

Automation Leads to New Business Model for Panel Shop: A Study in Competitive Manufacturing

CASE STUDY

A MINNESOTA PANEL SHOP USES NEW TECHNOLOGY FOR CUTTING AND WIRING CUSTOM ENCLOSURES, BOOSTING QUALITY, CHANGING WORKFLOWS AND DECREASING TURNAROUND TIME.

Introduction

When PTS Products, Inc. moved into a larger facility in Maple Plain, Minnesota during the summer of 2015, management's goals expanded to include higher quality and faster turnarounds for customers. The company is a contract manufacturer of electrical and electronic assemblies for OEMs and end-users. PTS's new space was crucial to their optimization, allowing the panel shop to change its workflows, add more quality checks and increase throughput.

PART OF FOUNDER PAUL SOBERG'S VISION FOR THE COMPANY WAS DEVELOPING NEW WAYS OF WORKING AND NEW SERVICES; THE NEW SPACE HELPS MAKE THAT POSSIBLE.

Their transformation also led to a refined business model. Part of founder Paul Soberg's vision for the company was continually improving in order to offer new solutions and services; the upgraded space helped make this possible.

"Our core competency is enclosure and panel building," Soberg explains.

This entails panel design, programmable logic controller (PLC) and motion control programming, cable harnessing, and printed circuit-board assembly.

By expanding the business, Soberg has been able to take on more customers and even provide services to other panel shops. He has also been able to strengthen his business by adopting new technologies for modifying and wiring panels, as well as switching over to storing all information digitally.

PTS's products are used in automation, packaging, wastewater treatment, water purification, medical device manufacturing and other industries.

A number of customers are Fortune 100 companies. PTS Products builds strong relationships with its customers, to the extent that when Soberg and other employees work with a customer on a new project, "we often know just what they want and need. We sit in on design reviews and take part in the layout and product selection," he says.

"On larger projects, we're doing some sales engineering," Soberg points out.

"We essentially become their manufacturing arm." In a competitive business, the added space is a crucial

part of retaining these long-standing customers.

New Workflow Builds on Employees' Specialties

The new procedures start when a customer hands off a design to the shop. "Previously, one employee in a work cell would build a control enclosure from start to finish," Soberg explains. "Now, the design comes into a central area where it's kitted with all of the components, and then it moves to different areas of the shop for different steps in production."

The new workflow lets employees work at their specialties — machine operators make cutouts for components, and wiring experts wire the components together. Special activities such as making printed circuit boards and engineering have dedicated areas. Engineers can design systems such as a conveyor belt or program PLCs with less noise and fewer distractions. After a panel completes a production phase, it is immediately returned to the central area where it undergoes an intermediate quality check. Soberg reports that this new workflow has greatly enhanced efficiency and quality.



Paul Soberg, founder of Minnesota-based panel shop PTS Products, achieved higher quality and faster turnaround times by automating custom cutouts on its enclosures and back panels using the ModCenter.

"We're also trying to go paperless," Soberg says. "To minimize the information people need to deal with, but to make sure it's the right information. We're eliminating paper drawings on the floor. We want people to pull up the design on their iPads, so if our engineering people change how a device is wired, that update is available immediately. The production manager doesn't have to look for the newest paper drawing. Paper slows down the process."

Just-in-Time Delivery

All told, the changes allow PTS Products to half the time it takes to deliver a finished enclosure — from more than a week to three or four days. And that's crucial because customers want just-in-time turnaround. "Once the design is done, they want the panel almost immediately," Soberg says. "They don't have lead time built into their schedules to be able to wait, and the control panel design is usually one of the last things to be finalized."

Typically, the customer creates a design, usually using computer-aided design (CAD), and gives it to the panel shop in DWG or DXF format or as a pdf file. In the old way of working, if the file was still in DWG or DXF form, PTS Products would generate a pdf version. Then, using a printed copy of the pdf file and pencil or marker, an electrician would transfer the placements for large components such as motor drives, graphics terminals, and fans and small ones such as circuit breakers and switches to either the

enclosure walls or the back panel, including marks for all holes and cutouts.

