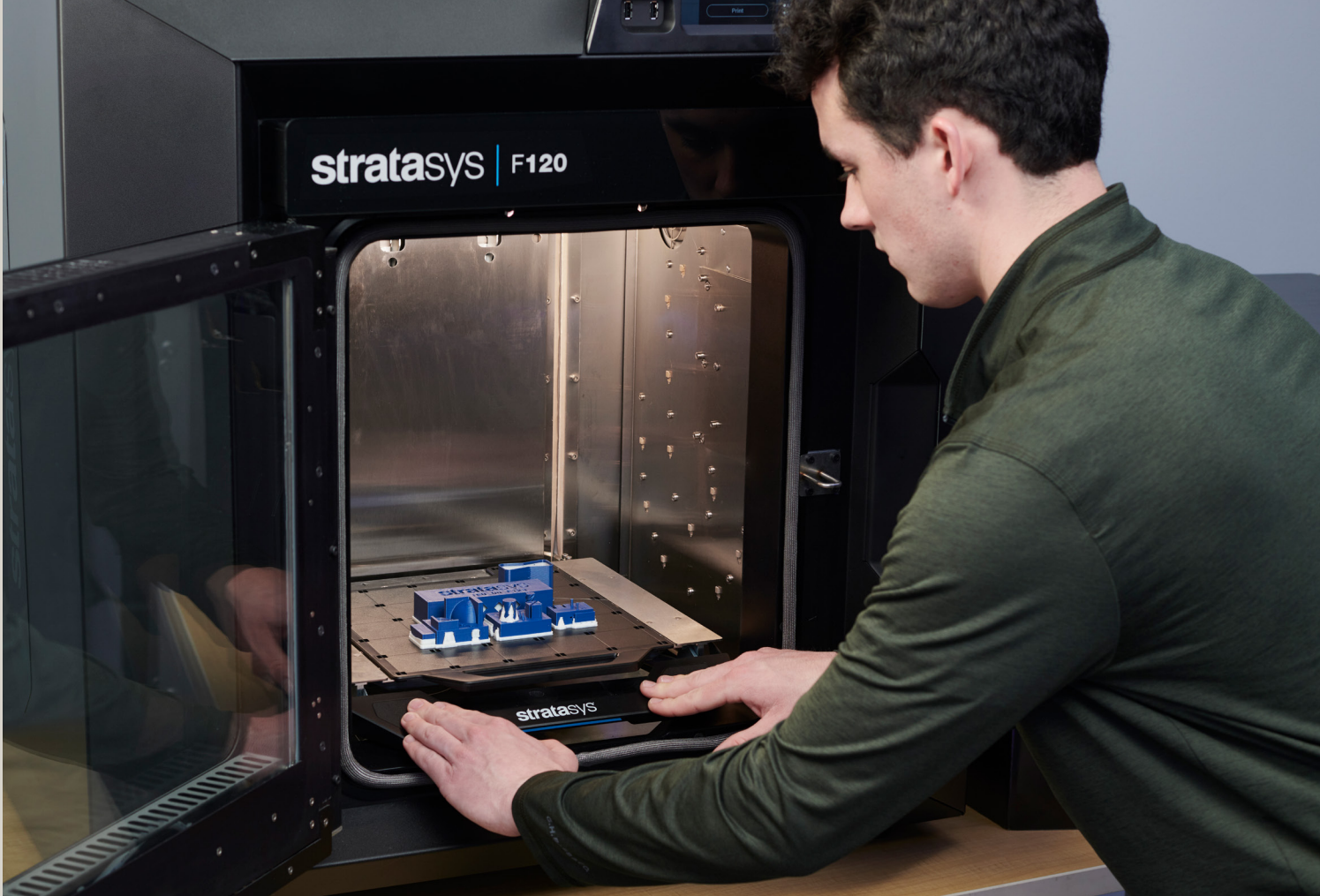


Value Is More Than Skin Deep

It's what you don't see that determines
the best desktop 3D printer.





