

The xTool F1 Desktop with Dual Lasers

In the mid-1980's there was a fundamental change in the way that printed and digital communication were produced. The convergence of the Apple Macintosh computer, Adobe PostScript imaging language, Aldus PageMaker software, and the Apple LaserWriter, produced the process we know as *desktop publishing*.

Desktop publishing put the tools, that were previously available only to publishing professionals, trade compositors, and printers, into the hands of practically anyone who wanted them. With the democratization of publishing, by virtue of lower cost technology, and the means of production fitting within the confines of a desktop, almost anyone could print and publish whatever they wanted or needed.

Today a similar transformation is occurring with laser scoring, engraving, and cutting. It comes with the introduction of the xTool F1, a compact dual-laser, with a footprint of only 7" (179mm) wide x 9.25" (235mm) deep. Along with a desktop or laptop computer, ipad, or iOS or Android phone, and the provided software, a user can produce their own engraved and/or cut workpieces for crafting, or as a business. The empowerment of a single individual to engage in a technology previously reserved for professional engravers, jewelers, and manufacturers of all kinds, is truly groundbreaking.

A blue light laser beam, found in diode laser engraver/cutters, generates an intense heat that is capable of reproducing highly detailed images, text, and designs, as well as precisely cutting intricate shapes and patterns, on a wide variety of materials.

During engraving, the heat of the laser melts or vaporizes the material surface, leaving a permanent visible mark. The depth of the engraving is controlled by the software parameter settings of laser power, laser speed, and number of passes, or repetitions. The details of the engraving are formed by the specifications defined in a vector drawing program. The computer file may be transmitted to the laser device using a USB cable,

WiFi, Bluetooth, or directly from a dedicated mobile app.

Printing with the heat of a laser is routinely performed to produce signage; fabricate parts; personalize and label industrial components; individualize awards, trophies and plaques; produce customized crafts; decorate jewelry; produce architectural models; and much more.

In 2023, xTool introduced their model F1, which is unique in a number of ways (FIG. 1). First, its compact design contains two lasers: a 10W 455nm Diode Laser, and a 2W 1064nm Infrared (IR) Laser. The combination of these two lasers enables

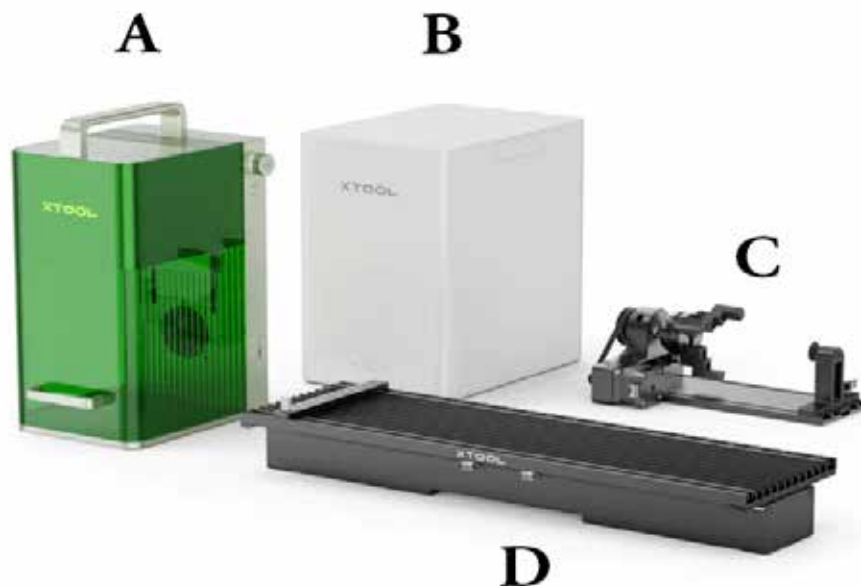


FIG. 1. A. The xTool F1 portable laser works at an engraving speed of up to 4000mm/sec. B. The xTool air purifier automatically starts when the F1 is active, and stops shortly after the F1 has completed its work, ensuring that any residual smoke is expelled. C. The xTool 4-in-1 rotary. D. The xTool slide extension kit. Credit: xTool

the F1 to process the widest variety of materials. The diode laser can process wood, leather, acrylic, glass, ceramics, and slate. The IR laser can process metals; including gold, silver, copper, platinum, aluminum, and iron.

Second, the design of the device enables the user to use the laser on a desktop, or to carry it easily to where the target material may be, such as a door, wall, or large unusually shaped item, and use it at any angle.

Third, the design uses galvanometer system technology, which uses lenses and mirrors to move the laser beam, rather than moving the entire laser head along a gantry in X and Y directions. This makes the F1 very fast, and eliminates vibration.

