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About SigmaTron International

SigmaTron International (NASDAQ:SGMA) is a full service EMS provider with a network of manufacturing facilities in the United States, Mexico, China and Vietnam.

We focus on companies who want highly customized service plus a scalable global manufacturing footprint.

We serve a diversified set of markets which include: industrial, consumer and medical/life sciences customers. Our quality certifications include ISO 9001:2015, ISO 13485:2016, IATF 16949:2016 and AS9100D. We are also International Traffic in Arms Regulations (ITAR) registered.

Tijuana Team Adds In-House Fixturing Capability

One thing OEMs agree on universally is that they don't like non-recurring engineering (NRE) charges. That said, custom tooling, fixtures and jigs help eliminate defect opportunities by minimizing the process variation that could otherwise occur. The Lean Six Sigma team at SigmaTron International's facility in Tijuana, Mexico has been investigating ways to reduce tooling-related NRE costs by developing internal 3D printing and computer numerically-controlled (CNC) machining capability.

The facility now has a Titan X2 3D printer, a FoxAlien Masutor Pro CNC router, FoxAlien

CNC XXL router and the software tools necessary to design and fabricate a wide range of fixtures.

In the first seven months of 2023, designing and fabricating fixtures internally has generated a nearly 200 percent cost savings over what the fixture cost would have been had the fixtures been purchased from external suppliers.

"We've seen two significant benefits from this investment. First, customers find this lower NRE attractive and it has resulted in business wins. Second, this lower cost capability enables us to fixture as poka-yokes are identified in situations

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Suzhou, PRC Facility Developing PTH Automated Inspection Capability

Odd-form plated through-hole parts (PTH) continue to be used in applications where operating environments or legacy designs are not conducive to use of SMT parts. From a production standpoint, this is legacy technology and there are limited options for automating odd-form part placement or inspection. SigmaTron's team in Suzhou, PRC has been developing solutions designed to change that paradigm.

Its MVS 1.0 machine vision system is now in Stage B development. This current iteration provided automated optical inspection (AOI) for missing or misaligned PTH parts. The platform has been developed by a cross functional team that included a project leader, machine technology and mechanical engineers, a purchasing representative, a production supervisor, a process industrial engineering supervisor and a production inspector. The result is product design input from the stakeholders who understand the production challenges that the machine needs to solve.

The development effort began in May 2023. A Stage A prototype with a single camera



The MVS 1.0 Stage B prototype was added to production in August 2023.

was added to production in July 2023. The Stage B prototype with dual cameras was added to production in August 2023 and a second machine is now in development. While in production, the Stage B prototype's detection functionality is being analyzed and the software is being updated to increase the range of functions and enhance inspection coverage. Once the work with Stage B

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EGV Adds Teradyne In-Circuit Test Platform

SigmaTron International's Elk Grove Village (EGV), IL facility has added a Teradyne TestStation LHS in-circuit test platform to its test equipment portfolio.

"We had standardized on Genrad previously for in-circuit test. Teradyne purchased Genrad and developed a compatibility solution that makes it possible to transfer existing Genrad programs and fixtures to this platform. This keeps NRE low for our customers with legacy products while enhancing our test solution capabilities for customers with newer technology," said Uche Ohiri, EGV's Director of Test Engineering.

The TestStation LHS in-circuit test system has a small footprint and is feature scalable. It features the voltage accuracy and backdrive current measurement embedded in Teradyne's SafeTest protection technology for accurate, reliable and safe powered-up testing of new low-voltage software. It satisfies low and high pin count applications; supports up to 16 pin card slots; and is configurable with



The new ICT has a small footprint and is compatible with legacy product test fixtures and programming.

analog only, pure pin, hybrid and high-density pin cards. Its test points range from 2,048 to 4,096.

SigmaTron's test engineering team has already converted test programming and fixtures for three legacy products to the new tester. Existing fixtures are compatible and following conversion, old programming only

needs minor adjustments to retain the same functionality on the new platform.

