

MACHINE SPECS AND OPERATION MANUALS

3D PRINTING

DIMENSION SST 1200ES

SPECIFICATIONS

- Model Material: ABSplus
- Support Material: soluble
- Build Size: 254 x 254 x 305 mm (10 x 10 x 12 in)
- Layer Thickness: 0.33 mm (0.013 in) or 0.254 mm (0.010 in)
- Power Requirements: 100 - 120 VAC, 60 Hz, min 15A dedicated circuit
- Temperatures: 99°C (model and support) 72°C (inside chamber)

OPERATION MANUAL

- Upload your drawing using the CatalystEX software for the Dimension printers.
- Here you may check on the orientation, time, and amount of material that will be used.
- Start in the General tab and select the proper print resolution, scale, number of copies, and set the support material fill to SMART.
- Check to make sure that your part is in the proper UNITS!
- In the Orientation tab you will decide how the part will be printed. Prior to printing, it is important to check that your print will be continuous. Start at the bottom and step up until you reach the top to ensure that all layers are set correctly and there are no gaps or undesired features.
- In the Pack tab, you may orient your part on the printing tray as well as examine how long your print will take and how much support and model material it will take.
- The software has a very good built-in help system. Go to the help tab and open Dynamic Help for assistance.
- The soluble support bath is located in the machine shop. Using the provided gloves, carefully remove the lid and lower your part into the bath. Pressing the 'ON' button will begin a preset 8 hour heat and circulation routine.
- Save the tray on which your part was printed. A staff member will remove the excess support material so that the tray may be used again.
- Please reference the PDF of the user guide to familiarize yourself further with the machine before using it.

LASER CUTTING AND ENGRAVING

RABBIT LASER ENGRAVING/CUTTING MACHINE RL-100-1290

SPECIFICATIONS

- Laser type: sealed CO₂ laser tube (lifespan approx. 8000 hours)
- Laser Power: 100 watts
- Power Source: 220 VAC
- Engraving Area: 1200 x 900 mm (47.2 x 35.4 in)
- Engraving Speed: 0 – 60,000 mm/min
- Max Cutting Speed: 0 – 36,000 mm/min
- Location Precision: <0.01 mm
- Laser Cut Diameter: 0.3 mm
- Graphic Formats Supported: BMP, PLT, DST, DXF, AI

OPERATION MANUAL

- Turn on the laser chiller and the compressed air (approximately 30 psi).
- Turn the laser fume exhaust system on before focusing the laser and performing a cut.
- Use the DATUM key to reference the cutter head to the upper right hand corner.
- Use the TEST key before cutting to check the footprint of your cut and ensure that the laser will not run off the edge of your acrylic or onto the aluminum frame of the cutting bed.
- Hitting the ESC key will put the laser cutter in to JOG mode. When in JOG mode, the word 'laser' will not be highlighted on the display panel. Use the arrow keys to move the cutter head to the desired origin position.
- To upload a file to the laser cutter, open the LaserCut 5.3 software and insert a device with your .DXF file. Go to File -> Import and select your file. The file will be placed on the grid.
- The blue dot on the screen indicates your origin. If you wish to make your cut based upon where the cutter head currently is jogged to, ensure that the 'Immediate' box on the right side panel is checked. If this box is not checked, the laser will make the cut based upon the drawing's position on the grid.
- Go to Tools -> Unite Lines. The software will pick the best route and cutting order for your part automatically, cutting the inside holes first and then the outside lines.
- Using the Pick function will let you move the drawing around, and using the Set Knife Origin key on the top bar will allow you to change the location of the origin.
- If you wish to make multiple cuts of the same .DXF at once, you may duplicate your part by going to Draw -> Copy(s) and selecting the rows, columns, and spacing.
- Using the Mode dropdown menu allows selection of the type of the laser mode (cut, engrave, ect.)
- Double clicking on the Speed/Power numbers opens a menu. Please reference the table for your material type and thickness in order to select the proper power and speed. The maximum power of the cutter should NOT exceed 85.
- Hit download to send the part to the laser cutter. Hit the DOWNLOAD CURRENT button, and click OK to replace the existing file.
- To focus the laser, use the small orange square that located next to the ON/OFF key. The cutter head has a conical section and a cylindrical section. The top of the square should line up with the top of the cylindrical section of the cutter head. This will ensure that the laser is focused to the correct depth at the top of the material.
- Hit the start key on the cutter and your cut will begin.