Fourth, the unit is completely enclosed, shielding the user from the harmful laser light. The built-in ventilation fan exhausts fumes and odors, and with the use of the optional Smoke Purifier, the unit is safe to use practically anywhere.

Fifth, with the optional 4-in-1 rotary attachment, the user can engrave on round and cylindrical objects, such as coffee mugs and baseballs.

Sixth, the optional slide extension kit supports the rapid batch-processing of multiple items, extending the work area up to four times, and automatically moving each item under the laser light.

The F1 has a number of distinguishing features that set it apart from other laser engraver/cutters. Among them are:

- The F1 requires no assembly. Unlike most lasers that require one or more hours to put together, the F1 can be used within minutes by removing packing material and shipping tape. This benefit also obviates the need for any technical skills or tools.
- The F1 has a unique form factor. It is relatively small, 7" (179mm) wide x 13" (334mm) high x 7" (179mm) deep, and fits conveniently on a desktop. Just as the laser printer did for desktop publishing, the F1 can do for desktop engraving and cutting.
- The F1 is portable. It weighs only 4.6kg, or about 10 lb., and has a built-in handle at the top for easy carrying. xTool also sells a power generator from Jackery so that the unit can be used at craft shows and other venues where there are no available wall outlets (FIG. 2). The portability also supports placement in a mall kiosk, pop-up stand, flea market stall, and other places, as well as a feature at a fundraising event.



FIG. 2. The Jackery Power Station enables the user to take the F1 to remote locations where there is no available power. Customized engraving and cutting can be performed at the point of sale, wherever potential customers may be. Credit: xTool.

- The F1, having two lasers, is able to process the greatest variety of materials. This includes workpieces in various physical forms and shapes, such as flat or round. The built-in lasers can work in tandem, to perform multiple operations.

- The F1, along with the optional Smoke Purifier, can be used indoors. The Smoke Purifier has three fan speeds, and can be set for continuous use, or synchronized to the operation of the laser. If it is synchronized it will continue working for several moments after processing has been completed to insure that all fumes are removed. Although the F1 has an excellent optional Smoke Purifier to reduce or fully eliminate smoke, soot, and odors, it does not have an available air assist. An air assist can reduce the amount of surface discoloration that can occur when cutting.

- The F1 has a built-in green light-tight shield that not only enables the user to observe the laser operation, but also eliminates the need for safety glasses, although a user may elect to wear them for extra safety. As the shield is lifted, it maintains its position to accommodate materials that are larger than the laser bed, or which require higher clearance.

- The F1 includes a cutting shelf, called the Triangular Prism Working Panel, eliminating the need for an optional honeycomb bed accessory (FIG. 3). The cutting shelf provides channels to accommodate cut pieces of material, and to let air circulate under the material to reduce discoloration. The panel also protects the removable baseplate from direct exposure from the lasers.



FIG. 3. The removable Triangular Prism Working Panel provides a base for airflow under the workpiece to help minimize wood soot and discoloration.

- The F1 provides two easy methods to focus the lasers. First, the lasers can be synchronized using the motorized multifunction switch, to merge the blue diode light and red IR light to form a single dot (FIG. 4). Second, focusing can be initiated in the software.

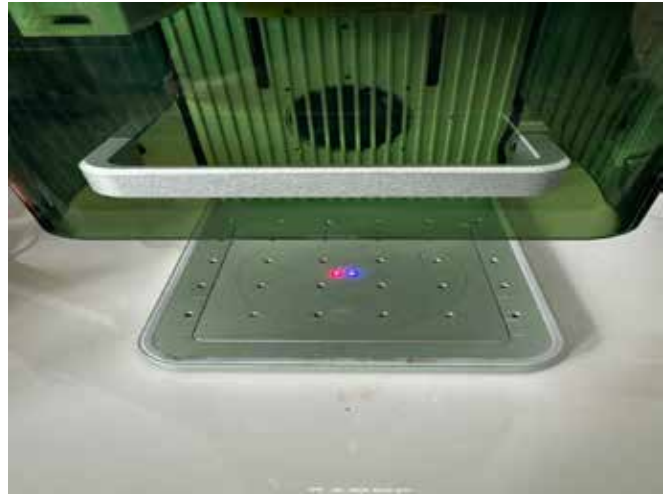


FIG. 4. Focusing can be accomplished by simply aligning the blue and red laser positioning dots over one another.

- The F1 is essentially a turnkey device. xTool provides the unit, instruction manuals, the software, start-up materials, tutorials, and online resources. Operational indicators are clearly illustrated on the right side of the machine for immediate reference (FIG. 5).

