

The xTool D1 10W Laser Engraver/Cutter

The xTool D1 10W (FIG. 1) has been engineered by industrial designers who have produced high-end CO2 laser engraver/cutters, and who have applied their design and manufacturing know-how to enter the diode laser market. The xTool D1 is the result of their mission to enter the hobbyist market with a machine that excels in significant ways, including a motion accuracy precision of up to 0.01mm.

The parent company of xTool is Makeblock, a world-renowned company in the STEAM education space, founded in 2013. It is a leading provider of technologies for education, with more than 100 worldwide distributor partners. xTool was launched in 2019 with its first product, the xTool Laserbox CO2 laser engraver/cutter.



FIG. 1. The xTool D1, available as either a 5W or 10W version, is the company's first entry in the diode laser market. Credit: xTool

Construction. The D1's solid aluminum alloy construction is noteworthy since the xTool opted for the strongest materials, yielding a laser head that glides smoothly on stainless steel wheels along a wear-resistant guide rail structure, producing very impressive laser spot accuracy and consistency, with a minimum of vibration. The X and Y axis movement is controlled with two stepper motors, contained within the frame, advancing the pre-installed belts that deliver the laser head to its required coordinates. With the stepper motors, belts, and electronics concealed and protected within the frame, the overall look of the D1 is exceptionally clean, sleek, and high-tech.

Assembly. The assembly process can take as little as 15 minutes for an experienced assembler, or 30 to 45 minutes for a beginner. The fit-and-finish of the parts is exceptional. Several of the components, such as the belts, stepper motors, and motherboard have been pre-assembled, not only reducing assembly time, but ensuring that precision parts have been factory set.

Focus. Since focus is a critical element in producing usable output, the D1 is notable since it offers a best-in-class solution. A finger screw on the left side of the laser head loosens it so that it can be moved up and down, closer or further from the workpiece, along the Z-axis. The amount of upward movement is significant, since it determines how high or thick the material that can be processed. A focus device, called the *ranging rod* (FIG. 2), is built into the right side of the laser head and is held in place magnetically. The user flips the rod down, adjusting the laser head until the rod touches the workpiece. The laser is now in focus, the set screw is tightened, and rod is returned to its

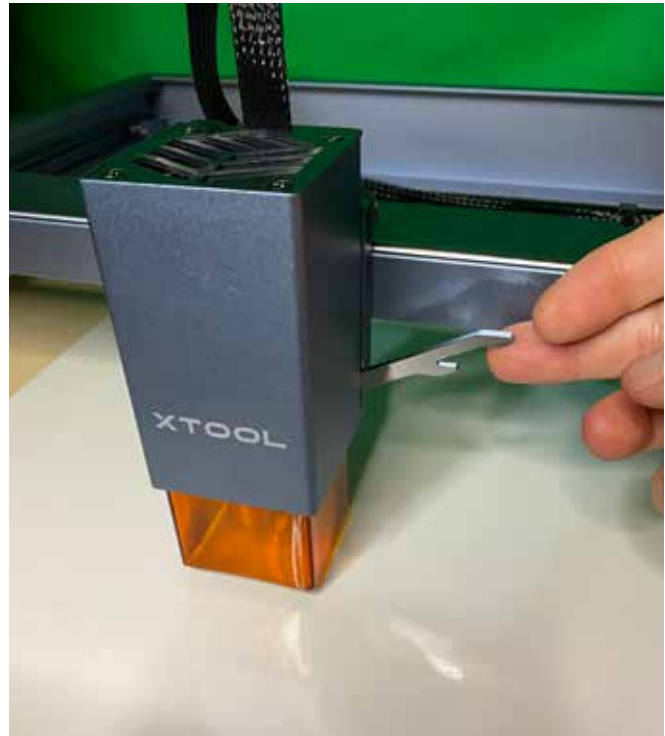


FIG. 2. The ranging rod, shown here in mid-position, offers the easiest solution to setting accurate focus quickly and consistently.

upright position. The built-in rod is not only convenient, but it is always immediately accessible.

The maximum speed of the laser head is 10000mm/min. which is considered exceptionally high.

The rated electric power of the laser head is 40W, outputting a laser power of 10W. Rather than sell the device as a 40W laser, xTool only touts its true laser strength of 10W. This honest assessment of the true laser rating is, unfortunately, a rarity in the industry.