Once all the markings were copied onto the enclosure, the electrician would begin to drill and tap to make the holes and jig saw for the cutouts. The costs weren't just speed and precision. Noise wear and tear on employees were also big problems. "When you have one person drilling hundreds of holes — basically spending all day doing it — that person gets tired from the repetitive motion and you can have carpal tunnel problems," Soberg says. In addition, the rasping from the drill and saw reverberates within metal enclosures and out into the shop. "It sounds a lot like a horn going off. It's extremely annoying."

Automated Cutting and Drilling

One of the largest influences into why PTS invested in a new facility was to accommodate a new automated system for making custom cutouts for enclosures, the nVent HOFFMAN ModCenter. This product comes from Minnesota-based nVent HOFFMAN, a Rockwell Automation Encompass Product Partner. A CAD drawing is fed directly into this system, so there's no time dedicated to marking the placements on the enclosure or back panel by hand. The ModCenter automatically converts the CAD data to CNC form, and interprets the data to make the holes and cutouts.

Enclosures ranging from 30 to 40-inches high can require 200–300 holes to be drilled in the back panel along with multiple larger cutouts on the sides, so all the cutting and drilling could take three to four hours. "Now we can do it in 30 minutes or less. And the holes and cutouts are accurate to within a few thousandths of an inch compared to the hundredths we could do previously."

This agility improvement allowed the shop to satisfy one customer in particular that needed an extremely quick turnaround time. This was a request that PTS would be unable to process prior, but continuous improvement and the ModCenter made this project a possibility.

"We got the order on a Monday and finished the three panels on Thursday. Previously this job would have taken two to three weeks by the time we got all the design work, cutting and wiring done," Soberg says. This was not a typical order, since PTS Products created the CAD drawing with the electrical schematics and placement of components on the panel rather than the customer providing it.

"We assigned four employees to the project and multitasked," he explains. "We designed the schematic, the layout of components on the panel, and the holes and cutouts for the ModCenter machine all in parallel." The group also did the cutting and wiring in parallel. The fast turnaround includes the 15–20 hours devoted to creating the design and schematics, and another 3–4 hours to do the layout. Actual construction, including cutting and drilling, affixing the components, wiring, and finishing took only about 8 hours per panel. Because the customer wanted 80 panels total, the shop's rapid response capability translated clearly into dollars.

Holes and cutouts done on the ModCenter are more professional looking, Soberg adds. "They all have a neat and clean finish. We also have less scrap because there's less opportunity for error." The new system is easier on employees, too: the machine uses end mills rather than saws to make cutouts, which are inherently quieter. "You can have a conversation next to the machine while it's running."

In addition, he says, "the machine helps people do what they're best at: Machinists can machine, and wiremen can wire. Talent is a limited resource." Often, as in the example of the food industry customer, PTS Products makes duplicates of enclosures. It now can turn out exact copies in even less time than needed for the original, because the ModCenter saves the program.

Breaking with Tradition

Modifying enclosures in-house is typically very time-consuming for panel shops according to Rick Maday, global marketing manager at nVent HOFFMAN.

The ModCenter machine speeds up the process by allowing shops to make better use of existing CAD files to automate the creation of holes and cutouts. To populate a back panel the traditional way a worker would place the components on the panel, mark their drill holes, remove the components, drill and tap the holes and replace the components for final mounting. This can take eight hours or more.

The idea made immediate sense to Soberg when he saw the ModCenter demonstrated at nVent HOFFMAN headquarters. He had been thinking about the benefits of such a capability. PTS Products received its machine in December, and after less than a week had it in production.

ALL TOLD, THE CHANGES ALLOW PTS PRODUCTS TO HALVE THE TIME IT TAKES TO DELIVER A FINISHED ENCLOSURE.

"We need to make modifications in-house," he says. "Almost every enclosure we build requires some modification, and it can take a lot of time. Reducing the turnaround time has been huge. Making the holes and cutouts automatically has increased our overall productivity by 30–40%."

nVent HOFFMAN is now building an extensive library of Rockwell Automation and Allen-Bradley parts so ModCenter systems will need only the part number to automatically create holes and cutouts. The list will encompass PanelView graphics terminals, integrated display computers, PowerFlex drives, motor control contactors and starters, transformers, circuit breakers, switches, and other devices.