- The F1 is provided with free software called *xTool Creative Space*, or XCS. The software is made exclusively for xTool devices, and provides a good collection of tools and capabilities that combine to get the most out of the F1 features (FIG. 6). Users can create designs, shapes, and text directly in the application, or input custom-made or commercially available files, and use them “as is,” or modify them.

- The form factor of the F1 makes its use much more personal and accessible. A standard gantry laser engraver model requires an enclosure to protect the user’s eyes from the dangerous laser light, and protect their lungs from noxious fumes. The F1 is used at arm’s length, making the placement and removal of workpieces very convenient, the production of multiple items much faster, and the oversight of quality control more immediate.

- The F1 ensures the accurate placement of workpieces, especially small jewelry items, by using a choice of two different preview framing modes, each displayed on the actual workpiece on the laser bed, with a harmless blue high-speed running light. The *blue rectangle light mode* provides an accurate visual indication of the extreme boundary areas that will be processed. The *blue outline mode* shows the precise shape and location of where the image will be produced (FIG. 7).

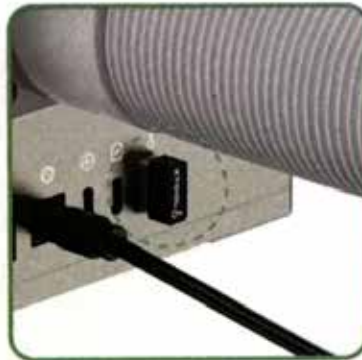
Part	Action	Machine response
Knob	Turn up	Laser head moving up
	Turn down	Laser head moving down
	Short press	Starts/Pauses processing
	Long press	Stops processing
	Double press	Performs the last processing task again
Framing button	Short press	Starts/Stops framing

Logo indicator	Knob indicator	Machine state
Solid on	Solid white	Not connected to the software
	Solid yellow	Network setting
	Solid blue	Connected to the software
	Solid green	Task completed
	Solid purple	Firmware updating
	Solid red	Exceptions occur
	Blinking red for 3 times	Invalid operation
Blinking	Solid blue	Performing a task
Going off	Blinking white slowly	Sleep state entered when no operation is performed within 10 minutes

Before use



Rotate to reset



Check the key



Remove the protector

FIG. 5. This chart, located conveniently on the right side of the green shield, provides "at a glance" access to important machine operations.