The laser head is a bit of an engineering marvel, given that it contains two 5W laser emitters; one directed straight down, and a second directed at a 45 degree mirror (FIG. 3). They are cooled by a built-in fan, that despite its strength, is relatively quiet. The dual lasers produce a very small, square laser spot of 0.08mm x 0.08mm which produces high-resolution images, and clean,

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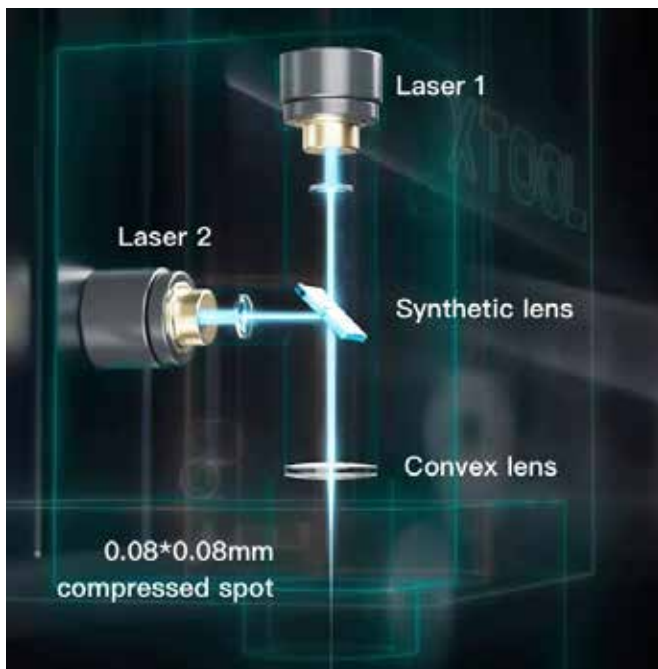


FIG. 3. xTool rates the power of the two 5W laser beams combined to be equivalent to a single 15W laser cutter. Credit: xTool

smooth cuts. The square dot shape is superior to other lasers, such as the Ortur Laser Master 2 Pro, which is rectangular.

The work area of the D1 is about 17" x 16" which is more than sufficient for accommodating most of the projects that would be appropriate for such a device. Despite its size it weighs only about 5kg (about 11 pounds), meaning that it can be moved and repositioned easily by one person.

The D1 is provided with legs that raise it off of the worksurface to accommodate a range of workpiece thicknesses. The space on all four sides of the frame allows the user to slide materials into the active work area. Additional-cost legs can be purchased to extend that height to allow for the additional space as required for a rotary device. These optional legs screw easily into the attached base legs and match their size and color (FIG. 4).

Another unique element of the laser head is a built-in red cross-hair light that indicates where the laser will fire. This indicator is safe to view without safety goggles, and despite the fact that it is offset from the actual laser lens, the software accounts for this discrepancy and properly positions the laser when firing. Users should not underestimate the importance of accurately aligning the laser head in relation to the workpiece.

Safety. The D1 was designed to provide an effective, efficient work experience with safety considerations built-in. The bottom of the laser head, closest to the workpiece, is surrounded with a light shield. The shield, a custom-fit piece of orange acrylic, allows the user to easily see that the laser is functioning, and protect others in the vicinity who may not be wearing safety goggles. Of course, proper eye protection should be worn by everyone within the work environment. The operation of the laser will stop automatically when the machine senses movement or a tilt,



FIG. 4. The purchase of the xTool Rotary attachment includes this set of extension legs that easily screw into the device's built-in legs to raise the unit.

as well as when USB or WiFi communication is interrupted.

During operation, the heat of the laser, reacting to the surface of the workpiece, will produce, to varying degrees, noxious smoke, soot, and other odors. Adequate ventilation, with the use of an enclosure and exhaust fan, repositioning the laser device near a window, or using fans to direct the airborne contaminants out of the environment, should solve this issue.

Workflows. The xTool D1 is unique in that the user is provided with three connection options: The standard USB cable connection, WiFi, and offline, with the use of the provided TF card. The TF card can contain only one job at a time. When a new job is sent, it overwrites the current job. A job on a TF card is processed by pressing the device button on the right front of the machine frame. These options mean the connection is not limited to the length of an available USB cable.

