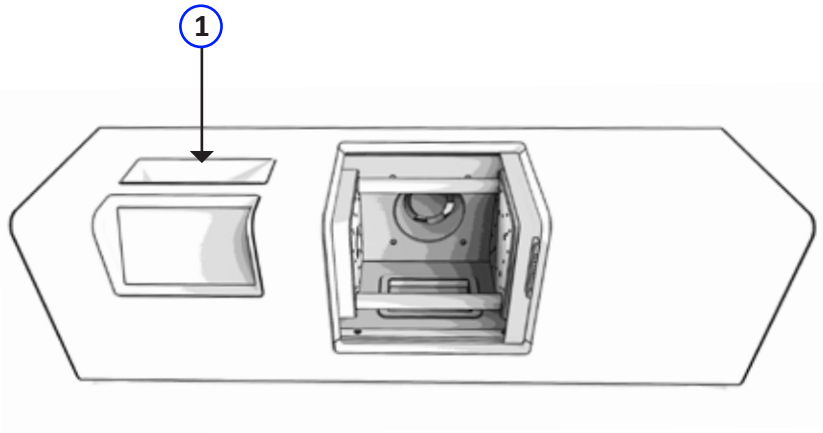


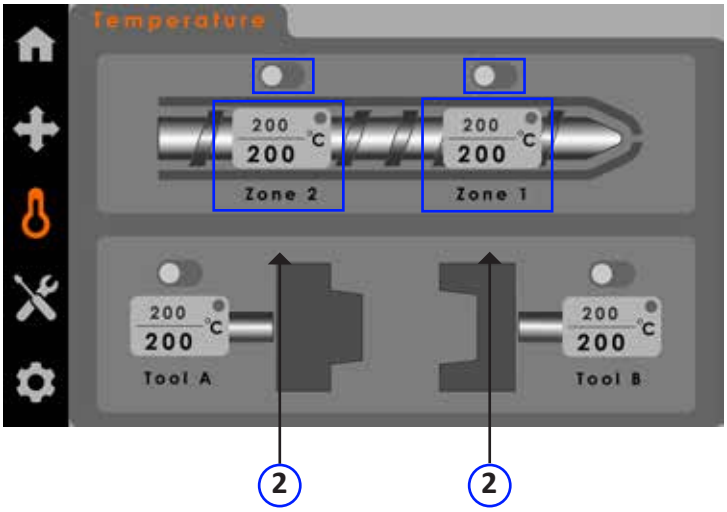
2) As you get more comfortable with the machine and your tooling setup, it is possible to extend the volume of the hopper by adding an accessory hopper extension. This will allow you to run the machine for longer periods of time without needing to replenish material.

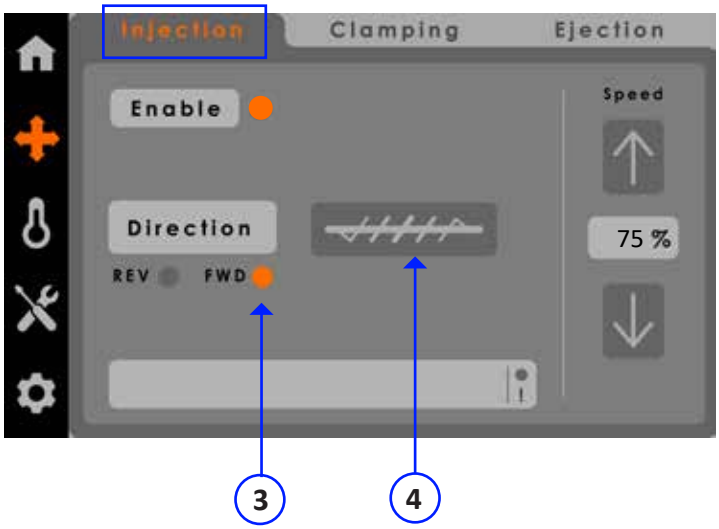
TOOLING SYSTEM: PURGING MATERIAL

Purging is typically needed upon any color or material change, after the injector system has been serviced, or a jam has been cleared. To purge the system, please follow the outlined procedure.