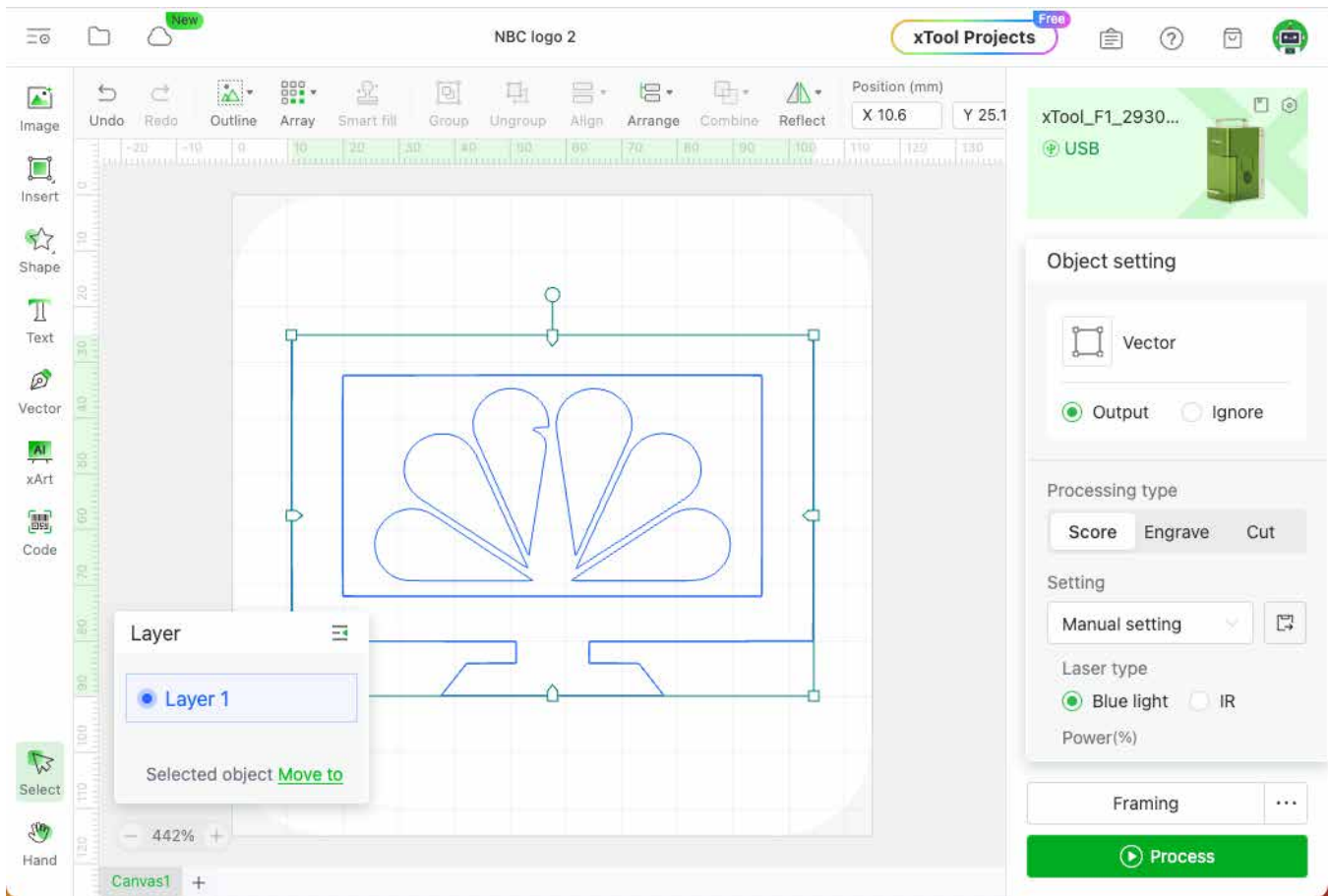


FIG. 6. Most users will find the xTool Creative Space software more than sufficient for a wide variety of scoring, engraving, and cutting projects. The F1 is also compatible with LightBurn.

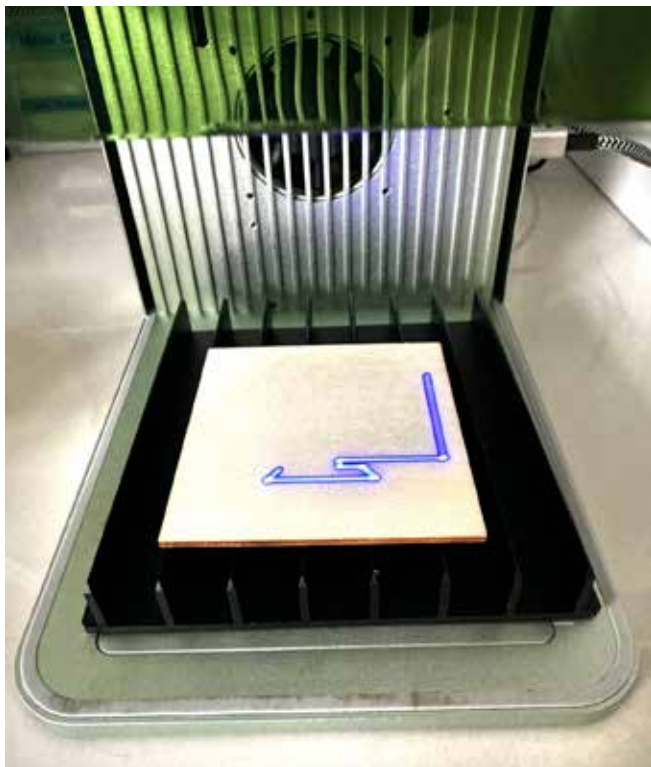


FIG. 7. The blue outline framing mode, shown, in part as the camera captures it, moves to delineate the full and exact placement of the image.

- The speed of the F1 is rather extraordinary, moving the laser beam at up to 4000mm/s. It does so with dual industrial grade galvanometer system technology. Speed is important when a customer is waiting, or if high quantities of items must be produced on deadline.
- The F1 receives files when connected with the supplied USB cable. Once the initial connection has been made, the user can use the CS software to set up WiFi for wireless communication, and eliminate the need for a cable.
- With the addition of the optional xTool RA2 Pro rotary the F1 is able to engrave round and cylindrical objects, such as wine glasses, mugs, and even the inside of rings. The innovative design can hold objects securely using the roller rotary, chuck rotary, sphere rotary, or ring rotary (FIG. 8).
- The functional laser bed surface onto which workpieces can be processed is 4.5" (115mm) x 4.5" (115mm). The removable baseplate, however, allows the F1 to be positioned over a larger workpiece to process a single image, or multiple images (FIG. 9). Alternately, the user can buy the optional F1 Slide Extension, which increases the work area by a factor of four. The Slide Extension is provided assembled and ready to use.
- The F1 is a well-made precision instrument with excellent

build quality, and impressive capabilities. It is capable of cutting wood up to 0.3” (8mm), and acrylic up to 0.2” (5mm), and can engrave on 3D printed parts.

xTool, the manufacturer of the F1 is somewhat unique in that it tests the materials that their lasers are capable of engraving and cutting, it provides the settings for these materials to their users (FIG. 10), and also makes those materials available for sale (FIG. 11). In terms of the F1, xTool provides material settings for paper, wood, leather, metal, acrylic, and rock.



