ONE SOURCE. GLOBAL OPTIONS.®
SIGMATRON INTERNATIONAL

THE SOURCE...

For News, Capability Updates and Success Stories at SigmaTron International

First Quarter 2024 | Volume 12, Issue 1

Inside this issue:

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.

Corporate Engineering Team Sees a Changing of the Guard

Tom Musser

Tom Musser has been promoted to the position of Corporate Director of Business Development, Technical Sales and Service. In that role, he will be assuming the responsibilities previously handled by Jerry Johnson, who has retired.

"I'm pleased that we are able to have a strong transition between two outstanding members of our engineering team. Jerry Johnson has done an wonderful job leading our Design Engineering Services group. While in the short term Tom will focus on the engineering services we currently provide a limited number of our customers, longer term he will be expanding engineering offerings to other areas of the Company, as we evolve our vision for product development and test support," said John Sheehan, SigmaTron International's President.

Tom previously served SigmaTron's engineering services team as Director of Product Management. He earlier served as a program manager. He was earlier associated with Chamberlain, Emerson Appliance Control and Texas Instruments in a variety of management and engineering positions.

He received a Bachelor of Science degree in electrical engineering from Bucknell University.

Chihuahua, Mexico Facility Diversifies Business Base

SigmaTron International's facility in Chihuahua, Mexico has added its first two automotive programs. The first program involves a trailer light control and the second involves an automotive light control.

The Chihuahua facility's investment in state-of-the-art SMT equipment and industry-specific certifications is attracting a broader base of customers.

The program involving a trailer light controller printed circuit board assembly (PCBA) has completed its Production Part Approval Process (PPAP) and was approved for full production in January. The program is currently shipping 5,000 units per month with volumes scheduled to ramp to 9,000 units per month by year-end.

The second program involving two automotive lighting control PCBAs has started production in January with a deviation pending implementation of planned materials engineering change order (ECO).

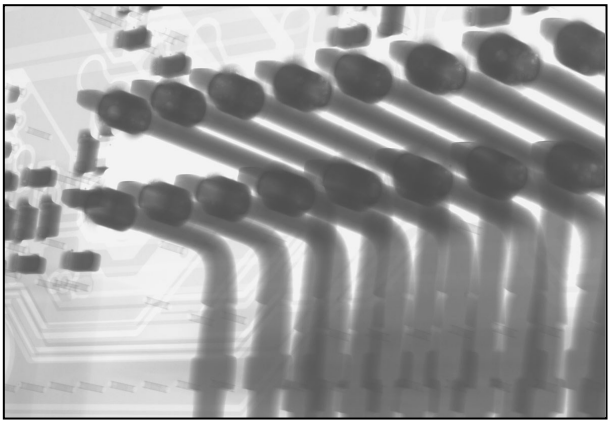
Pin-in-Paste Process Has Multiple Advantages

SigmaTron International's facility in Chihuahua, Mexico takes an innovative approach to processing some of its mixed technology printed circuit board assemblies (PCBAs). While most PCBAs today are entirely SMT, some products require limited use of through-hole parts in cases such as connectors, where a more robust solder joint is needed.

While wave soldering can be utilized as a high volume soldering solution, this adds extra handling, an additional process step and an additional thermal cycle.

Automated optical inspection (AOI) is critical to monitoring the the pin-in-paste process.

The team in Chihuahua has developed a pin-in-paste process which eliminates these issues by soldering through-hole components in the same reflow process utilized for the SMT parts. The process was originally developed to support appliance-related customers utilizing low temperature solder pastes with bismuth requirements and is now being utilized for some automotive products.



X-ray inspection is used to validate pin-in-paste process assumptions.

"The pin-in-paste process is easier to control. It requires a good stencil design and the right lead-to-hole ratio. We utilize 3D SPI and x-ray to control the filling of the holes when setting up the process, and 3D SPI and AOI to monitor the manufacturing process," said Alvaro Grado, the Chihuahua facility's Manufacturing Engineering & Quality Manager.