1. Load a small amount of material into the hopper.
2. Set Temperature the required temperature for both heater zones and allow the system to reach operating temperature.
3. Set Injection direction to FWD.
4. Close the machine safety window.
5. Manually run the injection screw for a short duration bursts (2-3 seconds) to ensure that the auger is turning freely.
6. Continue to jog the injection screw in short bursts until material comes out of the injection nozzle.







CAUTION:

Do not touch purged material, tooling, or injector nozzle as all will be extremely hot. Do not use any flammable containers inside the machine to catch purged material. A simple sheet of aluminum foil below the injector nozzle can aid in cleanup of COOLED purge material.

DISLODGING FREEZE PLUGS:

A freeze Plug in injection molding is a small slug of plastic that cools and hardens in the injection nozzle during periods of inactivity. This material must be removed before beginning an injection cycle to prevent an under shot or no fill condition.

1. Area where freeze plug forms

2. Freeze plug present at nozzle

ALWAYS CLOSE THE MACHINE SAFETY WINDOW WHEN PERFORMING THESE STEPS!

In order to dislodge a freeze plug, we will utilize the compression force of the injection screw itself to drive the freeze plug out of the nozzle.

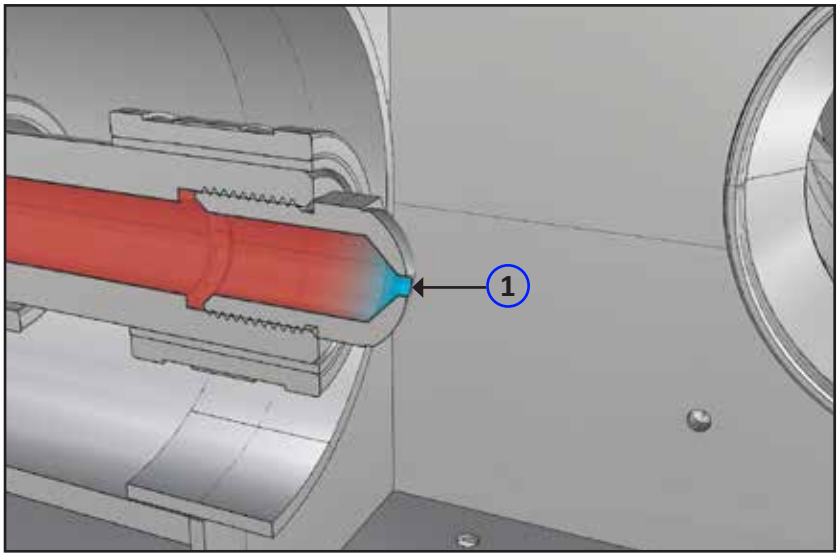
1. Bring the machine up to a set temperature appropriate to the material loaded into the machine. Allow adequate time for temperatures to build and settle at the set point.

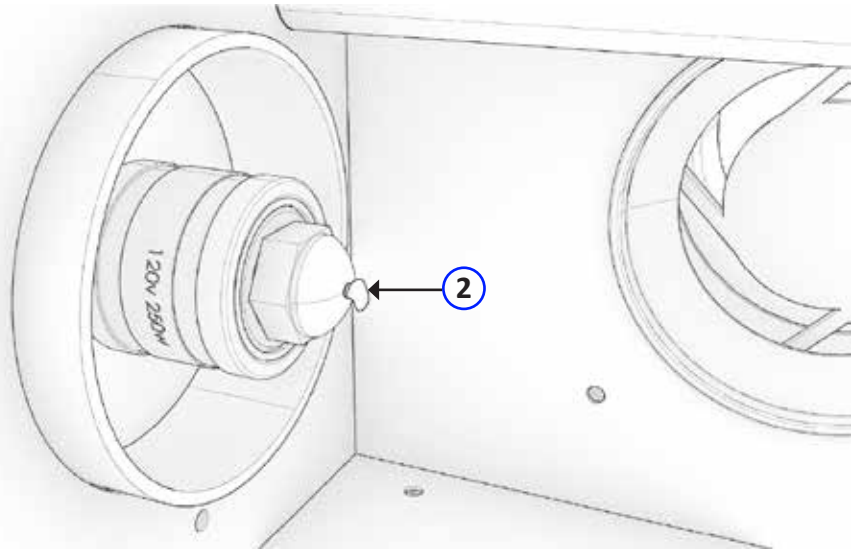
As the temperature distributes itself from the injection barrel to the nozzle, the freeze plug will soften slightly.