Lewis and Adrian had a problem. They knew their growing design group needed to move faster to compete in an increasingly competitive market. The big question was how to do it. They had heard how 3D printing helped other companies by accelerating the design process and decided it was time to make the same leap. But which 3D printer was right for them? Like others in this situation, they started small, with a low-priced desktop 3D printer.

Does this story sound familiar? It's not that uncommon. What's unknown is whether their decision paid off. There's no denying the fact that 3D printing provides real business-changing results. The less-obvious reality is that achieving those results isn't a guarantee. It really depends on the choices you make.

The spread of 3D printing to the consumer and hobby market has commoditized the entry-level desktop printer category while providing an ever-expanding array of choices. Many of them look similar, but they don't all provide the same results.

The reality is that 3D printers are not all created equal — even within the same category, like affordable desktop printers. How they're conceived, designed and built is what separates the best from the worst — not price. Cost is understandably an important factor, but what you should really focus on is the value behind what you're paying for.

A Real-World Comparison

The following images compare the build results of four FDM-style printers. All four printers are entry-level systems, but differ in how they're designed, built and priced. The sample part is a prototype thermoplastic air duct.



Printer 1

The first duct was made on a professional 3D printer built with hardware, software and temperature controls designed to produce consistently accurate and professional results.



Printer 2

While it might look the same (aside from the color), the lower flange is slightly warped. When building thermoplastic parts, sufficient heat and tight temperature control is needed to produce wide, flat parts that don't warp, which is a consistent challenge with many desktop printers.



Printer 3

The dimensional accuracy of the flange is worse compared to Printer 2. Inaccuracies like this mean you'll have to reprint your model and that can make it difficult to achieve your goals to prototype faster and cut development time.



Printer 4

A total build failure like this example could be caused by any number of errors. With the potential for results like this, you'll need to consider whether you have the time and knowledge to troubleshoot and fix problems like this.

Consider Output Quality

The reason you buy a 3D printer is to change your business for the better — whether that's through faster prototyping or reducing product development costs through quicker design iteration. However, keep in mind that while any 3D printer can make a part, not every printer can make it accurately, every time, without the need to constantly troubleshoot errors and poor print results.

The bottom line is that the quality of your printer's output is directly related to the integrity of the printer's design. Everything from how the printer is built to the experience and design capability of the manufacturer plays a role in the printer's performance, including its consistency and longevity.

So while the lower priced desktop systems may seem like a reasonable starting point, you may be settling for a 3D printer that's only "good enough."

The Cost of "Good Enough"

Choosing a 3D printer based on price alone is more like a game of chance than a solid business decision. Lower priced printers may save you up-front costs, but the odds of maintaining those savings in the long run are slim.

For example, Lewis and Adrian's design group was falling behind from delays caused by client indecision and scope creep. They previously outsourced prototype development but purchased a desktop printer to bring this capability in-house to reduce turn time and allow for more design iteration. Instead, the opposite happened. Their printer didn't provide the results they needed. Designers spent large amounts of time prepping CAD files for printing. More time was spent monitoring the print job because successful results were never a guarantee.

Because the project deadlines didn't change, the design teams had to settle for a "good enough" process that barely met minimum requirements.

These kinds of delays have a real cost impact. If the designers spent an average of one hour prepping the files for printing and another three hours monitoring and/or troubleshooting the printing process, four hours of critical design time is lost. At a billable rate of \$150/hour, that's \$600 per prototype. If this experience happens on three prototypes per project, the lost design time runs up to \$1,800. The cost increases to \$5,400 when spread across three projects, equaling 36 hours of designer time not billable for design work. Unless something changes, the group's cost continues to escalate. Soon enough, the low printer price is overshadowed by the ongoing cost of poor printer performance.

\$600

Average additional cost per prototype due to unreliable desktop printer performance.

Then there's the cost of lost business. If the designers aren't able to reliably print prototypes, the project suffers because there's less time to iterate and develop the best design. As a result, the customer takes their business elsewhere and the firm loses the business — negatively impacting the company's reputation and ability to attract new clients.