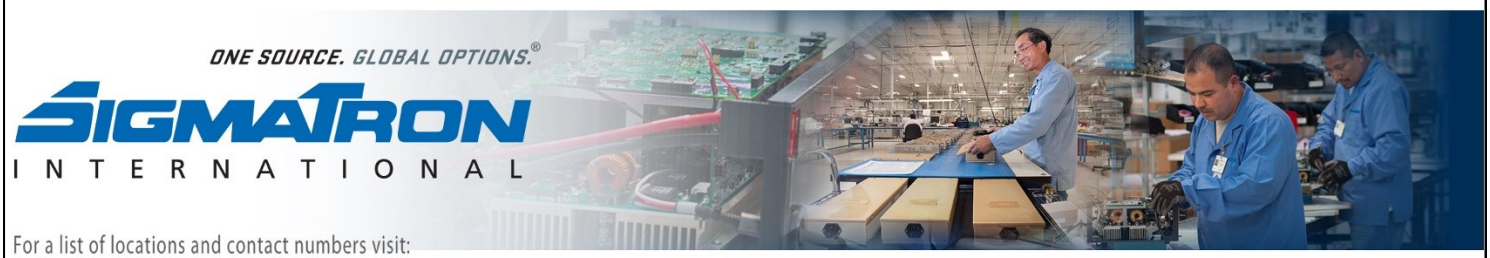
Román Rodelo Named Tijuana, Mexico Plant General Manager

Román Rodelo

Román Rodelo has been promoted to Plant General Manager of SigmaTron International's facility in Tijuana, Mexico. He joined SigmaTron as the facility's Production Manager in 2011. He was earlier associated with Muramoto Sumitronics and Panasonic in various production management positions in Mexico. While at Panasonic, he spent six months training in Japan. He trained in Thailand while with Muramoto Sumitronics.

"Román has over 26 years of experience in production management and quality systems. He is also skilled at working in multicultural environments, which can be critical given the diversified customer base our Tijuana facility serves. I feel he will be an asset to our facility in this new role," said Raj Upadhyaya, Executive Vice President, SigmaTron West Coast Divisions.

Román received a degree in industrial and quality systems engineering from the Culiacan Technological Institute, in Culiacan Sinaloa, Mexico. He is a Six Sigma green belt and certified in Lean manufacturing. He also is certified in leadership training.



Have a suggestion or article idea?
Contact Curtis Campbell, VP Sales
Phone: 510-477-5004
Email: curtis.campbell@sigmatronintl.com

SigmaTron Featured in Multiple Industry Articles

SigmaTron International's team regularly publishes articles in industry publications such as ***Circuits Assembly*** and Electronics ***Sourcing***. Links to several recent articles are provided on this page.

Links to all recent articles are provided on our website: News | Sigmatron International (sigmatronintl.com).

Articles and whitepaper sortable by key word topic and/or date are also provided on our blog: News, Events and Best Practices Tips from SigmaTron International


The Benefits of Internal Benchmarking

Published: 03 January 2024
by: Anita Tucker

Looking within the organization can yield unexpected benefits.

Benchmarking is an integral part of any continuous improvement strategy. There are typically three types of benchmarking: cross-industry, competitive and internal. Cross-industry benchmarking looks at similar processes in different industries and often delivers the biggest breakthroughs because it helps companies identify processes and systems not widely used in their industries. One example is Southwest Airlines benchmarking NASCAR pit crews' performance. Competitive benchmarking looks at data from competitors. The challenge is that direct competitors are not likely to share at the level possible with a cross-industry benchmarking exercise, and given the similarity of processes, the best-case improvement is often just being as good as your best competitor.

Internal benchmarking can take two forms. In the first form, processes and systems are evaluated against Lean manufacturing standards to target areas of improvement. In the second form, different facilities of a company are benchmarked to find improvements based on differences in processes and systems.

SigmaTron is increasing its use of internal benchmarking. Its facilities each focus on the industries and customer requirements that they serve. For example, its Mexico and China operations typically run higher-volume products which often cost-justify specialized equipment, tooling or processes not as well developed in operations running lower volumes. One of the most common benchmarking activities involves equipment acquisition. As facilities consider upgrading equipment options, they look to other facilities to better understand the options and experiences with the equipment they use. This reduces the learning curve associated with new technologies while providing more context on how this equipment operates in real-world environments. For example, when one of SigmaTron's facilities was adding nitrogen to reflow process, it benchmarked other facilities to determine whether nitrogen tanks or a generation unit made more sense.

Benchmarking can be virtual or onsite. The virtual process examines metrics, and the onsite process enables a team to view the operations they are studying. The increase in internal benchmarking has brought a switch from virtual benchmarking to onsite visits. Virtual benchmarking typically utilized a preplanned questionnaire, and while it saved on travel expenses, the downside was that it just gathered data found in the questionnaire. Improvements that weren't specifically asked about weren't mentioned in the response.

