

Automation, Robotics Are Key to Manufacturing PCB Assemblies

Assembling a printed circuit board requires more than steady hands

Robots aren't just a cheaper assembly method—they're almost required because some components are the size of ground pepper. Not coarse ground, either.

"Today, in the end, automation is essential to manufacturing printed circuit boards," said Accu-sembly President John Hykes, who founded the California firm in 1983 by making motion detectors with hand-held soldering guns in the family garage. He recruited the whole family, who turned out 100 to 200 of the detectors a week to start, and about 1,000 a week within a year.

Accu-sembly added automated machines within a few years of the firm's founding, Hykes said in a telephone interview with *D2P*. First, the company worked with surface mount components. It learned and added components with leads. Then came ball grid arrays, which had to be X-ray inspected, and Accu-sembly automated the process.

Accu-sembly operates today in a 30,000-square-foot factory with 100 employees in Duarte, California. The company's markets include aerospace, industrial, commercial, and automotive businesses. As an electronics manufacturing services provider, Accu-sembly manufactures custom printed circuit board assemblies. In support of this, the firm provides design for manufacturing review, procurement and supply chain management, and testing services.

Accu-sembly manufactures printed circuit board assemblies that meet IPC-A-610 and J-STD-001 class 2 and class 3 requirements. It can place the smallest 01005 (0.4mm x 0.2mm) chip components and large high pin count BGA devices. Its manufacturing processes are also suitable for placing tiny micro BGA devices as well.

Hykes said in an emailed response that most of its products begin with surface mount device installation using fully automated assembly lines. "This includes solder paste screen printing, robotic P&P (pick and placement), and reflow. Our equipment and processes allow us to place large complex BGA (ball grid array) devices, as well as the tiniest parts and micro BGA devices. Through hole assembly is managed with a combination of wave soldering, selective wave soldering, and manual assembly. Post assembly inspection includes both automated optical inspection and X-ray inspection as necessary. Functional test routines using customer specific equipment is offered, along with flying probe electrical test services. Conformal coating and potting are also available," he said.

"We grew organically," Hykes told *D2P*. "We worked with all of these processes extensively. What you need is the right equipment, people, and training to do these assemblies properly. We can bring



An Accu-sembly employee oversees a computerized printed circuit board assembly machine. The company offers turnkey manufacturing of electronic assemblies for the aerospace, security, automotive, and industrial controls markets. Photo courtesy of Accu-sembly.



An Accu-sembly employee stacks printed circuit boards during the assembly process at Accu-sembly's Duarte, Calif., PCB manufacturing plant. Photo courtesy of Accu-sembly.

that experience (34 years) to the table and work with their idea.”

Hykes doesn't want to say a person can't assemble modern PCBs. “Our pick-and-place robots are doing things that are basically very impractical to do manually. Some parts are smaller than ground pepper. They're too tiny, too costly. It's very important for them to be placed properly. Robotic assembly is the only way.”

Hykes should know. “We learned how to do it when it wasn't easy, before robots,” Hykes said. “We're constantly upgrading our equipment. Smaller, faster, cheaper. That's what everyone wants.”

He said in some cases, people can put 8 to 10 parts on a printed circuit board in a minute.

“Now a robot is putting five or six parts a second on a printed circuit board,” he said, “and we have multiple machines working.”

“Thirty years ago, everything was manually placed,” and today, “some bigger objects are hand-soldered to a PCB. There are still some things robots can't inspect,” Hykes said. He explained that today's workers have to be trained beyond being able to solder a component onto a board.

Workers take care of some finishing processes, and those are getting more complicated.

“They have to be more technically capable,” Hykes said. “Some finishing processes include inspections, although other inspections are done by machines.”

That process is called automated optical inspection.

Hykes said with 34 years of experience behind him, he feels good talking to a new customer walking through the door. “We have been in this business since 1983, and these years have taught us how to be good partners with our customers. That experience has also helped us acquire the technical knowledge necessary to manufacture today's complex assemblies,” Hykes said.

One of the first steps is to look at the customer's design, and for Accu-sembly and the customer to verify that the design for manufacturing is cost-effective.

“With some customers, they understand this is what we do and have been doing for 30 plus years,” Hykes said. “We've already proven we have the ability to do this. We've encountered all the different processes people tend to use, manual, surface mount, robotic, through hole, two sided, X-ray inspection, ball grid array. We know how to deal with it. We've proven we turn out a product with a low failure rate, on time. When a new customer comes to me, I can feel confident.”

With a design for manufacturing agreed upon, Accu-sembly then works with the customer on how to buy and manage the components. Hykes said each company has its own ideas about maintaining inventory.

“We can sometimes suggest a less expensive component or an easier to assemble material,” Hykes said. Accu-sembly can also man-

age the entire supply process to simplify it for a customer. “Our customers are all different. They may have issues with materials or with managing their inventory or with assembly.”

To maintain that relationship, Accu-sembly gives each customer someone to talk to.

“We assign a project manager to each customer. The project manager is the single point of contact. They're the liaison between the customer and the manufacturing floor,” Hykes said. “Each customer has their different way to assemble their product. We can add our primary business expertise, printed circuit board assembly.”

One of Accu-sembly's customers presented a challenge by quickly ramping production of approximately 50 different part numbers to a total of more than 25,000 assemblies per month. According to Hykes, this required “an accurate assessment of the required materials and a visible and flexible production schedule that could change from day to day.”

“The major challenge was managing the allocation of divergent component parts before committing production resources to build their assemblies,” he said in an emailed response. “Having an automated production line stop due to a lack of component parts is inefficient, costly, and could lead to subsequent quality issues. This is further complicated by the need to build multiple assemblies on multiple assembly lines while reacting to a schedule that would often change daily. We needed to design a system to properly account for all the materials needed to produce these assemblies, establish a production plan, and present this information along with a delivery schedule to the customer.”

Accu-sembly solved the problem with its managed inventory system.

“Parts arrive through a combination of vendor drop shipments and transfers between our two companies. All parts are barcode scanned and cross referenced to an internal part number using an approved manufacturer list,” Hykes said. “They are then received into a customer specific inventory system that integrates with the assembly BOMs (bill of materials) and production requirements. This information is shared with the customer with a daily report so they can maintain and expedite component inventory as required.

“In addition to inventory, the report displays the status of all orders, including current production status and delivery information. Administered by a dedicated program manager, the system has become an essential tool for both parties to ensure that production requirements are met.

“In the better relationships, we're not the ultimate say-so. If we do the review initially, we can incorporate some of the changes we recommend and we make the process as streamlined as possible,” Hykes said. “If it makes it easier for them, it makes it easier for us.”