Now put your own business in this scenario. The numbers might be different but the results will be the same. So ask yourself, "When was the last time the success of my business relied on 'good enough' performance?" If you don't make other business decisions based exclusively on price, why would you do it when choosing a 3D printer? Clearly, there's a price for choosing a 3D printer that isn't designed to produce professional results, day in, day out.



Built-In Value

Fortunately, affordable 3D printers that provide repeatable, accurate results on a consistent basis do exist. They're just not necessarily the lowest-priced desktop printers available. And there's a reason for that.

Printers that reliably produce accurate parts reflect a level of design expertise not available from many desktop 3D printer manufacturers. That capability is reflected in everything from the printer's design to the testing to the durability of each part. It may cost more, but the value manifests itself in the ability to print-and-forget, letting you focus more on your business and less on troubleshooting.

The Stratasys® F120™ 3D printer embodies these attributes. It's an entry-level printer, designed for professional results. By simply using it, you'll experience some of its advantages like ease of use and dependability. But to really see the value, you have to go beneath the surface. That's where the design expertise, the ingenuity and the durability that enable consistent performance lie.

Let's take a closer look at how accuracy, reliability, durability and safety are literally built into the F120. We'll "take it apart" and let you see the key features behind what makes it outperform every other desktop 3D printer.

Accuracy

To make the physical twin of your CAD model, you need a printer that tightly controls temperature and print head position and maintains that control over time.

Kevlar Positioning Belts

These belts move the print heads to the precise location needed to accurately print your parts. Kevlar belts are resistant to stretch — even when the print heads change direction — and wider than belts used on many desktop printers. The wide belts allow the extruder to move at higher speeds without losing position. Conversely, narrow rubber belts typically used on desktop printers can stretch. This reduces print accuracy, forcing you to periodically adjust or replace them.

Belt Tension Indicators

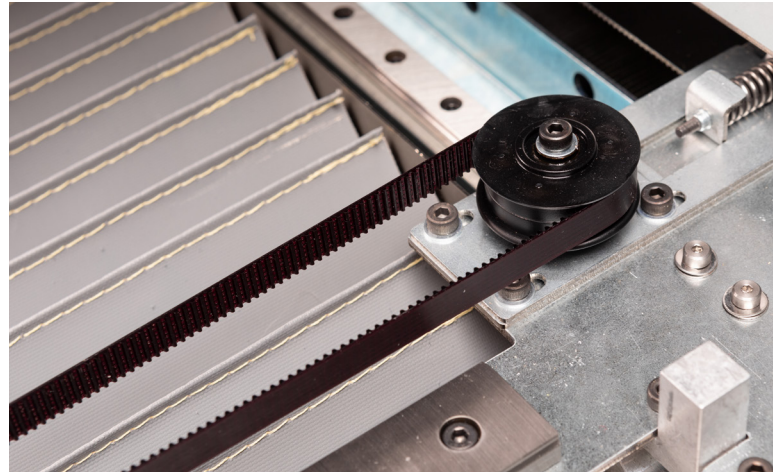
Proper belt tensioning is verified by belt pulley position indicators. When these indicators are physically aligned, the belts have the correct tension. On the F120, this is a factory-set feature that doesn't need adjustment. But if you're ever in doubt, you can always check this indicator to verify proper tension.

Closed-Loop Servo Motors

Servo motors drive the position of the print heads. They excel at precise movement and control, acceleration and quiet operation. Closed-loop means they're equipped with built-in feedback encoders that position the print heads exactly where they need to be, every time. Most desktop printers use stepper motors that don't have position feedback, making them susceptible to speed variation, resulting in less accurate positioning. They're also noisier, which is not always ideal for an office or classroom environment.