This issue was recently illustrated in a benchmarking trip that sent a five-person cross-functional team from the EGV facility in Elk Grove Village, IL, facility to one in Acuna, Mexico. One of the areas being evaluated was selective soldering. The Acuna facility's high-volume environment has made it an expert in solder pallet design, and its team has been designing EGV's solder pallets to requirements specified by EGV's team.

While in the facility, the team realized Acuna's solder pallets had additional features driven by poka-yoke that weren't incorporated in their pallet design. The Acuna pallet design poka-yoke incorporated features that made it impossible for an operator to place a component incorrectly, while the EGV facility had been using transparent overlays as a poka-yoke to eliminate this defect opportunity. Additionally, some Acuna pallets had been modified to shield the printed circuit board assembly (PCBA) from flux overspray. EGV had also modified some of its pallets to deal with this issue in conformal coating, but the Acuna shield design represented an improvement they hadn't considered.

The team included both technical and managerial resources. Teams composed exclusively of technical personnel tend to focus on production processes and equipment. Broadening the team to include managerial resources enables better analysis of non-value-added but necessary processes, such as planning and release of kits from the stockroom for potential improvements. Quality practices were also reviewed. The Acuna facility's higher volumes make it data-driven and focused on inspection efficiency. Operators check the work of the previous station as part of this process. Additionally, acceptable quality level (AQL) data are utilized to determine sampling plans, and in some cases, specialized short-term inspection operations are set up to address specific issues.

Similarly, a recent all-hands meeting at EGV enabled personnel from other facilities to look at EGV processes. While not designed as a formal benchmarking effort, the tour generated discussions that will likely lead to further internal benchmarking efforts among facilities.

Multi-facility manufacturing operations benefit from focused internal benchmarking efforts. In some cases, this benchmarking may drive improvements in similar processes. In other cases, this benchmarking may create strategic partnerships where a facility deemed expert in an area such as tooling design can supply that expertise in facilities not able to justify developing that capability internally. Onsite benchmarking enables teams to view improvements they may not have been originally looking for. It also breaks down silos that can develop when different facilities have different areas of expertise.

ANITA TUCKER is the general manager of SigmaTron International's EGV facility. She can be reached at anita.tucker@sigmatronintl.com.

Read Article


Continuous Improvement and Mass Inspection

Published: 04 September 2023
by: Filemon Sagrero

Automating inspection in secondary assembly operations.

One of the first lessons in quality management is the difference between quality assurance and quality control. Quality assurance focuses on eliminating defect opportunities before they occur, while quality control focuses on inspection strategies that eliminate defects before they escape the factory. There is universal agreement that quality assurance is more cost effective than quality control. Lean manufacturing principles are based on a quality assurance focus. That said, use of automated inspection equipment has been growing dramatically in recent years because increasing density and complexity in printed circuit board assemblies (PCBAs) is driving the need for a blended quality assurance/quality control approach that includes mass inspection.

Over the past 18 months, SigmaTron International's facility in Tijuana, Mexico, has been exploring the best way to automate inspection and integrate the captured data into real-time corrective action throughout its entire PCBA assembly process. A July 2022 PCD&F/CIRCUITS ASSEMBLY column, "An Industry 4.0 Approach to Employing 3-D AOI on an SMT Line," discussed the journey of integrating Industry 4.0 capabilities in a Lean Six Sigma framework in this facility's SMT area. Once that phase was completed, implementation of 3-D AOI capability began in secondary assembly work cells. Typical secondary assembly operations include soldering cables and components such as switches which can't be reflowed, adding rubber caps and placing QR labels.

Unlike the SMT area where PCBA handling, assembly and inspection operations are inline and automated, secondary assembly operations include semiautomated and manual processes plus manual handling during transit among work cells. This stage of the process introduces a higher potential for cavitation and associated defect opportunities, particularly in complex PCBAs. Monthly volumes are in the millions on many part numbers. The goal of utilizing 3-D AOI for mass inspection following secondary assembly wasn't to implement a long-term 100% inspection process for every product. Instead, two 3-D AOI machines have been installed in the secondary assembly area to focus on complex products with low yields. Defect data for all products built are analyzed. PCBAs showing lower yields in secondary assembly are shifted to 3-D AOI inspection to better determine defect root causes and implement corrective action. When results show desired improvement levels, new products destined for continuous improvement action are shifted to inspection.