2. Manually jog the injection screw in the forward direction until you hear the pop sound of the plug being released from the nozzle.

3. Although it is possible to dislodge a freeze plug with A Side tooling installed, it is recommended to remove the A side tool leaving the M.U.D. in place as shown in fig 3.

For persistent freeze plugs a small pointed screw driver or pin may be needed to push the plug back into the nozzle to be melted. The method for disloging a freeze plug will vary from case to case.





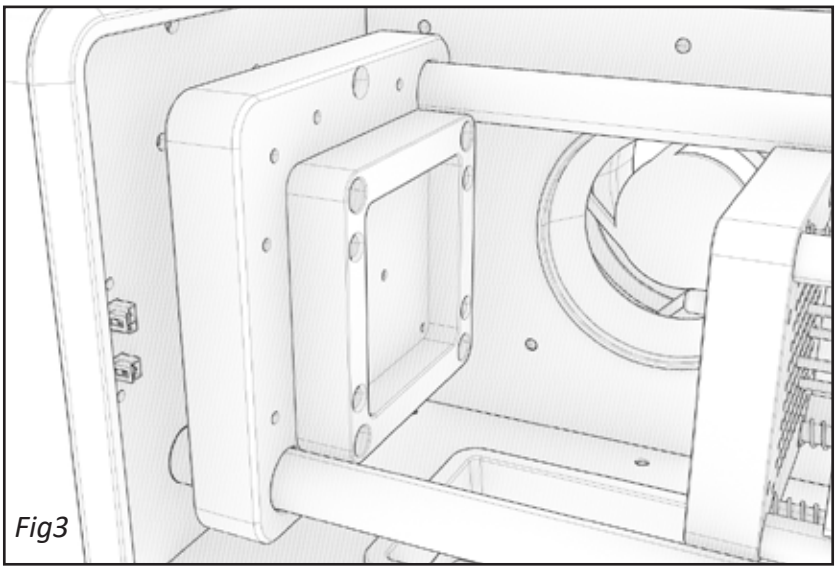
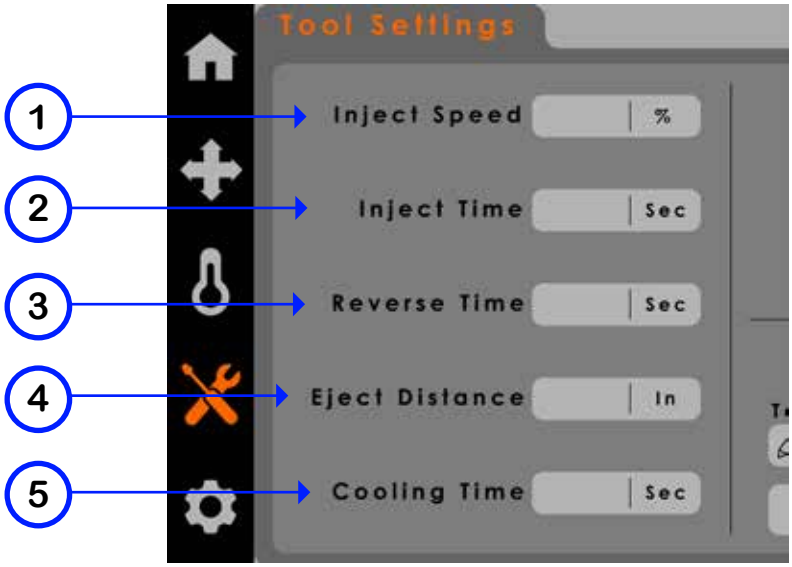