Laser-Measured X-Y Positioning

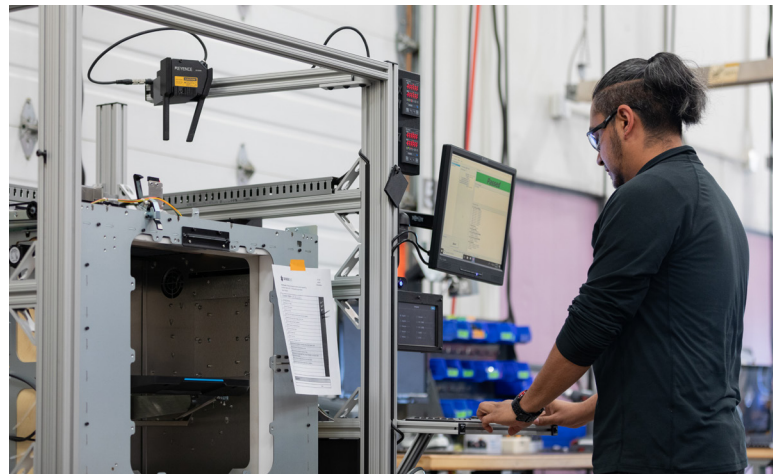
Every F120 print gantry (the framework that positions the print heads) is laser inspected during production for precise X-Y squareness to ensure the printer's frame and rails are not canted or misaligned. Results are databased to track trends and ensure specifications are maintained from printer to printer.



Kevlar positioning belts



Closed-loop servo motors



Laser-measured X-Y positioning

Temperature Control

Without accurate temperature management, you lose control of your part's quality, accuracy and consistency. That's why the F120 has multiple design features that maintain consistent build chamber temperatures.

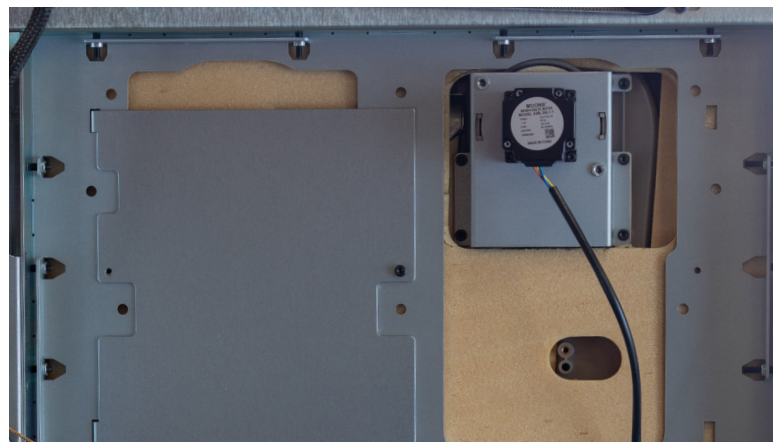
- A highly specialized electronic control algorithm maintains accurate temperature across the entire build tray. That means no dead zones and complete use of the build volume, a feature not reflected in most desktop printers.
- Patented airflow design provides precise temperature control right where the material is extruded. This is really important for avoiding curled parts. It also lets you print solid parts and use materials like ABS that need higher temperatures for successful results. Many desktop printers can't produce parts with solid fill, a significant drawback when strength is important.
- Consistent temperature at each build layer maintains layer-to-layer strength from top to bottom. Printers that only use a heated bed lose temperature control as the built-up layers get further from the bed. This can result in cracking between layers.
- Cross-chamber ventilation maintains consistent temperatures across the build platform, resulting in better Z-layer strength. Most other desktop systems that use a heated build chamber only use single-side blowers.
- Dual-wall construction and a double-wall door keeps the heat where it needs to be — inside the build chamber.
- Large heaters bring the build chamber up to operating temperature quickly, accelerating the overall build cycle. They're also capable of maintaining elevated temperatures needed to print certain thermoplastics that other desktop printers just can't reliably print.



Cross-flow oven design for even heat distribution



Double-wall oven and door retains heat



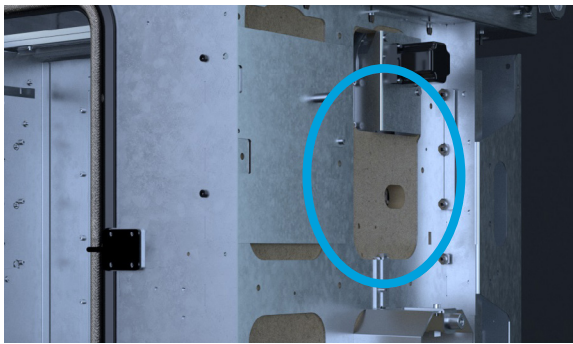
Large heaters enable faster heating and higher temperatures

Reliability

Reliable 3D printing is defined two ways: output consistency and printer longevity. Most desktop printers aren't designed with industrial grade components. So to avoid buying a replacement printer in a year or two, invest in one that's designed for the long haul.