The project implementation team included a Six Sigma Black Belt, a fixture designer/continuous improvement technician, an SPI/AOI programmer/continuous improvement technician, an AOI technician associated with quality assurance and a project administrator/trainer who is also a continuous improvement assistant.

In setting up the systems, the implementation team utilized Gage R&R (GR&R) studies for repeatability, and reproducibility using the Automotive Industry Action Group's acceptability definitions. Cp and Cpk ratios were also calculated to measure the process capability against voice of the customer (VoC) standards and requirements, ensuring machine programming reflected all failure modes identified by the customer on the products under study. Once control limits were established, programming parameters were adjusted for each PCBA to assess acceptability based on IPC-A-610 and customer documentation requirements. The programming process differed from the SMT setup in the number of datasets required. Setting up the 3-D AOI program validation database for SMT required 16 datasets, while secondary assembly required 32 datasets for the initial products under study. As with the SMT area setup, there is a methodology for utilizing trends tracking in continuous improvement activities. Data are available in real-time to correct defects immediately and can also be viewed remotely for more detailed trends analysis. The 3-D AOI machines continue to learn as they analyze trends.

Two Kaizen events were held to improve initial implementation assumptions related to fixturing. Analysis of initial trending indicated that the fixturing design to facilitate inspection did not have enough support for the solder side of the PCBAs and was causing board warpage. The fixture design was modified to include additional support. Additionally, the initial fixture storage setup did not make it easy enough for operators to easily identify correct fixtures. To counter this, 5S principles were implemented that segregated fixture storage by product in custom-designed storage carts.

Since implementing mass inspection, customer report card data shows an over 50% improvement in yields on the inspected boards. Use of 3-D AOI instead of manual inspection is also reducing inspection time on complex PCBAs while improving accuracy of defect identification. SigmaTron's team is working with the customer on design for excellence (DfX) suggestions to further improve yields on PCBAs with manufacturability issues contributing to lower yields. The result is a stronger partnership with customers that focuses on improvements in quality assurance as a result of data derived from quality control activities.

FILEMON SAGRERO is continuous improvement engineer at SigmaTron International (sigmatronintl.com) and a Six Sigma Black Belt; filemon.sagrero@sigmatronintl.com.

Read Article


In-House Fixture Fabrication

Published: 01 November 2023
by: Filemon Sagrero

Leveraging additive manufacturing technology to mistake-proof production.

One thing OEMs universally agree on is that none of them likes non-recurring engineering (NRE) charges. Implemented as part of new product introduction (NPI), however, custom tooling, fixtures and jigs can eliminate defect opportunities by minimizing process variation that could otherwise occur when those issues can't be resolved through product design changes. They are also a good tool when a production team identifies the need for a poka-yoke, or mistake-proofing solution, later in a product's lifecycle.

The concept of poka-yoke was developed by Shigeo Shingo as part of the Toyota Production System (TPS). When applied, the resulting process improvement eliminates a specific defect. Its focus on simplicity is its strength, in that simple fixes are often the best solution for small variances in the manufacturing process. Simple fixes are also easy to rapidly implement and encourage production operator involvement in the pursuit of product perfection. That said, when fixtures are procured through third parties, the cost may exceed the benefit.

The Lean Six Sigma team at SigmaTron International's facility in Tijuana, Mexico, decided to investigate ways to reduce tooling-related NRE costs by developing in-house 3-D printing and computer numerically controlled (CNC) machining capability. In 2022, they initiated a DMAIC (define, measure, analyze, improve and control) effort to determine necessary equipment and the likely return on investment if the capability was added.

The facility now has two 3-D printers, two CNC-controlled routers and the software tools necessary to design and fabricate a range of fixtures. In the first seven months of 2023, designing and fabricating fixtures internally has generated cost savings of almost 200% over the costs had the fixtures been purchased from external suppliers.

In addition to lowering tooling-related NRE costs as programs are ramping up, the lower cost of this in-house capability has made it possible to expand use of specialized tooling for poka-yokes identified in Kaizen events. Improvement opportunities are 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, is also helping rapidly identify quality trends where a poka-yoke fixture solution would eliminate a defect opportunity.