Fig3

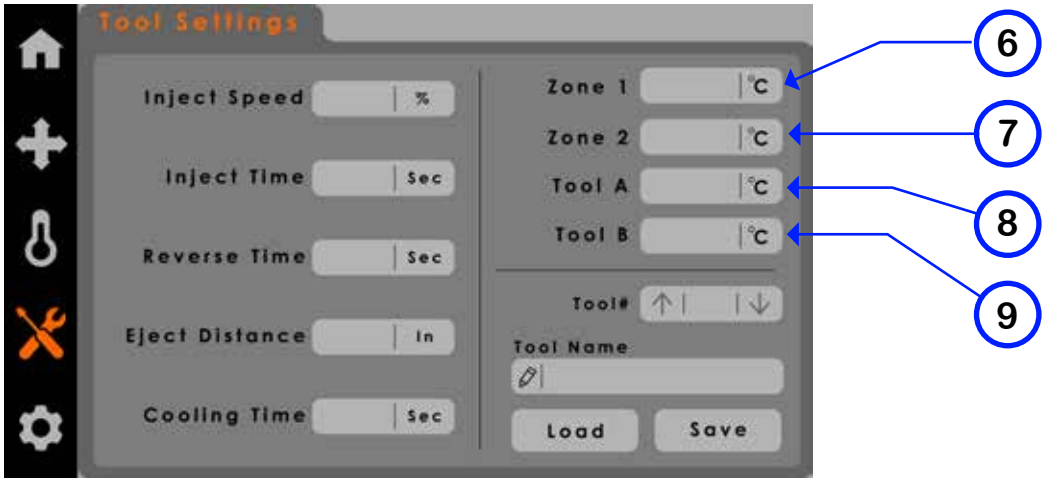
TOOL SETTINGS CONFIGURATION:

The configuration of a new tool can be simplified into the following steps:

1. **Injection Speed:** The injection speed can be set from 0-100% of the motor's maximum output. Different plastic types, mold materials, and geometries will require different injection speeds.
2. **Injection Time:** The injection time, set in seconds, depends on the type of plastic used and the inner cavity volume.
3. **Reverse Time:** This is the duration in seconds that the injection screw runs in reverse once the mold has cooled. Running in reverse can help reduce drooling or freeze plugs. *Do not run the injection screw in reverse for more than 3 seconds*, as extended reverse running can push plastic back into the barrel and up into the hopper, causing melted plastic to mix with unmelted plastic.
4. **Eject Distance:** This is the length the ejector rod extends to engage the ejection pin plate on a mold.
5. **Cooling Time:** This is the time the mold remains clamped closed after the injection cycle is complete to cool.



TOOL SETTINGS CONFIGURATION: CONT



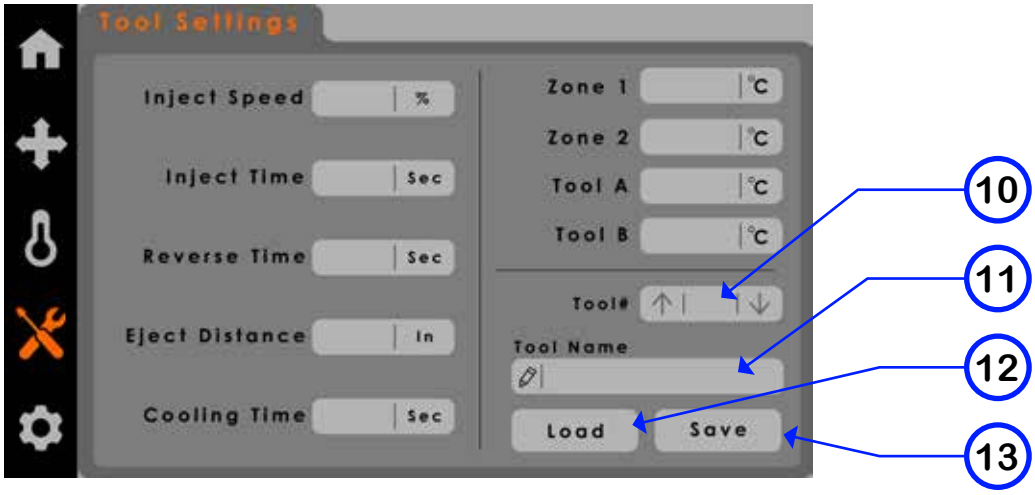
6) **Zone 1: Injection barrel zone 1 heating set point:**
   - Maximum Temperature: Do not set the temperature above 310°C.
   - Over Temperature Shutdown: The system will automatically shut down if the temperature exceeds 320°C for more than 3 minutes.
   - Temperature Variations: The PID heater control system may cause short-term temperature fluctuations of up to 10°C above the target set point. Setting the maximum temperature to 310°C helps prevent over-temperature shutdowns.