High-Temperature Insulation

Robust gantry mechanicals and precise temperature controls won't do much good if the oven can't retain heat, year after year. The F120's double-wall construction encloses high-temperature insulation for long-term heating reliability. The insulation used in desktop printers — if any is used at all — is made with foam. Over time, the plasticizers in the foam break down, reducing the insulating capability.

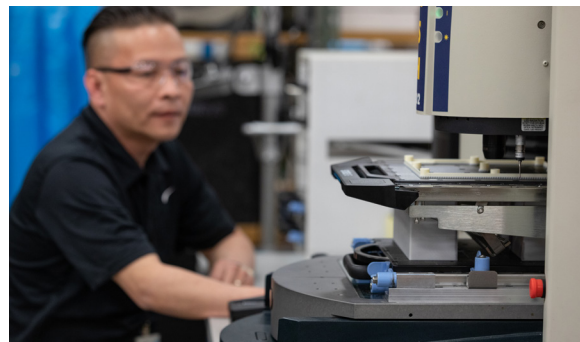


Optimized Materials

The materials the F120 can print are specifically “tuned” to produce optimal results. That simply means the printer and material combination has been designed, tested and adjusted to accommodate oven temperatures, print head suck-back rates and other material extrusion parameters. This helps you avoid the hassle of print failures, head jams and similar problems that are more prevalent with desktop printers using open-source materials.

Rigorous Testing

The F120 backs up its performance with over 250,000 hours of development and production testing, and the testing continues. Even before these printers were introduced to the market, 100,000 hours of component testing was accomplished to ensure dependable performance. The print heads alone have undergone over 60,000 hours of testing. And before each printer is sent out the door, it receives a battery of tests and checkouts to ensure it will produce consistent, repeatable results for years to come.





Flexible, textured build tray

Textured Build Tray

A subtle but important feature of the F120 is the sacrificial textured build tray. This gives the first layer of your printed part the grip it needs to establish a solid foundation for the rest of the layers to build upon. At the same time, the tray's flexibility allows easy part removal once it's finished. Most desktop printers use a permanent bed that requires repetitive cleanup and prep prior to each print, making it harder to achieve consistent print results.

On-Board System Monitoring

Reliable operation depends on rigorous system feedback. The F120 monitors 53 operational signals to assess the system's health. That includes filament tracking, which lets you know if you have sufficient material to build your model before you leave for the day. Most desktop printers don't even have half that number of sensors — and some don't have any at all.

Durability

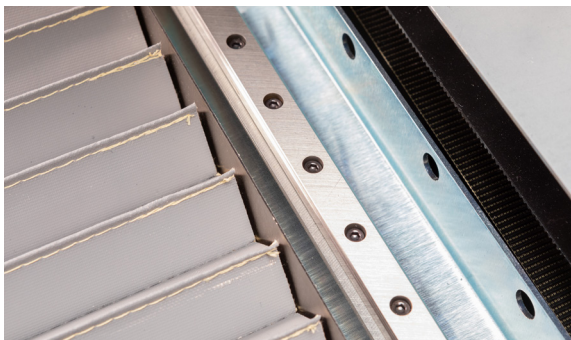
Durability has a direct relationship to print accuracy and your return on investment. There's a reason the F120 outweighs the competition — it's built to become obsolete before it wears out.

Linear Profiled Rails

For a 3D printing gantry system, profiled rails are a more durable option than round rods. They have greater load capacity, linear guide accuracy and accommodate faster speeds. This adds up to a more rigid system, resulting in greater accuracy and durability over years of heavy use.