The D1 has one of the most direct and simple workflows, assuming that the connection has already been made:

1. Position the workpiece
2. Adjust the focus.
3. In the software...
 - a. Select the connection mode
 - b. Select Engrave, Cut or both
 - c. Select the workpiece type
 - d. Position the laser head relative to the workpiece
 - e. Press Start

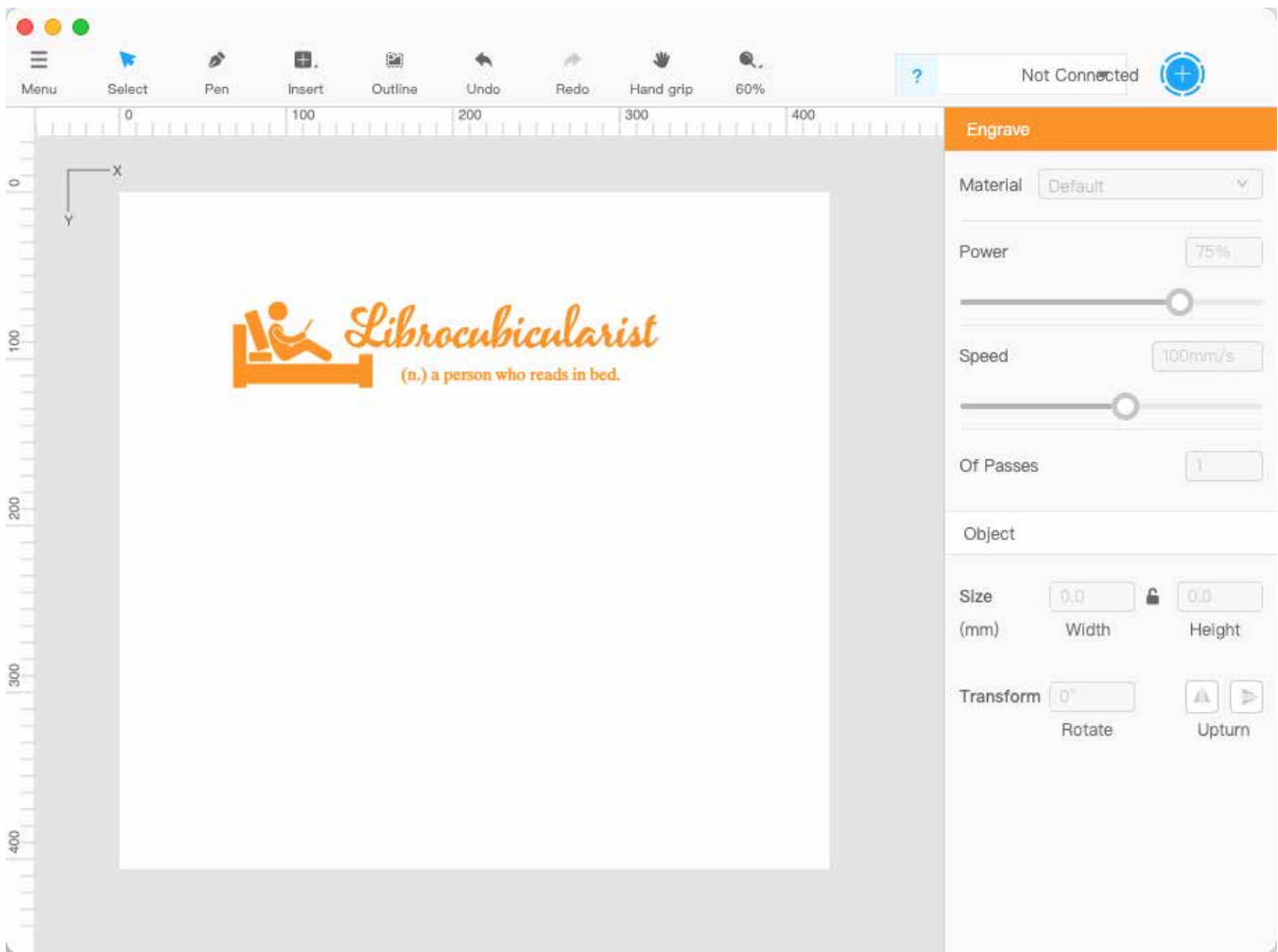


FIG. 5. The Laserbox Basic work area is uncluttered, with only the core capabilities available.