7) **Zone 2: Injection barrel zone 2 heating set point:**
   - Maximum Temperature: Do not set the temperature above 310°C.
   - Over Temperature Shutdown: The system will automatically shut down if the temperature exceeds 320°C for more than 3 minutes.
   - Temperature Variations: The PID heater control system may cause short-term temperature fluctuations of up to 10°C above the target set point. Setting the maximum temperature to 310°C helps prevent over-temperature shutdowns.

8) **Tool A: Tool A side heating set point:**
   - The maximum allowable temperature for tool heaters should not exceed 120°C. Achieving and maintaining this temperature can be challenging due to the varying properties of different tool materials and sizes.
   - The heating times and the ability to sustain stable temperatures are influenced by the dynamic thermodynamic processes involved in injection molding. During operation, the tool will be subjected to significant temperature fluctuations as hot molten plastic is injected and subsequently cools within the mold. These variations can make it difficult to keep the tool heater at a consistent temperature.

9) **Tool B: Tool B side heating set point:**
   - The maximum allowable temperature for tool heaters should not exceed 120°C. Achieving and maintaining this temperature can be challenging due to the varying properties of different tool materials and sizes.
   - The heating times and the ability to sustain stable temperatures are influenced by the dynamic thermodynamic processes involved in injection molding. During operation, the tool will be subjected to significant temperature fluctuations as hot molten plastic is injected and subsequently cools within the mold. These variations can make it difficult to keep the tool heater at a consistent temperature.

TOOL SETTINGS CONFIGURATION: CONT



10) Active Tool Number:

- Indicates the active tool number. The up and down arrow buttons will cycle the tool number incrementally.

11) Tool Name:

- Tool names or short descriptions can be assigned to any given tool number. Tool names are not required but can be helpful in managing multiple tool setting data sets. Pressing the pencil icon will open a dialog box to add/edit the tool name.

12) Load button:

- To load a previously saved tool data set use the tool number arrows to change the tool number. Once the desired tool number is selected press the Load button. If tool data has been stored to the selected tool number, all the tool setting fields will be populated with the saved data. If no tool data was stored to the selected tool number, all the fields will be populated with a zero value.

13) Save button:

- To save tool settings data use the tool number arrows to select the desired tool number slot. Enter a tool name if desired and then press the Save button.

INJECTING THE FIRST PART:

1) Secure the Tooling:

Attach the tooling onto the platen plates.

Set the ejector pin depth if applicable to your tooling design. *(See: Tool Installation steps starting on page 44)*

2) Enable Barrel Heaters:

