

## Make It Labs Laser Class Outline

1. What is laser / how it works
  - a. Laser Tube – (Do not open/touch)
  - b. 2 axis gantry
  - c. mirrors (Do not touch – do not clean – do not align)
  - d. Z Axis (Mention binding)
  - e. Positioning laser
  - f. Foot/switch (Limitations)
  - g. Cooling system
  - h. Ventilation system
    - i. Material placement for optimal ventilation
    - ii. Avoid far front and left
    - iii. Use “porous” backing materials for airflow
  - i. Blower system
  - j. Control Pad
    - i. Home
    - ii. XY movement
    - iii. Z
    - iv. Auto-Z
    - v. Stop button
    - vi. “Emergency” stop button
      1. When to use
        - a. Whenever in doubt!
      2. TWIST to reset
  - k. RFID box
  - l. “Large piece” doorway (Mention, but use only with “special permission”)
2. Safety
  - a. YOU are responsibly for safety of others/surroundings
  - b. You MUST BE PRESENT and ATTENTIVE in area during operation – Watch for fires!
  - c. CO2 & Hallotron fire extinguishers
    - i. Only use It – keep on-hand
    - ii. Report all useage
  - d. Interlock switches – DO NOT override
  - e. Eye Protection
    - i. Wear at all times
      1. Always “Two layers”
      - ii. You and OTHERS in the area
      - iii. Do not look directly toward laser
      - iv. Laser beam is INVISIBLE (different than positioning laser)
- f. Smoke, Vapors and Gasses
  - i. Use only proper materials! (See Material section below)
    - ii. Allow materials to “sit” on bed with exhaust on and door closed “as long as possible” (This is my own practice – it’s a bit “fuzzy”)
  - g. Warn about “gaps” in housing
  - h. Warn about placing potentially hot materials in trash
    - i. “Cool down” time
  - i. Violations will revoke laser privileges
3. Materials
  - a. What you CAN cut
    - i. Wood (Up to 3/8”) – Thicker – maybe – multipass – carbonization? (Fire Risk)
    - ii. Acrylic – (Multipass for thick pieces)
    - iii. Leather
    - iv. Fabrics
    - v. Most Plastics
    - vi. Cardboard/Paper (Be careful for fires)
    - vii. Food
      1. Chocolate
      2. Others
  - b. What you can ENGRAVE
    - i. Glass
    - ii. Metals (With CerMark)
    - iii. Stone
    - iv. Tile
  - c. What you CANNOT cut
    - i. Chlorine=BAD
      1. Testing materials for chlorine (burns Green)
    - ii. Why?
      1. Poisonous Gasses
      2. Corrosive Gasses
    - iii. Which Materials
      1. PVC
      2. Vinyl
      3. Anything Highly Reflective
      4. Fiberglass
      5. Polycarbonate/Lexan

## Make It Labs Laser Class Outline

6. Polystyrene Foam
7. Polypropylene Foam
8. HDPE
  9. Coated Carbon Fiber
  10. Pressure Treated Wood
- d. Materials Book
  - i. Online wiki materials DB
  - e. Rabbit web site reference
  - f. Materials Shelf
4. Materials Storage
  - a. New 48-hour temp policy
  - b. Must fill out form
  - c. Longer storage needs approval
5. Software
  - a. Basic Drawing
  - b. Assigning of colors/layers to geometry
  - c. Setting speeds/feeds (and “output”) of layers
    - i. (See “Materials”)
  - d. Raster/Engrave (vs. Cut)
  - e. Downloading to Laser
  - f. Bounding-box check
6. Cutting
  - a. Keep work away from sides of machine
  - b. Badly warped pieces – weights or silly putty
  - c. Positioning of work – adjustment with keypad/arrows
  - d. Auto Z-Axis calibration
  - e. Check travel of machine
    - i. Head crash into weights
    - ii. Head crash into sides
    - iii. Visible laser vs. Cutting laser vs. Food
  - f. Positioning of
  - g. Test Cuts
    - i. Different speeds/feeds
  - h. Make sure air, chiller and exhaust all work
  - i. WATCH machine during all cuts!
- j. Allow for cool-off after use & before discarding materials
- k. Backing materials
  - i. Save Honeycomb
  - ii. Reduce reflections/burning
7. DXF Import
  - a. Inkscape example
  - b. Millimeter Units
8. Editing Operations
  - a. Unite Lines
  - b. Rotate (i.e. “Rotal”)
  - c. Copy
  - d. Scaling
  - e. “Immediate” (relative/absolute positioning)
9. Engraving
  - a. Import Bitmaps
    - i. Prefer to change to black/and white – Dither/mezzotint in “real” photo editing program
  - b. Half Bitmap (“Half Bmitmap”) – Half-tone feature
  - c. Fast-scanning Laser head will travel outside the bounding box at ends of X-Axis
  - d. Scan Gap Parameter
10. Rotary Tool
  - a. Where it’s stored
    - i. Warn about belts and pulleys in storage cabinet!
    - ii. Placing tool and alignment board on bed
    - iii. Tool-to-Bed alignment
    - iv. Connection
      1. Shut laser off when connecting/disconnecting
      - v. Configuring Y-Rotation
        1. File->Machine->Options->Work Table
        2. Y Pulse Unit = 0.01823829
        3. Password=<Return>
        4. “Download Config” to send settings
        5. Reset Y Pulse Unit when done: 0.005625