Software. Bundled with the D1 is proprietary software called Laserbox Basic (FIG. 5), which is a version of the software used with the CO2 laser engraver marketed by xTool. The software, which uses G-code to set the position of the laser head, has rudimentary capabilities that will help the user, particularly those new to the technology, get up-and-running quickly. It incorporates the machine settings that are needed to get good results from a wide variety of materials, such as various woods and acrylics, without the need for running time-consuming tests (FIG. 6).

The program incorporates its own options for Undo, Redo, Cut, Copy, Paste, Delete, and Select All, in the Edit Option in the main menu, rather than use the commands from the Operating System directly; although the key commands do work (FIG. 7). The program provides primitive shapes, including line, rectangle, rounded, oval, star, heart, and text. The Outline option (FIG. 8) creates a simplified line art tracing from a shape, saving the laser the time and energy necessary to fill it in.

Before a job is sent to the laser the user must ensure that the laser head is properly placed, so that the job will be burned in the exact position necessary. The first step is for the user to po-

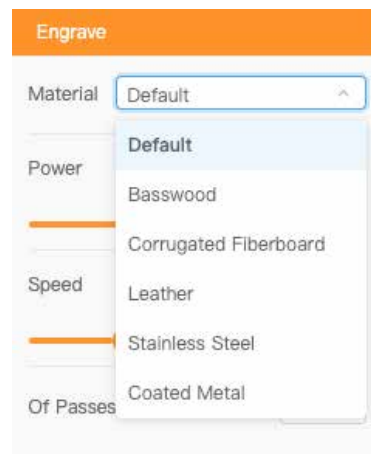


FIG. 6. The user has only to select the workpiece material and the program will set the necessary power and speed.

sition the laser using the red cross-hairs, and then hit the Frame button to see where the image will appear. Based on the outline revealed by the cross-hairs, the user can either adjust the position of the laser head or the workpiece.

The travel of the laser head during this framing step is controlled

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FIG. 7. The Laserbox Basic menu provides only the most rudimentary commands.

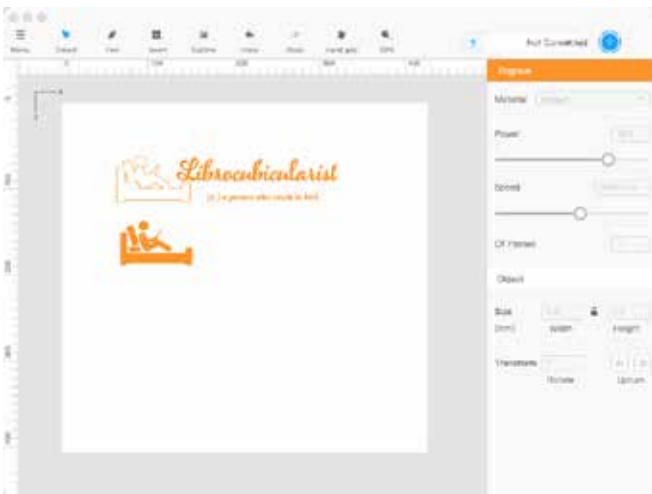


FIG. 8. The Outline option creates an outline of a shape to reduce processing time.

using the Laserbox Control Panel (FIG. 9). The user can set the speed that the cross-hair will advance, and how much it will advance with each step, as executed using the compass arrows.



FIG. 9. The user can define the incremental movement of the laser head as it frames its intended image

The iPhone/Android app is very simplistic, offering only two options (FIG. 10). The user can engrave an image that they have captured on their phone, or engrave one that is among the small number in the contained gallery (FIG. 11).

Fortunately, xTool D1 is compatible with LightBurn, unlocking its full capabilities. LightBurn is considered the software standard for controlling laser engravers and cutters.



FIG. 10. The two default options for the xTool D1 iPhone app are Quick Engrave and

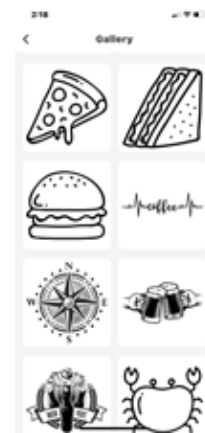


FIG. 11. The built-in gallery contains vector images in categories that include animals, food, flora, and others.