FIG. 8. The xTool RA2 Pro is an engineering marvel able to hold almost any round or cylindrical object for engraving. Credit: xTool

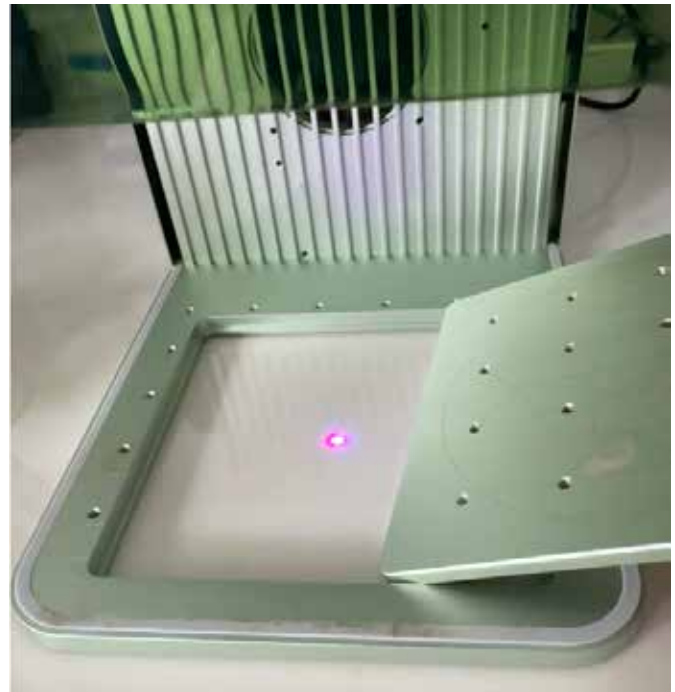


FIG. 9. The removable baseplate allows the user to direct the laser beam(s) over a larger workpiece, one that is situated on an angle, or one that cannot be moved easily.

Safety. The xTool F1 remains locked until the user inserts one of the two supplied keys (one key is an extra). A key must be inserted in the back of the machine in order for it to function. Removing the key prevents unauthorized people from using the F1, and that includes children who are not under competent adult supervision.

When the F1 is in operation the xTool logo flashes to indicate that it is in use. If the cover is raised while the machine is working it will stop immediately, as it will if the machine is picked up, tilted, or moved. The machine also will not operate if the cover is in the raised position when a job is sent.

xTool D1 Pro xTool M1 xTool D1 Laserbox **xTool F1 xTool P2**

	Paper	Wood	Leather	Metal	Acrylic	Rock			
Material Name	Thickness(mm)	Processing	Module	Power(%) / Speed(mm/s) / Pass	DPI	Lines per cm	Dot duration (µs)	Bitmap mode	Edit image
Basswood	3.0	Vector score	10 W blue-light laser	70 / 60 / 1	/	/	/	/	/
Basswood	3.0	Vector engrave	10 W blue-light laser	100 / 300 / 1	/	80	/	/	/
Basswood	3.0	Bitmap engrave	10 W blue-light laser	80 / - / 1	250	/	400	Jarvis	/
Basswood	3.0	Vector cut	10 W blue-light laser	90 / 4 / 1	/	/	/	/	/

FIG. 11. xTool has tested materials for all of their products to help ensure that users can get acceptable results quickly. The suggested settings make it possible for the user to begin working almost immediately. Credit: xTool

Materials

[View all >](#)

