

Then and Now

PCB prototyping with LPKF over the past two decades

20 years ago, gas was cheap and Netscape Navigator was still in the development stage. A lot has changed since then, including what is possible with in-house PCB prototyping. Over the past two decades, technology introduced by LPKF has made PCB prototyping more efficient, more accurate, and of higher quality than was previously thought possible.

In recent years, many LPKF users have retired older milling machines in order to take advantage of the advancements available on current LPKF models. What follows is an overview of these advancements and their implications for board quality, workplace productivity, and technological innovation.

Performance upgrades

- **Milling resolution**

Then: Milling resolution has improved dramatically since the ProtoMat 90-Series was introduced in 1994. ProtoMats 91s, 92s, and 93s all sported accuracy resolution of .31 mils, a number that pales in comparison to ProtoMat accuracy of today.

Now: 2011's second generation S-Series, consisting of ProtoMats S43, S63, and S103, features resolution of .02 mils, 15 times higher than what was possible in 1994. This is like milling in high-definition and means design execution will match simulation software, making redesigns less likely and assuring prototypes are ready as soon as possible.

- **Travel speed**

Then: Early 90-Series models featured a travel speed of 40 mm/s. While this allowed boards to be ready much quicker than possible if prototyping was outsourced, today's machines are much faster.

Now: Current S-Series models feature a travel speed of 150 mm/s. The higher travel speed combined with a reduction in weight and substantially faster acceleration allows boards to be produced 4 times faster than before. Having a fully testable board ready before lunch (including revisions) opens the doors for new levels of productivity and innovation in the workplace.

	1994	2012
Milling resolution	.31 mil	.02 mil
Travel speed	40 mm/s	150 mm/s

Then and now: milling machine performance, 1994 vs. 2012

New features

- **Automatic tool change:** The ProtoMat 95s (1995) introduced automatic tool change for PCB milling. This allowed for more automation during board production, speeding up the overall process of making a board, and enabling the machine operator to stay productive while waiting for the job to finish. Currently this feature is standard on ProtoMats S63 and S103.

- **Non-contact depth limiter:** Introduced with the Protomat 95s, this pneumatic air bearing foot makes it so the tool being used for surface removal is all that comes in contact with the board. This is ideal for RF and microwave applications where even the slightest impression on the board can affect performance. Currently available on the S103, the air foot has been upgraded for maximum performance.

- **Fiducial recognition camera:** Dramatically improving the process of making PCBs in-house, in 2003 LPKF debuted with the ProtoMat H100 the fiducial recognition camera. The camera automatically locates fiducial markers, automating board alignment and measuring cut widths most precisely. Today the camera is standard on the S63 and S103, and can be added to the S43.



- **Vacuum table:** When combined with the fiducial camera, the vacuum table eliminates the need for set pins, making rework easy. It also makes working on soft, thin, and flexible materials a breeze. Also introduced with the H100, the vacuum table comes standard on the S103 and can be added to the S43 and S63.



- **Acoustic cabinet:** Shh! For years, the effectiveness of in-house PCB prototyping was overruled, for some, by the noise machines omitted while in use. The first generation S-Series (2005) eliminated that problem, introducing the acoustic cabinet that makes LPKF milling machines purr rather than growl.

- **Automatic tool depth calibration:** 2011 saw the second generation S-Series bring more advancement to in-house PCB milling than many could have imagined.

One of the most dynamic developments was the introduction of automatic tool depth calibration. Standard on ProtoMat S63 and S103, this feature works with the fiducial camera to ensure cut widths match specifications. Set the cut width in the software and the machine does the rest!

- **CircuitPro software:** The second generation S-Series brought with it improved software, the powerful yet user-friendly CircuitPro. Importing nearly all industry standard CAD files while calculating tool paths and controlling the machine, CircuitPro is the most formidable software available for in-house PCB prototyping and ensures maximum speed and accuracy during board production.



	1994	1995	1999	2003	2005	2011
Automatic tool change		▪	▪	▪	▪	▪
Non-contact depth limiter		▪	▪	▪	▪	▪
Extra large working table			▪	▪	▪	▪
Fiducial recognition camera				▪	▪	▪
Vacuum table				▪	▪	▪
Acoustic cabinet					▪	▪
Tool depth calibration ramp						▪
Solder paste dispensing						▪
CircuitPro software						▪

Then and now: standard machine feature availability by year, 1994-2011

Recap

With 20 percent of LPKF's workforce dedicated to research and development, technological breakthroughs should not come as a surprise. Spurred on by a desire to improve the user experience of making PCBs prototypes in-house, what is truly impressive is the way LPKF has progressed milling technology while keeping prices down.

Today's machine prices are not that far off from those of the 1990s, displaying LPKF's commitment to making in-house PCB prototyping an attractive solution for nearly any setup. And thanks to the current S-Series upgrade path, LPKF has ensured that your machine can grow with you and your prototyping needs.

Sometimes it takes a look back at yesterday to understand how remarkable it is where we are today. To learn more about how the latest LPKF PCB milling machines can increase productivity and provide a more innovative work environment, email sales@lpkfusa.com.

The world and LPKF over the past two decades