Laser Positioning. Unlike the Ortur Laser Master 2 Pro, which uses absolute positioning, the D1 uses relative positioning. What this means is that the Ortur uses built-in limit switches to ensure that the laser head always starts from, and returns to, the 0,0 starting coordinates, or Home. In LightBurn, for example, when the user places their design at a certain set of coordinates, the Ortur knows how to position itself at precisely that location. The D1 uses relative positioning, meaning that the user positions the laser head using the lighted red cross-hair, and indicates in the software, where on the design the laser should begin working.

The always-on red cross-hairs are a significant benefit, since the user can position a workpiece anywhere in the laser bed, and manually move the laser head to the desired start position.

Workbed. The proprietary Honeycomb Working Panel set is an optional accessory made from aluminum and iron (FIG. 12). It fits on the working space of the D1, protecting the surface on which the D1 sits, and diverting the exhaustion of smoke through its channels. The surface is magnetic, making it possible to secure workpieces in place, either directly, if they are thin, like paper or cardstock, or indirectly, for thicker workpieces, in custom user-made magnetic jigs.



FIG. 12. The xTool Honeycomb Working Panel consists of two pieces: the honeycomb top panel, with imprinted mm increments along the left and bottom sides, and a rigid aluminum base. Credit: xTool

Air Assist. An air assist attachment adds a proven and trusted method for removing smoke and other harmful airborne particulates from around the tip of the laser (FIG. 13). In addition to keeping the laser lens cleaner, it is also the primary means by which smoke, char and burn marks are reduced or eliminated from the surface of workpieces when laser cutting. Particularly noteworthy is that the use of air assist can reduce the number of passes required for cutting, thereby reducing processing time. The xTool D1 air assist, designed as an integrated unit for the D1, is distinguished by its small, quiet, pump, its low level of vibration, and its significant amount of air movement.



FIG. 13. An air assist unit, such as the one designed for the xTool D1, is an essential add-on, producing higher quality output in less time. Credit: xTool

Rotary Attachment. The D1 rotary attachment (FIG. 14), unlike the Ortur Rotary, comes completely assembled. It is engineered to work seamlessly with the Laserbox Basic, engaged by simply selecting the “toggle for cylindrical” option in Laserbox Basic. To connect the device to the D1 the user simply plugs its cable into the control board, and it is ready to use.

The rotary enables synchronized engraving on cylindrical objects, such as water bottles, drinking glasses, and mugs. It slowly turns the object as the laser head traverses, burning the design onto its surface.

Maintenance. The laser head has an expected life expectancy of 8000-10,000 hours, and will, as is the nature of lasers, degrade over time. One of the things that will shorten its life is running the power at 100% for extended periods. This should be avoided. Rather than running at 100% the user can decrease the speed, or increase the number of passes.

Routine maintenance is fairly easy. The light shield must be cleaned regularly as well as the laser lens. The light shield tends to trap soot and smoke and negatively impact the clarity of the



FIG. 14. The xTool Rotary attachment enables the engraving of cylindrical objects.

lens. An air assist can help keep the air circulating around the lens.

When cleaning the light shield or the laser head, disconnect the power from the machine. Use alcohol on a lint-free cloth or paper towel to clean the inner and outer surfaces of the shield. Use an alcohol-soaked cotton swab to clean the laser lens and the cross-hair sight. A helpful video can be viewed at https://youtu.be/lh53_cg6tW0.

Lubrication of the steel shafts is critical to preventing rust and maintaining the smooth travel of the x-axis wheels. For these purposes xTool includes a small container of grease in the assembly kit package (FIG. 15).



FIG. 15. Super Lube, recommended for use on the xTool D1, is a multi-purpose, safe, synthetic lubricant. Due to some shipping limitations it may not be included with all assembly kits. It is available from Amazon at <https://amazon.to/35vpuIT>. Credit: Amazon

The tension on the belts is a critical setting. If the belts are too loose they will cause deformation of the engraved or cut pattern. Tightening the belts, although an uncommon need, is easily done with an Allen wrench.

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