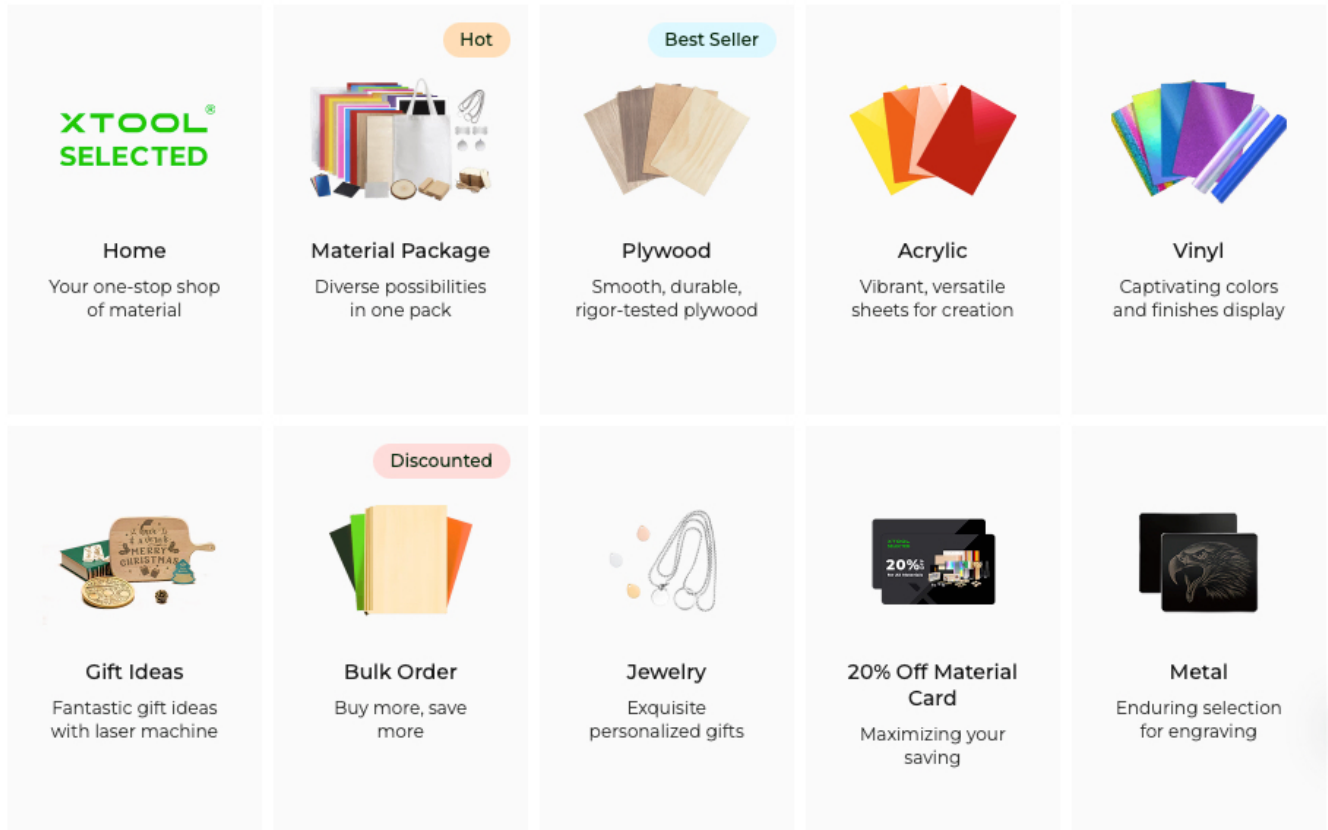


FIG. 11 xTool sells more than 100 different materials all of which have been tested for successful engraving and cutting on their machines. Shown here are a representative sample. Credit: xTool

The F1 includes a safety shut-off switch to stop the machine for any emergency situation. The red switch is prominently positioned at the top corner of the left side (FIG. 12).

When the protective plexiglass cover is in the full down position the user is shielded from the potential harm of the 455nm and 1064nm laser beams. However, if the size of the workpiece prevents the cover from closing fully, then it is imperative that the user wear suitable eye protection. With the cover partially up there is also the danger of fumes escaping, and in such a case, suitable respiratory protection equipment may be necessary. *The lasers present a potential hazard to the users' eyes, skin, and lungs, and its operation should be executed with all due caution.*

The purpose of the laser is to produce marks or engravings on the workpiece surface, or to cut through it. The intensity of the laser beam vaporizes the surface of the workpiece and, in the process, may produce hazardous fumes, smoke, and minute material particles. These airborne pollutants can cause respiratory and other health issues, such as eye irritation. In addition, there are materials, such as PVC and galvanized steel, that are known to emit toxic fumes that not only injurious to users, but corrosive to their laser devices as well.

The F1, with the use of the optional xTool Smoke Purifier eliminates virtually all odors and unwanted exhaust produced while engraving and cutting. The F1 galvo lens system also has the



FIG. 12. In case of an emergency, or to abort any operation, the F1 can be stopped immediately by pressing the red Stop button. The button is reset by twisting it to the right.

advantage of being much quieter than a typical gantry laser design. The control of emissions and the low noise level make the F1 sufficiently safe to use inside a house rather than in a garage, basement, or workshop.

The Software. A laser engraver operates on the instructions it receives from a software file. The file is composed of precise commands written in the G-code language, which has been used since the late 1950s to control CNC (Computer Numerical Control) machines in a wide range of industries. The G-code directs the laser head to move, modify its speed, express a specific laser power, and other related functions.

