Cut Smart™ and the Precision Revolution
A ground-breaking precision architecture reinvents DIY crafting

The pursuit of precision
DIY crafters make amazing projects—everything from beautiful home décor and handmade gifts to upcycled apparel and personalized party décor. Their projects are a way to add their own style to different aspects of their life and create things that they can be proud of. To do this, the projects need to look professionally handmade—something that is polished, but doesn’t look store bought.

Many of these crafters use the precision offered by electronic cutting machines to achieve that professional look. In a survey of over 1600 crafters, 75% agree that “producing a polished look” is a very important feature when selecting an electronic cutting machine.

And any cutting machine needs to create precise cuts at a variety of different shapes, sizes and materials. In another survey of 500 crafters, 82% agree that it is important that a new electronic cutting machine “allows me to make precise cuts from ¼ in. to 23 ½ in.”, while 83% believe it is important that a new machine “allows me to cut a wide variety of materials”.

Defining precision
When developing the Cricut Explore™ electronic cutting machine, delivering a precise cut became one of the primary goals for our product team. We wanted to deliver a precise cut regardless of the material used or the image shape or size—from very small circles to large, intricately designed shapes.

Based on consumer feedback, the team identified three key areas that define precision:

• Circles must be perfectly round regardless of size
• Angled corners must be sharp on any image
• Size of any image must cut exactly as it is designed in the software

Letter Cuts
With these objectives in mind, the team built the Cricut Explore™ cutting architecture from the ground up. The team didn’t improve the design from an existing Cricut® cutting machine; they started from scratch, examining every aspect of the cutting system. This allowed them to identify all areas of the cutting experience that impact precision and innovate accordingly.

Introducing Cut Smart™ technology

The new Cricut Explore™ machine showcases a groundbreaking precision architecture. Cut Smart™ is an innovative technology that dramatically raises the standard for precision on DIY crafting systems. Advancements in software, cut drive system, and user interface combine to give crafters the ability to create projects that are more polished and professional-looking.

At the core of the new architecture is an intelligent hybrid motor system that dramatically improves blade control and cutting precision. Complementing the patent-pending motor system is software that automatically adjusts cutting speed so every cut is smooth from start to end.

An interface makeover makes precision accessible. The Smart Set™ dial replaces controls for setting blade depth, speed, and pressure. A crafter simply chooses a material and lets Cut Smart™ technology automatically adjust the cut settings for maximum precision.

The final component is a redesigned, super-hard German carbide blade that optimizes cuts across a wide range of materials while extending the life of the blade.

Foundation: The cut drive assembly

The heart of Cut Smart™ is an innovative cut assembly that adds precision with a unique dual-axis configuration combining the best features of both stepper and servo motors.
A high-torque stepper motor drives a rack and pinion gear that compresses a spring, allowing highly granular control over the blade assembly—adjusting the pressure as needed based on material setting. Linear bearings housed in metal tubing ensure precise alignment and dramatically reduce friction, creating a smooth and consistent cut depth.

The result is an unprecedented level of control over blade depth and pressure across the entire cutting path. When a cut starts, the assembly reads the cut path and then adjusts the speed to accurately cut the close corners—realtime adjustments that limit deviance from the cutting path to less than 0.3% based on the overall size of the contour.

Software—the brilliant mind of Cut Smart™

Sophisticated device software lets users reap the benefits of the hardware advancements and create impressive finished projects.

Exploiting the feedback capabilities of the servo motors, the device firmware adjusts blade speed to ensure the most precise cut possible. The new software ensures more perfect cuts by anticipating changes in the cutting path and controlling the speed around sharp corners—thereby eliminating tears and jagged edges. The software also keeps track of blade orientation as the assembly moves from one image to another on a sheet of material.

An overhaul of existing software was also part of the improvements to cutting precision. A rewrite of the packet exchange algorithm increased address space from 16 bits to 32 bits—allowing the Cricut Explore™ machine to process more information a faster rate. For users, that translates into less lag and more responsiveness.
Refining the user experience

The best technology is worthless unless it’s easy to use. An enhanced user experience further improves the precision of Cricut Explore™ by eliminating the guesswork associated with cutting different materials. The Smart Set™ dial does away with the need for manual adjustments to blade depth, speed, and pressure. Simply choose a material on the dial and Cut Smart™ technology has the ability to automatically adjust blade speed and cut force to settings that have been carefully tuned for the media being cut. In other words, the Smart Set™ dial makes it simple to get precise cuts.

Since material types may vary, users can customize the Smart Set™ dial factory settings to their preferred settings. Furthermore, users can access the Custom setting to choose from a broader range of preset materials or create and save their own settings based on preferences. For more information, see “Cricut Explore™: The World’s Easiest to Use Design-and-Cut System”.

A keener edge—rethinking the blade

Precise cutting doesn’t end with the Cut Smart™ system. A totally redesigned blade was also necessary to ensure the most precise cuts. Working closely with metallurgy experts, we cast the blade tip in a specially formulated tungsten carbide. This finely-grained metal better resists wear and breakage, greatly extending the expected lifespan of the blade.

Research drove a change in the blade geometry that improves accuracy and optimizes cuts.
across a wider range of materials. The new geometry extends the life span of the blade tip even further, providing users with a noticeable increase in cutting distance. The new blade design also makes it easier for the blade to navigate sharp corners, adding more precision and speed.

A brand-new blade housing takes advantage of the new tip with a sophisticated spring-loaded, dual bearing design that allows the blade to spin freely, enabling the most intricate of cuts.

**Putting it to the test**

We performed extensive testing to ensure precise cutting of different shapes, sizes and materials using the Cut Smart™ system and new blade design. Over 5,000 hours of standardized testing across hundreds of machines helped to ensure the cut accuracy of Cricut Explore™. Some of the standardized cuts include:

- 5 mm and 11 inch circles to ensure consistency of the diameter at all points
- 11 inch squares to measure the size accuracy
• The letter “R” to measure the angle on sharp edges

• Intricate images to test the repeatability of cut accuracy

The testing doesn’t end with the development process. Extensive testing is included in the Cricut Explore™ manufacturing process. Every machine is calibrated on the manufacturing line to ensure that materials settings are precise, draw and cut lines are aligned, and cuts are accurate. Once machines are produced, random samples are pulled for extensive materials and cut testing at the end of each day.

Designed to surpass consumer expectations, Cut Smart™ technology and new blade design combine to make Cricut Explore™ the new standard for precision in DIY crafting systems.