Steel-Reinforced Rails

Backing up the linear rails is a steel support structure that adds additional stiffness. Most desktop printers attach their gantry system to a much less rigid, more flexible sheet metal framework.



Linear profiled rails



Reinforced linear rails

Steel Box Frame

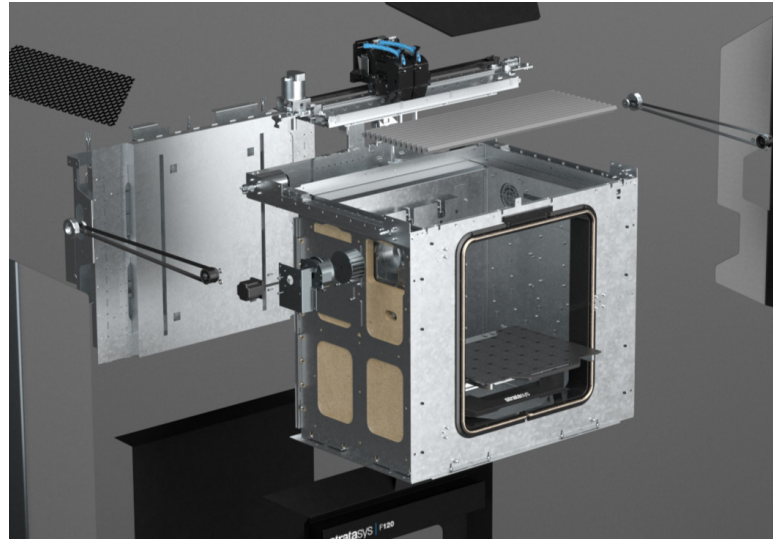
A rigid frame keeps the gantry properly aligned, preserving the accuracy of your parts. The F120 uses a steel box frame construction to maintain its structural and functional integrity over the long term, regardless of how often you have to move the printer. Lower-priced systems typically use aluminum sheet metal or plastic that can deflect and shift, compromising the accuracy of your print results.

Build Tray Reinforcement

Any amount of build tray deflection will cause dimensional inaccuracies. The F120's build platform maintains its planar rigidity thanks to a rugged steel beam mounted on the back of the printer. This prevents the build tray from drooping as the weight of the part increases during the build. It's another example of "overbuilding" to maintain part accuracy and printer longevity.

Steel I-Beam Head Gantry Reinforcement

If the extruder head rail isn't sturdy enough, the head can sag or rotate slightly, compromising the printer's accuracy. The F120 uses a steel I-beam to reinforce the extruder rail, so there's no risk of deflection.



Steel box frame provides rigidity and long-term durability



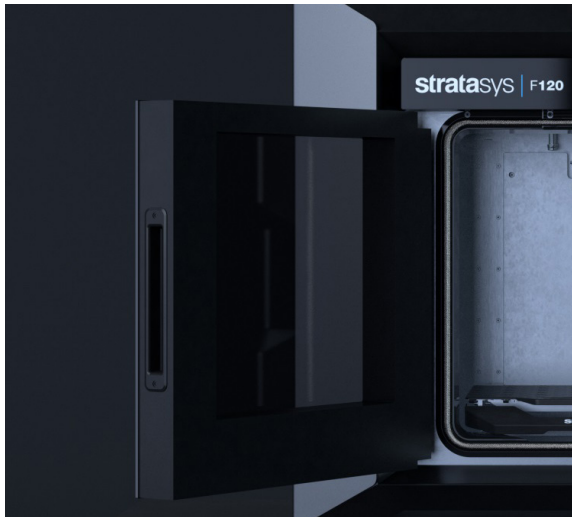
Robust build tray reinforcement



Head rail I-beam reinforcement

Safety

Safety is not always top of mind, particularly as it relates to desktop 3D printing. But 3D printers have very hot components as well as moving parts that can pinch and cut. Some desktop printers are completely open, exposing users to these hazards. These safety concerns are important to keep in mind, especially in classrooms and office environments where people and printers are in close proximity.



Double-wall door with integral automatic lock

Automatic Door Lock

The F120 uses an automatic door lock to keep it secure during operation. It stays locked until the printer is cool enough to safely access the part, avoiding the risk of burns.