The software determines how the laser engraver/cutter will perform, and how easy or complex the process will be for the user to create and edit their projects. Some laser engraver manufacturers provide no software, and rely on the end-user to download open-source software such as LaserGRBL (Windows only), or purchase professional software, such as LightBurn.

Other manufacturers provide their own software, either in the form of desktop or mobile device versions, or both. xTool provides full-featured user-friendly versions of their Creative Space software for Windows, MacOS (Intel and M1/M2 chips), iPadOS, iOS, and Android (FIG. 13).

The Laser Material Testing Process

Simply stated, the two main factors in determining how clearly a laser will score, how deep a laser will engrave, and how reliably a laser will cut, are laser speed and power. Although experienced users may guess correctly at these settings, it is best to make a test grid, to be able to determine the optimal results, reduce frustration, and lessen material waste. This is only necessary, of course, if xTool has not already provided the suggested settings.

Making a test grid begins in xTool Creative Space beginning with the creation of a single square shape. The shape is selected and identified by its category of material, and then assigned a Processing Type, either Score, Engrave, or Cut. With the square still selected, the user clicks Array and Material Test Array from the upper toolbar (FIG. 14). The settings are entered, or if the defaults are adequate, the user clicks OK. With the grid still selected, the user must click Ungroup. Now a sample of the grid positions can be checked by clicking on a few of them to confirm that object settings are correct (FIG. 15).

The laser is prepared by positioning the material, and the test grid is framed to confirm its proper placement. The file is sent to the laser, producing a different variety of power and speed settings for each square. After processing is complete it is up to the user to select the square that represents the best combination of settings. The test, which is valid only for the material it has been used with, should be kept as a reference.



FIG. 13. xTool's Creative Space software is tuned to the capabilities of its laser engravers/cutters. xTool has tested its materials on their lasers and provide the user with material presets that help to ensure output success. Credit: xTool

Material test array ×

X columns	Y rows
Parameter Power	Parameter Speed
Max. 100 % - +	Max. 4000 mm/s - +
Min. 10 % - +	Min. 10 mm/s - +
Columns 5 - +	Rows 5 - +
Spacing(in) 0.118 - +	Spacing(in) 0.118 - +

Cancel OK

FIG. 14. The Material Test Array enables the user to plot two parameters, Power and Speed, with a range of their powers, their increments, their spacing, and the number of columns and rows.