## Make It Labs Laser Class Outline

- vi. Adjustment of wheels
  - vii. Artwork should be rotated 90-degrees (to match orientation of object)
  - viii. Tool/Work piece-to-Laser alignment
  - ix. Weighing down pieces
  - x. Nubbin
  - xi. Disconnection
    - 1. Power off laser
    - 2. Press the little metal tab when pulling DIN
    - 3. UN-Configuration Y-Rotation when done!
11. Cleanup
- a. Discard in trash
    - i. Make sure things in trash have COOLED
  - b. Empty trash
  - c. General Tidiness
  - d. Clean bed/vacuum if/when necessary
12. Troubleshooting
- a. Cutting Issues
    - i. May need cleaning/adjustment
    - ii. Bad Material!
    - iii. Z axis/focus
    - iv. Power/Speed
  - b. Runs but doesn't cut anything
    - i. RFID may need periodic re-checking-in
  - c. Geometry problems
    - i. Y-Rotation set incorrectly
  - d. Insufficient Depth
    - i. Two-Pass – manual Z-Adjust on second pass
    - ii. Hard to do on wood – carbonization
  - e. Horrible noise on Z-Axis
    - i. "Stop"
    - ii. Manually move Z – try again
  - f. Gantry/head/laser crash into stuff
    - i. Emergency "Stop"
    - ii. Fix physical issues
  - g. Gantry/head crashes into limit/perimeter on cut or on test box
    - i. Check for weird artifact – far edges of drawing
    - ii. "immediate" mode
- h. Uneven cutting
- i. Larger/warped piece uneven on bed
    - 1. Silly Putty
    - 2. Tape
    - 3. Use weights
    - 4. **MAKE SURE** head will not crash into weights!!!!
  - i. Keypad working oddly – beeping – or gantry moving
    - i. Stuck key – find and press again
  - j. Keypad beeps instead of doing something
    - i. Wrong mode - Press "ESC"
  - k. Nothing powers on at all!
    - i. Check Emergency stop button
13. Contact for:
- a. Calibration
  - b. Lens cleaning
  - c. Problems/Questions
  - d. If there's a problem – let someone know – don't let the next person discover it down the road!
14. Software
- a. Free
    - i. Inkscape – Vector Drawing – artwork
    - ii. Draftsight – Engineering/CAD
    - iii. GIMP – Image Manipulation – Engraving
  - b. Commercial
    - i. Vector Art – Adobe Illustrator, Corel Draw
    - ii. CAD – AutoCAD, Draftsight
    - iii. Images/Engraving – Photoshop
15. Contacts
- a. Problems/Questions/Classes:  
[laser@makeitlabs.com](mailto:laser@makeitlabs.com)
  - b. [brad.goodman.makeitlabs@gmail.com](mailto:brad.goodman.makeitlabs@gmail.com)
  - c. Slack!
16. References
- a. [rabbitlaserusa.com](http://rabbitlaserusa.com)
  - b. [wiki.makeitlabs.com](http://wiki.makeitlabs.com) - see "Resources->Laser"