In one case, an overlay was created to cover an unused plugged via on a printed circuit board assembly (PCBA) used in a harness assembly. Production operators soldering the harness to PCBA were confused by the via because it looked similar to pads for the harness attachment and was in the same area of the PCB. Once the overlay covered the via, yield improved from 95% to 100% on the product. The annual return on investment exceeded the cost of the overlay by over $3,000.

In another case, wave soldering had become a production bottleneck due to a shortage of fixtures used to stabilize a capacitor on PCBA. Lower cost in-house fixturing capability enabled the team to add 20 additional fixtures. Waiting takt time per assembly dropped to 1 min from 10 min. The annual return on investment exceeded the total cost of the fixtures by nearly $1,500.

In a different example, a manually inserted connector needed to be pressed into a socket on the PCBA. Manual pressure increased the risk of damage and had a 5 min. takt time. Internally designed and fabricated small press tools controlled the pressure, eliminating the damage risk. Takt time on the operation dropped to 30 sec. The annual return on investment exceeded the cost of the presses by over $2,500.

In addition to quality, cost and efficiency improvements, moving to an in-house fabrication option has given the team better control of the tooling design and reduced tooling fabrication lead time. The fixtures are utilized in a variety of operations including manual insertion, wave solder, AOI, SMT, test, secondary assembly and box-build.

The Lean Six Sigma team is now evaluating ways to better automate the tooling fabrication process, to further shrink lead time and cost.

FILEMON SAGRERO is continuous improvement engineer at SigmaTron International (sigmatronintl.com) and a Six Sigma Black Belt; filemon.sagrero@sigmatronintl.com.

Read Article


MAKING SENSE OF EVOLVING SERVICE REQUIREMENTS

November 17, 2023

SigmaTron International's Allen Abell explains how EMS providers are playing the lead role in helping OEMs manage increasingly complex compliance regulations

Outsourcing electronics manufacturing used to focus on identifying the best partner in a location providing cost or proximity advantage. Today, manufacturing expertise is only part of that equation.

Electronics manufacturing services (EMS) providers are now expected to provide a complete solution that may include product development assistance, multi-region manufacturing support and post-manufacturing logistics support. The supply chain management element equation has expanded to include serving as a conduit for increasing compliance reporting requirements. Growing interest in environmental, social and governance (ESG) practices has expanded the breadth of audits and increased the range of metrics EMS companies must measure.

Regarding outsourcing strategy, it is important to analyze whether projects require an EMS provider capable of delivering a more complex compliance solution, particularly if the project's annualized volumes range from 50,000 to 500,000. Understanding compliance reporting complexity is critical. Some well-established requirements such as the Conflict Minerals reporting requirement of Section 1502 of the Dodd-Frank Wall Street Reform and Consumer Protection Act, CA Prop 65, RoHS, REACH and SCIP reporting are well-served by supplier disclosures, third-party databases and reporting templates. However, initiatives expanding due diligence on sources or actual elimination of raw materials or chemical substances are ongoing. Where OEMs have started proactively tracking substances and expect support from their EMS provider, internal EMS resources are often required. The following are some initiatives.

The Extended Minerals Reporting Template (EMRT) created by the Responsible Business Alliance (RBA) focuses on cobalt and natural mica supply chains. While not required by any regulatory body, it is designed to support due diligence in accordance with the OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas by expanding the list of conflict minerals monitored.

The Toxic Substances Control Act (TSCA) as amended by the Frank R Lautenberg Chemical Safety for the 21st Century Act, has resulted in the US EPA beginning a safety review of a list of 90 chemicals developed in 2014. Under the legislation, the US EPA must now have at least 20 of these chemicals under safety review evaluation at any time. If it is determined a chemical presents an unreasonable risk, EPA must mitigate that risk within two years.

Various US states are restricting use of per- and polyfluoroalkyl substances, known as PFAS or forever plastics. The European Chemical Agency (ECHA) is also proposing a universal ban on PFAS within the EU by 2026. The list of PFAS has not been fully established and some don't have Chemical Abstracts Service (CAS) numbers. This complicates PFAS reporting.

SigmaTron International uses proprietary software, third-party databases and an internal Compliance and Sustainability Center team to address customers' reporting requirements. The Center is in its Taiwan International Purchasing Office which coordinates disclosure statements as new suppliers are added. The team also supports customer-driven ESG audits, as needed. A specialized team addresses reporting requirements not well covered in third-party databases. The team also provides feedback to help design out problematic materials.

Read Article