Designed-in Library of Rockwell Automation Parts

This is important to PTS Products, since most of the components it places on panels and enclosures are Allen-Bradley and Rockwell Automation products, Soberg says. "I cut my teeth on Rockwell

Automation parts so using them and recommending them to customers is a no-brainer. He believes the quality is especially important in components "that have some smarts, like PLCs and motor drives. And most of our customers specify Rockwell Automation parts."

The library will save the shop a lot of time, he adds. The machine will pull up the catalog number and the CAD file will slot the specs right in. "It'll specify that a certain part needs four holes and their size and spacing. We don't have to reinvent the wheel." Without the library, a technician had to find a manual in the shop or data sheet on the Internet or look at the component itself and measure it. "A brute force method," Soberg commented.

The next innovation will be automating wiring more than the shop has already, he says. "Currently we precut a lot of wires, and we'll do more of that as well as crimping and possibly labeling them too. Again, that will save a good deal of time, and it's another task we might perform for other panel shops."

The shop already cuts wires in batches of 25 or 30 for a given panel and puts them in labeled bags for the wiring expert to use. A wire-cutting machine unwinds the wire, cuts it to length, and strips it — up to 30 or 40 wires per minute.

"When the diagram says to use an 'A' wire from relay #1 to terminal #4, the wireman just grabs a wire from the 'A' bag. He doesn't need to know what the circuit does. When he finishes installing all of the 'A' wires, he goes on to the 'B' bag and makes those connections. It's so much more efficient and faster than having the wireman measure and cut each wire individually." He estimates the time savings at 50%.

In the future, Soberg plans to replace the aging wire-cutting machines he has with newer models that also crimp ferrules.

THE NEW WORKFLOW LETS EMPLOYEES WORK AT THEIR SPECIALTIES — MACHINE OPERATORS MAKING CUTOUTS FOR COMPONENTS, AND WIRING EXPERTS WIRING THE COMPONENTS TOGETHER.

The IEC requires crimping as it gives additional girth to the wire ends, which is valuable with smaller gauge wires. He's seen videos of machines that go one step further and connect up the wires automatically and he's interested in that next step.

Innovation Is Part of the Culture

Innovation is a key differentiator that Soberg believes that PTS Products offers its customers. But he talks about culture as well. "We develop relationships with our customers. We give them consistently high quality service and fair pricing. We understand industries so we can easily identify what a customer needs."

When he started the company 12 years ago, he wanted the challenge of developing new systems and workflows. He also wanted to develop people within the company and to make it a great place to work. "I want us to treat people well, so they like being here. I want them to feel challenged and rewarded. And I want customers, vendors, and employees all to feel well treated. All three are equally important." The innovations PTS Products has instituted have certainly played a role in that part of his vision.

Need for Speed

PTS Products is a typical customer for ModCenter machines, Maday says. "It's a medium-size shop that does upwards of 50 enclosures per week. Feedback from current ModCenter owners shows that if a shop processes 12 enclosures a

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month, it can save 75% on the costs of modifying them."

"Panel shops have very few ways to cut costs," Maday points out. "Traditionally, the highest paid people, the electricians, are doing cutouts. That's a highly skilled person doing work that's essential to panel building, but not their true value-add."

Soberg adds that, "Making holes and cutouts were the bottleneck of the whole shop." The ModCenter machine "changes the workflow."

Drilling holes and making cutouts by hand is hard on tooling, Maday explains. "Depending on the enclosure material, drill bits can wear out after about 150 holes. Saw blades, especially when cutting stainless steel, can wear out in just minutes. I've seen three blades consumed making one large air-conditioner cutout. But with the

ModCenter machines, where speed and pressure are optimized based on the type of material being processed, tools last much longer."

The system was designed to be easy to use, he adds: Saving employees the tiresome labor of copying the pattern by hand was a big goal. Building a simple interface for feeding in the CAD data and operating the machine was another. He points out that it's also easy to program, making it appropriate for shops that do a lot of custom design work.

The machine can use any of 21 precision cutters — a combination of drills and taps for holes and end mills for cutouts. As for speed, "the machine is capable of milling mild steel at 2,000 mm (78 in.) per minute. It's very fast. It will make a 4 by 4-inch cutout in under 3 minutes. Including filing and cleanup, it can take a person about 15 minutes." It will work on

mild steel and both 304 and 316 stainless steel, cast aluminum, copper, and nonmetallics including fiberglass — "just about anything except glass."

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