CNC MACHINING

HURCO VM1 VERTICAL MACHINING CENTER

SPECIFICATIONS

- X travel: 26 inches (660 mm)
- Y travel: 14 inches (356 mm)
- Z travel: 18 inches (457 mm)
- Table size: 30 x 14 in (762 x 356 mm)
- Maximum weight on table: 750 lb (340 kg)
- Maximum spindle speed: 8,000 RPM
- Rapid Traverse X,Y / Z axis, ipm (M/min): 945 / 750 (24 / 19)
- Positioning: ±0.0002 in (0.005 mm)
- Repeatability: ±0.0001 in (0.0025 mm)

OPERATION MANUAL

- The Hurco VM1 is operated by the touch screen and button interface through the WinMax interface. Please have read and understood all of the options, commands, and menus available in the WinMax manual.
- To manually mill a part, select the manual button on the keyboard interface. This will open up a window where you may set up your tool or part. Select 'Tool Setup' -> 'Part Setup' in order to access the screen where you may zero the part axes.
- If you are going to be running a CNC program, you will want to set up stock geometry. This will create a 3D representation of your stock part and when you write your program you can verify that your cuts and tool paths are correct.
- Note that the tool being used dictates the maximum spindle speed. This can be changed using the manual function setup interface in the manual menu. The spindle speed may be controlled using a knob in the upper right hand corner.
- For edge-finding, use 1000 RPM.
- Before moving the spindle manually, select a magnification (x1 x10 or x100) and ensure that it lights up. Movement of the spindle should be thought of similarly to the Tormach mill (see Tormach instructions below for more detailed instructions). Think of your part in the machine as your zero point, and the spindle head as the object that you wish to move. For instance, if the spindle is above the part and you wish to move down, select the Z axis using the knob in the bottom left and turn the movement wheel in the negative direction. If you are on the left side of the part and wish to touch the left edge, such as is the case when edge-finding, select the X axis and move the spindle wheel in the positive direction.
- To do any programming with the Hurco mill, you must be in INPUT mode. Select it with the keyboard interface. This is how you do tool setup and calibration, or load CNC programs on to the machine.
- In the INPUT mode, there are three important soft keys. These are: Part Setup, to set your X and Y zeros, Tool Review, to set up your tools, and Part Programming, to make your CNC programs.
- Please be familiar with the machine modes section of *hurconotes*. This section covers manual machine mode, input mode, and auto mode.
- $$RPM = \frac{3.82 * SFM}{Dia.}$$

- Suggested Cutting Speeds (Surface Feet per Minute (SFM))

Material	High Speed Steel	Carbide
Stainless steel	70	150
Annealed tool steel	50	120
Low carbon steel	125	275
Brass	200	500
Aluminum	300	800
Plastics	500	1000

Feed per tooth on drills use the diameter divided by 100.

Feed per tooth on end mills use the diameter divided by 200.

TECHNO GANTRY ROUTER LCX

SPECIFICATIONS

- Foot Print: 109 x 149 in
- Travel: 59 x 120 x 5.0 in (X,Y,Z)
- Spindle Speed: 6000 – 18000 RPM
- Feed Rate: 200 ipm
- Software: Control Interface v1.423.8