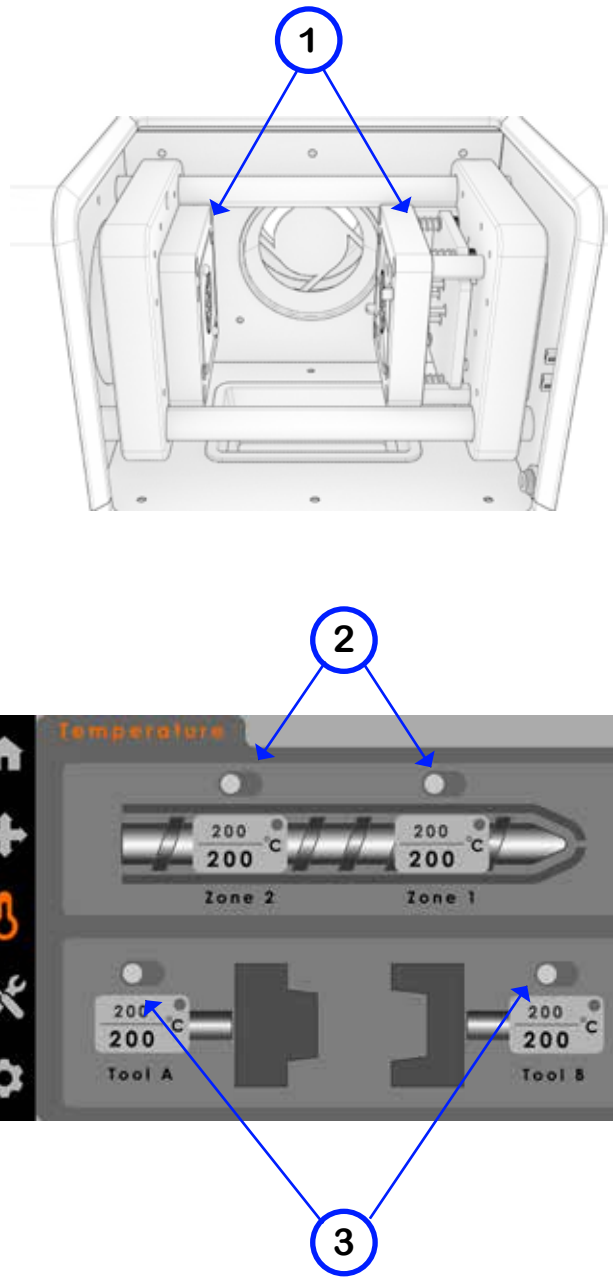
Turn on the barrel heaters and allow each zone to reach the desired temperature set point.

Note: During initial startup, the heating system may overshoot and undershoot the target temperature for 15-20 minutes. Over time (about 15 minutes), the PID control will stabilize within +/- 3 degrees of the target set point.

3) Enable Tool Heaters (if applicable):

Turn on the tool heaters and allow the tool to reach the target set point.

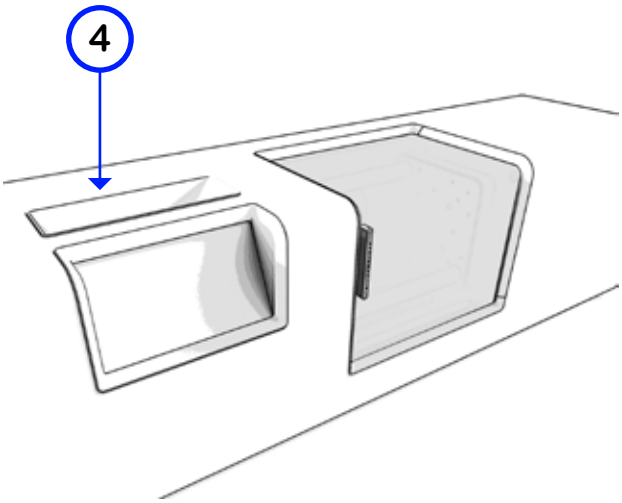
Note: Depending on the tool size and material, it may take time to reach the desired temperature. Use thermal blocking materials between your tool and the platen plates to mitigate thermal creep. MicroMolder Evo includes a .25" thick piece of G10 FR4 between the platen and the chassis to prevent thermal migration. Adding an additional .125" piece of G10 between the tool A side and the platen can help reduce heat transfer.



4) Fill the Hopper:

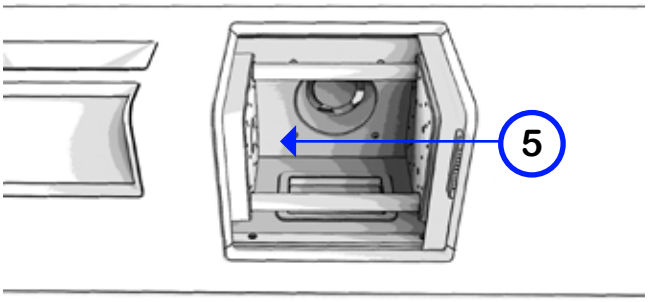
Fill the hopper with plastic pellets.