Double-Wall Build Chamber and Door

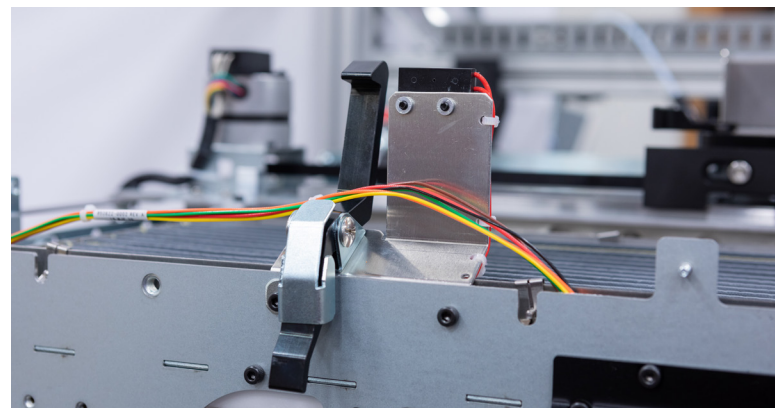
Most fully-enclosed desktop printers only have a single-panel door. But the F120's double-wall construction not only keeps the heat inside the build chamber, it keeps the printer and door cool to the touch.

Automatic Top Hatch Lock

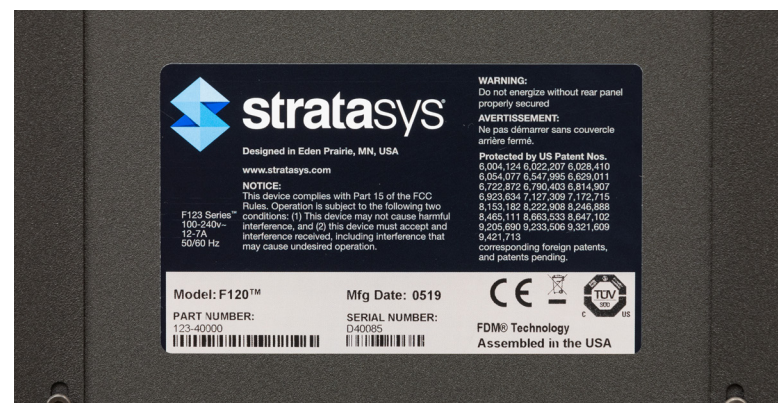
Like the build chamber door, the F120's top hatch locks automatically when the printer is operating — minimizing the risk of harm from moving parts and electrical components.

Safety Standard Compliance

The F120 complies with both UL and CE global standards governing health, safety and environmental protection guidelines. When you buy an F120, you'll know it's safe to operate in the office and the classroom.



Top hatch automatic lock



Built to comply with current safety, health and environmental standards

Results Matter

We get it. When you're new to 3D printing, you want to start small and do it for the lowest cost possible to gain experience with the technology. But as we've shown, there's a relationship between price and performance.

The truth is, you're not just buying a 3D printer — you're investing in better business results or equipping students with job-ready skills. So you need to decide whether you want to make a one-time investment or a series of ongoing payments to continually replace printers that don't perform.

The F120 is made for 3D printing newcomers. It's incredibly simple to use — just plug and print. It's also built with the same technology, design expertise and serious production intent as larger, industrial-grade 3D printers. It's not the cheapest desktop printer because it's built to last and produce consistent, professional results. You pay for it once and your only additional cost is the material you use.

Ready to take the next step toward reliable 3D printing that achieves your goals? [Visit the F120 page](#) on our website to learn more about the best affordable 3D printer.

Stratasys Headquarters

7665 Commerce Way,
Eden Prairie, MN 55344
+1 800 801 6491 (US Toll
Free)
+1 952 937-3000 (Intl)
+1 952 937-0070 (Fax)

stratasys.com

ISO 9001:2015 Certified

1 Holtzman St., Science Park,
PO Box 2496
Rehovot 76124, Israel
+972 74 745 4000
+972 74 745 5000 (Fax)