While a separate functional test platform is still preferred for products requiring complex functional testing, the Teradyne platform can perform simple functional tests. It can also do flash programming as part of test.

Its higher end capabilities are already paying dividends for customers with complex test needs.

"We have a customer known for providing testing solutions to the agricultural and mechanical industries with a measurement device that has a complex component that can't be x-rayed without damage to its measurement capabilities. The new tester can electrically and functionally test the component to ensure it is placed correctly and functions," added Uche.

Another benefit of the new test platform has been a reduction in false failures of over 70 percent. Currently, EGV has one Genrad tester still in service and will replace it once the Teradyne system has proven itself out in production.

SigmaTron Focuses on Sustainability

Infrastructure technology has improved significantly since many of SigmaTron International's facilities were built, so it shouldn't be surprising that there has been a multi-year effort throughout the company to upgrade to more sustainable infrastructure.

Most of SigmaTron's facilities have upgraded to LED lighting. This reduces annual kilowatt consumption related to lighting by more than 30 percent. There is also a maintenance savings as lights need to be changed less often. In the EGV facility, the switch to LEDs saves over \$30,000 in total savings annually and availability of utility

rebates offset nearly 50 percent of the upgrade cost. That level of savings was driven by incorporating the use of motion sensors so lights turn off if no one is in the monitored area plus the use of daylight harvesting technology which dims or turns off lights if the area has enough outside light.

The Chihuahua, Mexico facility changed over to LED lighting over a four-year period and also replaced a 60-ton air conditioner with two 30-ton units to provide better zone cooling options. Office restrooms now have sensor-controlled faucets and urinals are now waterless, to better conserve water resources. A new class 100,000 clean room is under construction and the engineering

team is testing new LED sealed lamps for that area that are brighter and consume less energy.

The Suzhou, PRC facility has also switched to LED lighting and utilizes electric forklifts.

SigmaTron's US border warehouses are also switching to electric forklifts as they replace gas-powered models.

From a company standpoint, these upgrades improve energy/water use efficiency and may also improve workplace quality of life in small ways. From a sustainability standpoint, the changes help reduce reliance on limited resources.

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Fixturing

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where externally-built fixtures would have been cost prohibitive. So, customers get the benefit of lower NRE and the benefit of improved quality,” said Filemon Sagrero, Continuous Improvement Engineer.

The fixtures are utilized in a variety of operations including manual insertion,

wave solder, AOI, SMT, test, secondary assembly and box build operations. In addition to the improvement opportunities identified by Lean Six Sigma-trained personnel in regular Gemba walks through the production area, the facility’s Industry 4.0 AOI inspection capability which covers both SMT and secondary assembly operations helps rapidly identify quality trends where a poka-yoke

fixture solution would eliminate a defect opportunity.

“Even when defect rates are small, each defect carries a cost. We are constantly looking for ways to achieve zero defects. Fixturing supports that goal, particularly in products where redesign isn’t an option,” added Filemon.

Automated Inspection

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is completed, work will begin on a Stage C MVS-V2 machine that incorporates robotics to minimize handling and improve cycle time. The Stage C unit will have an inline dual camera and be capable of inspecting for a greater number of defect types than Stage B. The target time for Stage C kickoff is March 2024. A Stage D

MVS-V3 will integrate Industry 4.0 AI inspection capabilities into a final machine after Stage C analysis is complete. This final unit will have machine learning capabilities, enabling it to improve detection as its database analyzes trends over time.

The initial goal of this development effort is to meet customer requirements for quality, improved process control and traceability in processes where automated inspection

and test options have been limited. This initial focus helps reduce cost and the variation associated with manual inspection operations. Longer term, the goal is to provide an Industry 4.0 compatible robotic system for PTH PCBA manufacturing to improve quality and efficiency on a broader scale.