Note: Beginners are recommended to use polyethylene or polypropylene due to their lower processing temperatures, non-hygroscopic nature, and good flow characteristics.



5) Close the Safety Door

If open, close the safety door.



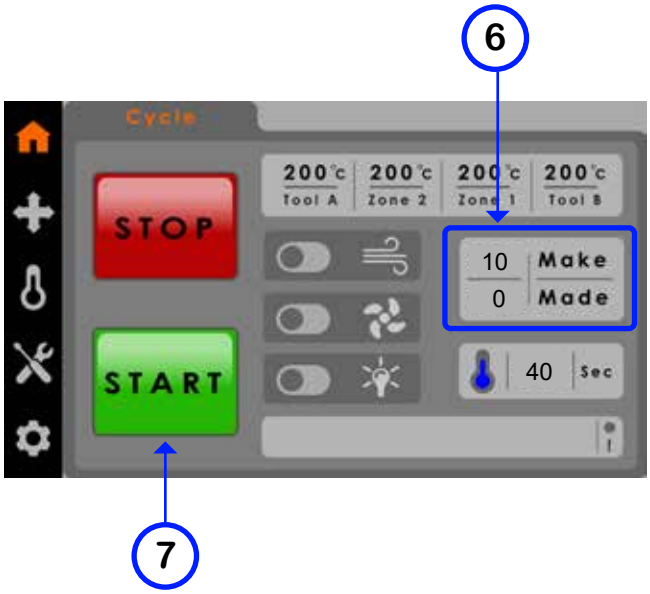
6) Enter Production Details:

Enter the number of parts to make in the "Make" field.

Note: The "Make" value must be greater than the "Made" value.

7) Initiate Injection Cycle:

Press the Start button to begin the injection cycle.



INJECTING THE FIRST PART: CONT

Injection Cycle Steps:

1) The platen plate moves forward approximately 0.50 inch (12.7mm) and then pauses.

2) If using the ejector rod system, the motors initialize and move the push rods to the value entered on the Tool page.

3) The platen plate motor closes the tool halves together. The servo motor automatically detects mold closure and stops moving when the two halves meet.

4) The platen plate motor applies clamping pressure to the mold halves.

5) The injection motor initializes and begins filling the mold with plastic at the speed and time values entered on the Tool page.

6) The mold remains closed for the cooling cycle to complete.

7) The injection motor runs in reverse to draw back molten plastic from the nozzle, minimizing drooling or freeze plug formation.

8) After injection and cooling, the platen motor moves to the home position.

9) If using the ejector rod system, the mold contacts the ejector push rods to eject the part from the tool.

10) The platen plate moves forward 0.50” (12.5mm) and then back to the home position. Sometimes a second push is required to dislodge the part.

11) The completed part falls through the drop doors and is counted and tabulated in the “Make” field.

Repeat Process:

- If the "Make" value is greater than the "Made" value, the machine repeats this process until the desired part count is completed.
- Upon completion the “Make” value will be set to 0, the platen and the ejection motors will home and the heating zones will be disabled. “Part count to make is complete” will be displayed.

INJECTING THE FIRST PART: CONT

Initial Shot Testing Guidelines:

During initial shot testing, various issues may arise:

- The cavity might be under or over-filled.
- The part may not eject properly.
- Temperature settings might be incorrect.
- Cooling time may not be optimal.

The goal at this stage is to observe the resulting part and adjust parameters to improve the quality of subsequent parts. Remember, adjustments to machine settings cannot fix a poorly designed tool. This process does not account for the tool's design or the part's geometry.

As you gain experience with the machine and improve your tooling design skills, your results will become more predictable. Injection molding does not have a one-size-fits-all solution; what works for one part/tool combination may not be suitable for another, even if the part geometries are similar.

Injection molding and tool design require patience, trial and error, testing, failure, and dedication to problem-solving. The reward is the ability to reliably, efficiently, and repeatedly bring ideas into physical form. With each part you create, you will develop a recipe for success.