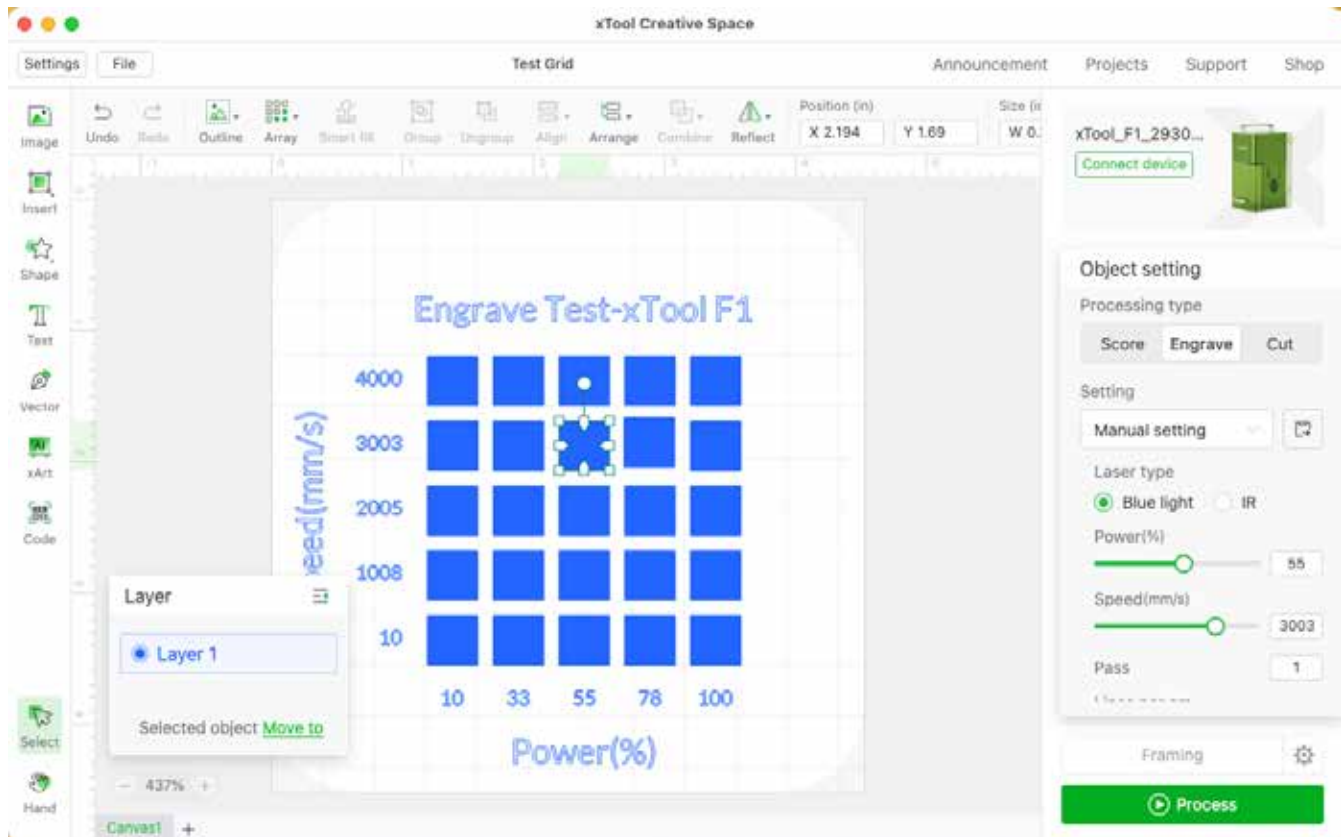


FIG. 15. By selecting an element in the grid, the user can confirm that the object settings coincide precisely with the settings shown on the right.

Further Reading

In-depth coverage of the entire laser engraving and cutting process is available in the new book, **Focus-ing on Laser Engraving and Decorating: Affordable, Versatile, and Creative Marking, Engraving and Cutting** (<https://tinyurl.com/2j2kmyc4>) sold exclusively on Amazon.com.



<https://tinyurl.com/32y2j44e>

The Laser Engraver Buyer's Guide*

FREE

<https://tinyurl.com/mr32447y>



© 2023, Michael L. Kleper, Boynton Beach FL. All rights reserved. This guide, in its entirety, may be freely distributed "as is." info@printerport.com.

*Photos, illustrations, and other visual representations in this guide do not constitute an endorsement. No company has provided sponsorship nor payment, and has not contributed editorial input. The products shown are illustrative of those available in the marketplace, and are presented as such.

Free Detailed Form for Laser Engraving/Cutting

Some users are overwhelmed, confused, and frustrated when trying to learn and master laser engraving and cutting. There is certainly a learning curve, but mastery comes with learning the settings that will provide reliable, repeatable results. To make that process easier users can download a free *Laser Engraving & Decorating Job Processing Record* PDF at <http://kleperreport.com/wp-content/uploads/2023/07/Laser-Material-Worksheet-v1.pdf>. This form can be reproduced for developing a lasting record of machine settings for consistent, quality results.

Laser Engraving & Decorating Job Processing Record

Date: _____ Laser Model: _____ Operator: _____

Project Description: _____

Client/Customer: _____ Phone(s): () () () e-Mail: _____

Special Instructions: _____

	Speed	Power	Passes	LPI	Est. Run Time
<input type="checkbox"/> Engrave					
<input type="checkbox"/> Score					
<input type="checkbox"/> Cut					

Photograph/Bitmap Parameters:

Workpiece Material(s): _____ Material Source(s): _____ Material Cost(s): _____

Material Characteristics (size, thickness, color, etc.): _____

Computer File Name/Location: _____

Pre-Treatment(s): _____

Post-Treatment(s): _____

Additional Tools/Processes: _____

Photo/Sketch: _____ Notes/Comments: _____

This form is from:
FOCUSING ON LASER ENGRAVING AND DECORATION
Affordable, Versatile, and Creative Marking, Engraving, and Cutting available at:
https://www.amazon.com/Focusing-Laser-Engraving-Decorating-Affordable/dp/9520994972/ref=sr_1_1?keywords=focusing+on+laser+engraving+and+cutting&pf_rd_p=1059633038ac83

Selling Price: _____ Profit: _____ Delivery Instructions: _____

©2022, Michael Kleper, Boynton Beach, FL. All rights reserved.

<https://tinyurl.com/4hfwmbw>

About the Author

Professor Michael L. Kleper is a Distinguished Professor Emeritus of the Rochester Institute of Technology, Rochester, NY. In addition to his more than forty years of undergraduate and graduate teaching, he has authored several books and research studies. He is the author of the two-volume *Handbook of Digital Publishing* (Prentice Hall), considered the industry standard text on the subject. He has lectured extensively, consulted with major corporations, and has edited, in various formats, *The Kleper Report on Digital Publishing* (<http://kleperreport.com>), since 1977, which now also includes up-to-date information on laser material processing.