OPERATION MANUAL

- Power on the LCX using the black toggle switch on wall facing side of LCX
- Check that the E-stop is unlocked by turning clockwise
- Run Techno CNC Interface v1.423.8
- Turn all Power Box Levers to the ON Position (The left box resets power to the Vacuum Pump, the middle box controls power to the Spindle, and the right box provides power to the machine.)
- Check air pressure at the tool changer pressure regulator is greater than 80 psi
- "Home>All" in program interface (home is at the far left corner, furthest from the computer terminal)
- Basic controls include: Jog Speed Slider, GoTo>XY zero (returns to home position), GUI buttons or NumPad Pendant to jog by hand (+/- moves the Z axis).
- Use "Tool>Identify Tool in Chuck" to enter corresponding tool number for tool in spindle ('0' corresponds to no tool in the spindle).
- For manual tool change, depress green button on side of spindle to release or load a new tool (don't forget to identify the new tool).
- Confirm that the highlighted tool in the GUI matches what is loaded into the spindle
- For automatic tool change, use "Tool>Tool Change" to open popup dialog. Proceed by inputting the desired tool number; the machine will then move to drop off the current tool before picking up the desired tool (inputting '0' will empty the spindle).
- The E-stop will immediately stop movement during a tool change.
- G-Code programming is covered during training.

TORMACH PERSONAL CNC 1100

SPECIFICATIONS

- Table size: 34 x 9.5 in
- Travel: 18 x 9.5 x 16.25 in (X,Y,Z)
- Power Requirements: 230-250 VAC, 50/60 Hz with 20A breaker recommended for primary phase, 115 VAC 50/60 Hz for secondary phase
- Maximum table weight: 500 lbs.
- Spindle Taper: R8
- Spindle Speed: 300 – 4450 RPM
- Transmission: V-belt drive, 2 ratios (Upper 750 – 4450 RPM, Lower 300 – 1750 RPM)
- Feed Rate: 110 ipm (X,Y) 90 ipm (Z)

OPERATION MANUAL PART 1, COMPUTER SOFTWARE PCNC-M3

- Hit the RESET button on the computer interface to sync the computer and the machine. The CNC software should be in simple run mode.
- Hit the 'Reference All' button moves the spindle to its initial reference position. These will be the greatest Z value, the greatest Y value, and the least X value.
- To zero an axis, simply click the 'Zero' button underneath the coordinate label. To change the coordinate or any other number such as feed rate, simply click on the number. After entering the number, you must hit enter or the computer will not save your entry.
- The jog rate window affects the speed of the spindle when in manual control.
- You may wish to use G-code commands to move the spindle. Here are four basic and useful G-code commands that can be typed into the command prompt:
 - g0: rapid positioning command. Moves the spindle to the desired position in the fastest way possible. For example, g0 x1 y1 will move the spindle from the current position to x = 1 inch and y = 1 inch.
 - g1: linear interpolation. Will move the spindle from the current position to the input position by interpolating a straight line between the two points. The spindle will move at the feed rate.
 - g90: absolute distance mode. Axis coordinates are described in terms of the current active coordinate system.
 - g91: incremental distance mode. Typing in g91 x1 will move the spindle from its current position in the positive direction one inch. This command is simply an increment that is useful when making a part that has evenly spaced holes or cuts.
- For more complicated cuts, you may wish to use the G-code wizard built in to the CNC software in the upper control bar. Simply select the desired function, and input the appropriate dimensions. Select 'post G-code' to run your program in the main interface.
- It may be useful to verify your G-code before cutting your part by setting the Z zero point somewhere higher above your part and running the code. This can ensure that you do not need to redo your cut.
- You may also post custom G-code programs using Mastercam and upload them to the computer.

OPERATION MANUAL PART 2, MOVING THE SPINDLE AND EDGE-FINDING

- If you are unsure which axis is selected, look at the computer screen. Next to the axis label, there will be a small box. When this box is yellow, that axis is currently selected.
- There are two wheels, a multispeed coarse wheel and a fine adjustment wheel that moves a single step as defined by the software.
- Turning the wheel CLOCKWISE will move the spindle in the POSITIVE direction.
- Turning the wheel COUNTER CLOCKWISE will move the spindle in the NEGATIVE direction.
- The best way to think about the coordinate system is to think of the spindle and yourself as a unit that moves, instead of the table. Think about the spindle in terms of where you want to go on your part. For example, if you are on the left side of your part, and want to move to the right side, you want to go in the positive X direction, so the knob is turned Counter Clockwise. This moves the table to the left, which is counter intuitive and could confuse you and cause you to mess up your part, or trip a limit switch, shutting down the machine. This is why you visualize the movement of the spindle in terms of where you want to go relative to where you are right now.
- When edge-finding, look perpendicular to the axis that the tip will touch. The edge-finder offsets to the side.
- Once the edge-finder displaces, stop the spindle and zero the computer. Then, back the edge-finder off of your part, and move it in again using the fine adjustment wheel. Watch carefully when the edge-finder displaces, and then re-zero your axis. This will give you a more accurate zero.
- Remember to account for the thickness of the edge-finder (.100 in) when zeroing. Add this thickness in to the computer.
- You will need to add (+) 0.100 inches on the X-axis. You will need to subtract (-) 0.100 inches on the Y-axis. This convention is followed if you are using the upper left hand corner of your part as the (0,0) coordinate. This ensures that the middle of the edge-finder is exactly on the left corner of the part.

OPERATION MANUAL PART 3, CHANGING THE TOOL OR GEAR RATIO

- To change the tool, use the wrench that is next to the mill to loosen the bolt that tightens the collet. This wrench should ALWAYS be next to the mill. Use the smaller end of the wrench to prevent the bolt from stripping.
- To the left of the bolt will be a spring-loaded arm. Put this arm in place to prevent the spindle from spinning. This allows you to have one hand free when changing tools.
- Turn the bolt counter clockwise to loosen the bolt. Once the bolt is loose, place your hand on the tool and smack the top until the tool you are currently using comes free and drops out. Be sure to have your hand on the tool or else it will drop out on to your part, hand, or table, and could cause damage.
- Insert the tool the full way in to the collet so that the top of the tool is flush with the bottom of the collet. This ensures that your Z coordinate reference will not change in between tool changes.
- There are two gear ratios for the motor: high and low. The low gear will give you more torque at slower speeds and is useful when cutting certain types of materials such as steel.
- Loosen the motor assembly, and then use the handle to move the motor so the belt becomes loose.

- Slide the belt off one side of the gears down on to the next set, and rotate the gear assembly to transfer the belt fully from one gear ratio to the other.
- Push back on the handle until the belt is taut. Keep pressure on the handle while simultaneously tightening the handle to secure the motor assembly into place. Close the motor cover to complete the process.

POWER TOOLS

NOTE: There are several circuits in the lab that share the electrical load for the power tools. Be sure that no more than 2 devices are running on the same circuit. When in doubt, reference the information board or ask for assistance.

TABLE SAWS, 10 INCH CRAFTSMAN MODEL, 10 INCH BOSCH 4100

SPECIFICATIONS

- Both saws are 120V, 60 Hz, AC only 15A
- Craftsman: 5000 RPM (no-load speed)
- Bosch: 3650 (no-load speed)
- Max cutting depth: 3 inches @ 90°; 2.5 inches @ 45°
- Degree range: 0 (vertical) to 45°

OPERATION MANUAL

- When cutting large sheets, clearly mark your desired dimensions.
- Adjust the table prior to turning on the saw. Make sure that the fence and any necessary guards are in place.
- Ensure that all of the adjustable parameters of the saw are tight and will not move during operation.
- Adjust the height of the blade to where it is just high enough to cut through the thickness of your material.
- If the part you are cutting is fairly small, use a miter gauge. This will allow you to push your material through without needing to get your hands anywhere near the path of the blade.
- On large sheets, have three people total making the cut: one to feed the material at a safe distance from the blade, one to guide the material to make sure that the cut is straight, and one to receive the cut sheets on the other end.
- Rollers may be positioned on either side of the table to assist with holding the material.
- Use a slow and steady feed rate.
- Once your cut has been made, turn off the saw before you attempt to reach near the blade to grab scrap material or thin parts.
- Remember to retract the blade and unplug the machine when finished.
- Clean up the area when you are finished.

JET VERTICAL BAND SAW MODEL J-8201K

SPECIFICATIONS

- 14 inch maximum wood and metal bandsaw
- 115/230 V, 1 Ph
- Vertical height limit: 6 inches
- Seven speeds total
- Blade speed (wood SFM): 3300
- Blade speed (metal - SFM): 39, 57, 78, 107, 142, 196, 278

OPERATION MANUAL

- Make sure that the caster wheels are disengaged and that all of the doors are tight and closed.
- Before cutting, check your material with the lab staff in order to find the correct gear and cutting speed for that material. Have them assist you in changing the gear if need be.
- Double check with staff that the blade is the proper type for cutting your material.
- Adjust the vertical guard so that your stock material fits underneath. Do not leave much excess blade exposed.
- Plug in the machine and position the guards properly.
- If your part is very small, use a piece of scrap wood or material to feed your part through the machine.
- When you are done cutting, turn the machine off and let the blade stop completely before reaching in and around the blade to get parts.
- Completely unplug the machine when you are finished and clean up the area.

WILTON HORIZONTAL BAND SAW MODEL 3410

SPECIFICATIONS

- 7" x 12" part area.
- 115V, 1 Ph
- Cutting Capacity: Round (in.): 6
- Rectangle (in./wide x high): 9-1/2 x 6
- Flat Stock (in./wide x high): 11 x 1
- Blade Size (in.): 3/4 x 0.032 x 93
- Blade Wheel Speeds (SFPM): 86-132-178-260
- Blade Wheels (in.): 11-7/16
- Height of Work Table: 23-1/2
- Motor: 3/4 HP, capacitor start, 1725 RPM
- Overall Dimensions (in./LxWxH): 50x18x41

OPERATION MANUAL

- Place your stock material in the vice and turn the knob connected to the base. This will close the vice.
- Tighten down both levers so that your stock does not move.
- Pull the cutting head up by hand. Letting go will engage the hydraulic and the head will rest in place.
- Adjust the blade guard so there is not much excess blade viewable.
- Visually check that your stock is in the correct position by bringing the cutting head down close to your part.
- Check with a staff member or a reference sheet to make sure that the blade is at the correct speed for the material you are cutting.
- The hydraulic control is at the lower right of the front of the saw. Flipping the small lever down will engage the hydraulic to keep the head in place. Flipping the switch up will disengage the hydraulic lock and the cutting head will begin to move down.
- Turn the knob next to the hydraulic counter clockwise to speed up the feed rate of the cutting apparatus, and turn the knob clockwise to slow it down.

- Once the saw has cut through your material it will come to a resting point. Once it reaches this point the saw will turn off automatically.
- Wait until the blade has stopped before collecting materials or parts. Once you are done with the machine unplug it and clean up the area.

BOSCH CIRCULAR MITER SAW MODEL 4212L

SPECIFICATIONS

- 120V, 15 A
- 3,800 no-load RPM
- 12 inch blade diameter
- 3 HP max power

OPERATION MANUAL

- Before beginning the cut, clearly mark your materials where you will cut them.
- Be mindful of the thickness of the blade and how it will affect the size of your parts. The blade has a thickness that will need to be accounted for. Bring the blade down to check that you are cutting in the correct spot before you make each and every cut.
- If you wish to cut multiple lengths of material at the same length, measure one piece off of your stock material, and place it in the saw and line up the cut. Then, use a piece of scrap material on the other side of the stock and clamp it in place to the fence. This will allow you to make the exact same cut each time as long as you line up your stock against the place holding material.
- To start the blade, either the trigger on the top or bottom of the back of the handle must be depressed. Pulling the main trigger starts the blade. You will feel the spinning blade move the handle slightly as it accelerates.
- Notify those working with you when you are starting the blade.
- Keep your hands away from the guard when the machine is plugged in.
- Hold your stock material steadily. If your stock material is awkwardly shaped, you may wish to clamp it in place as well.
- Run the blade through the down and up strokes of the cut. Doing so keeps the blade at a relatively constant velocity. Releasing the trigger will slow the blade and draw it down due to the angular momentum of the blade.
- Once you are finished with the saw, unplug it and clean up your area.