MACHINE SHUTDOWN PROCEDURE:

To shut down the machine, please follow this procedure:

1. Turn off any active heaters and allow the unit to cool.

2. Return all systems to their home positions.

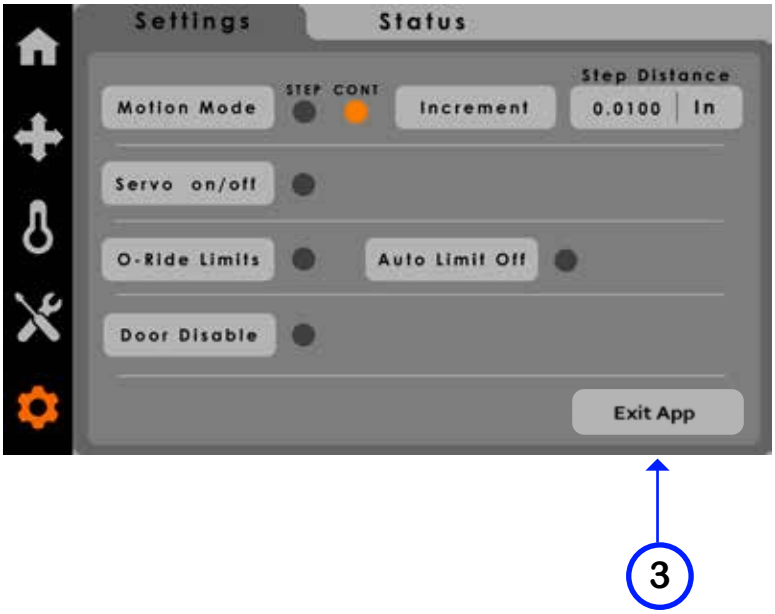
3. Exit MicroMolder Software by navigating to the Settings page and pressing the Exit App button. This action will close the application and return you to the main Windows Desktop.

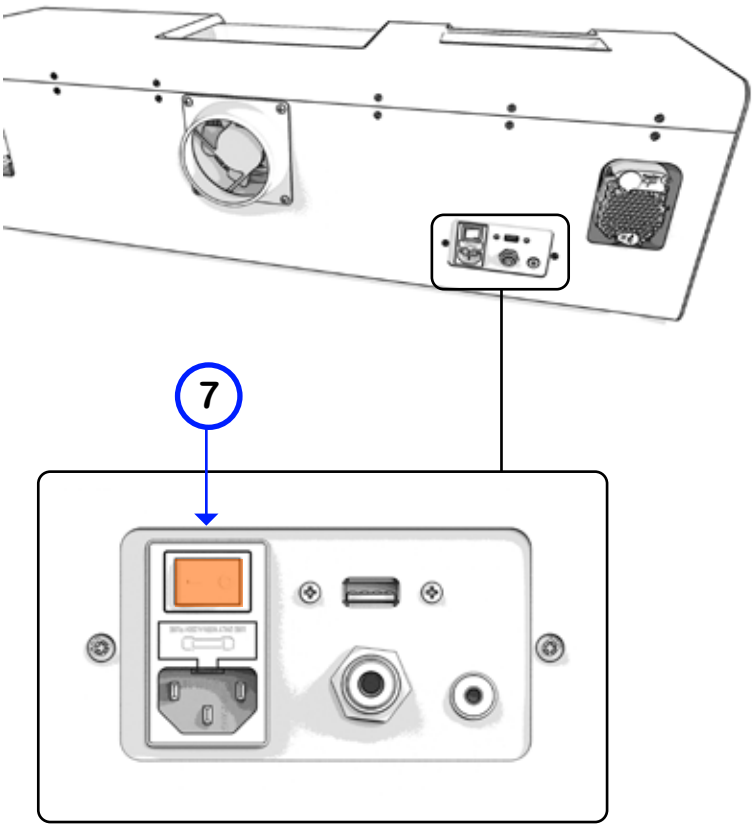
4. When software is shut down, you will notice that the machine end cap lights turn off.

5. Navigate to windows start and select Power>Shut Down

6. Once the on board computer has shut down you will notice that the chassis fans will still be running. This is normal.

7. Now you can turn off the machine power supply switch on the back of the unit.





TROUBLE SHOOTING/ERRORS: