It’s More Than Inspection: It’s Process Improvement

Barry Matties speaks with Brian D’Amico, president of MIRTEC, about the current state of machine-to-machine communication in the industry, and how the inspection company is interfacing with the different manufacturing languages currently available to gather predictive data and feedback from every inspection step to eliminate future defects.

Barry Matties: First, can you tell our readers a little bit about MIRTEC?

Brian D’Amico - MIRTEC Corp

Brian D’Amico: Certainly Barry. MIRTEC is a Leading Global Supplier of inspection equipment to the electronics manufacturing industry. Our company is basically comprised of three separate divisions serving the SMT, LED and Semiconductor industries. We also own a camera division, ISVI Corp, which manufactures cameras for all of the various systems across these divisions. Here at SMTAI we are primarily focused on SPI and AOI equipment for SMT manufacturing.

Matties: Let’s start with SPI. In the SPI realm, what challenges or trends do you see from your customers?

D’Amico: In terms of the SPI machine, there is a trend toward closed loop feedback. In other words, the SPI system must be capable of communicating upstream with the screen printer/dispenser, as well as downstream with the pick-and-place machine. The goal is to provide actionable data to the Screen Printer and Pick-and-Place systems that may be used to reduce defects and maximize efficiency. Industry 4.0 is a topic of much discussion within the electronics manufacturing industry. Manufacturers and vendors are basically trying to come to terms with what that means. In the most simplistic of terms, Industry 4.0 is a trend toward automation and data exchange within the manufacturing process. This basically requires connectivity and communication from machine to machine within the manufacturing line. The challenge is to collect data from each of the systems within the line and make that data available to the rest of the machines.

Matties: When you mentioned communicating, are machines upstream and downstream are making adjustments and fine tuning to that particular panel?

D’Amico: Yes, however, these adjustments are typically based on trends within the inspection data. For example, let’s say that the SPI machine detects an offset trend in solder depositions, with regard to pad location. Under these circumstances the SPI machine would report the trend to the Screen Printer. The Screen Printer in turn may then use this data to adjust the location of the stencil with respect to the pads in order to eliminate the offset. Please keep in mind that the goal is not to control the Screen Printer, but to provide actionable data which may be used to eliminate the offset trend and potential defects.

Matties: So, the machines do this without human intervention?

D'Amico: Yes and no, it's really up to each vendor to determine whether adjustments are to be made manually or autonomously. Most vendors will provide a means of selecting between manual and automatic mode.

Matties: This is a big deal in yield performance.

D'Amico: Agreed.

Matties: Is there a proprietary or a universal language that people can tap into their data models?

D'Amico: That is a very good question. There's a trend towards standardization right now. Keep in mind that there are two basic requirements for machine to machine communication. The first is connectivity, the second is data sharing from machine to machine. The goal is to format the available process data from each respective machine in a manner which is usable by other machines within the line.

If we take this one step further, the ultimate goal is analysis of "Big Data". This is where we want to use Artificial Intelligence (AI) to help determine where the manufacturing process broke down and make recommended corrective actions. That's a while off yet; it requires a lot of data and AI to sort through that data and come up with recommended predictions.

Matties: If we can predict it, then the machines can adjust on the fly, which eliminates the need for personnel in line.

D'Amico: That's the key. There's no way to beat a human being right now because humans can evaluate all of the various process information a lot better than a machine can at this time. The goal of any AI engine is to try to approximate the decision-making capability of a good process engineer, but I think that's quite a bit off. It's going to require a lot of data and processing power to get there, but that's the "Holy Grail," to have the machines communicate with each other and come up with predictive data that eliminates defects at each stage of the manufacturing process.

Matties: How many of your customers or prospects are demanding this, or is this a requirement for doing business with them?

D'Amico: Well, with the movement toward Industry 4.0, I find that a lot of people are asking the same question. Are these machines Industry 4.0 capable? I understand the reason for this concern. When a manufacturer invests in a new piece of assembly equipment, they expect to use the equipment for a period of 5 to 10 years or more. So it stands to reason that any new piece of assembly equipment must provide the required process data as well as the ability to communicate with other machines within the line. These are the basic requirements for Industry 4.0 capability.

Matties: You started by saying there's this movement toward Industry 4.0, but what does that really mean? How do customers define that or distill it down to something that's meaningful? Do they come with you and say, "We already have this language in our shop, and we want you to adhere to that?"

D'Amico: It's important to keep in mind that Industry 4.0 is still evolving. So, it's not really a matter of somebody saying, "This is what I have now, and you have to adhere to it;" it's more like, "Can you tell me what this is all about?" The bottom line is that all of us are still in the midst of defining Industry 4.0 and how it pertains to the electronics manufacturing industry.

Matties: As the industry moves forward and we see the integration of data, part of the problem that we're facing now is data overload. What sort of datasets do you think are the most valuable for people to look at?

D'Amico: I completely agree, there is a definite excess of data. It is important to understand, however, that only certain data may be useful from one machine to another. In other words, only specific subsets are going to be used by each machine. That's still something that we vendors are trying to determine: "What data can be used by each system to streamline the manufacturing process?"

Let's consider the following example in which we are assembling a panelized PCB with an X-out. The location of bad module is not really useful to a Screen Printer, but it would indeed be useful for to a Solder Jetting System. Once the bad module has been identified, this information is fed forward to the SPI system, the Pick-and-Place machine, the Post-Placement AOI systems and the Post-Reflow AOI system eliminating the need for these systems to check for X-outs, thereby streamlining this particular process of identifying a bad module within a panel.

Matties: It's interesting because there are two parts to data. One is the data that the machine—upstream or downstream—needs, but there's also the data that the human needs because we have to put it into context. The context still matters. What were the conditions, what caused the variations, and from the installs that you see, what sort of yield improvements are they getting with this 4.0 strategy?

D'Amico: Again, Industry 4.0 is still evolving within the electronics manufacturing industry. In my opinion it will take some time for this project to mature. In the interim, the focus is on providing detailed process information to the manufacturing engineer so that he or she may use this data to maximize line efficiency and yield. For example, MIRTEC has developed a proprietary Intelligent Factory Automation Software Suite called INTELLISYS. Within this suite is an application called INTELLI-TRACK. This software collects data from our SPI, Post-Placement AOI and Post-Reflow AOI machines and provides this data to the process engineer on one dashboard. We also have a variant of this software called Smart-Loop where the application also displays data from an At-Line X-ray system. Smart-Loop is a collaborative software application between MIRTEC and YXLON.

Matties: So, we are talking about “Human Data”.

D’Amico: Exactly. The process engineer can see all of this process data at a glance allowing him or her to determine exactly where the defect was introduced within the manufacturing process. They would then use this data to modify the process as required. I consider this to be an interim Industry 4.0 solution because the machines aren't making these decisions. The goal is to maximize efficiency and decrease defects, and we still need a human to do that. As far as doing this automatically, our industry simply is not there yet.

Matties: Is it years down the road?

D’Amico: I believe so. This will require the collection and processing of “Big Data” using Artificial Intelligence. We, as an industry, still have a way to go to achieve this goal.

Matties: As an equipment OEM, it sounds like you've focused on software code. Is that something you had to think about more recently in the last five years or so?

D’Amico: Yes, but rather than “re-invent the wheel”, we made a strategic decision to partner with companies like Cogiscan. Cogiscan specializes in machine to machine communication allowing us to connect to virtually any machine within the manufacturing line. Machine data is then collected, formatted and entered into a repository from which it is made available to other systems within the line. This also overcomes the hurdle of working with some competitive systems. Together MIRTEC and Cogiscan have collaborated on a fully integrated Industry 4.0 solution which is our Total Remote Management System (TRMS). This application displays data collected from MIRTEC’s AOI and SPI systems as well as all other equipment in the SMT manufacturing line giving our customers a clear view into the manufacturing process, thereby helping them achieve higher operating efficiencies and improved quality.

Matties: The other thing that is interesting with manufacturing today is the datasets that are coming in from the factory at the design level to the bare board fabrication level because we hear that 99% of the files that come into a board shop need some form of data verification or correction. Do you see any issues with data coming into the EMS companies?

D’Amico: Yes, I would say that on average 90 percent of the time there is some sort of issue with the data, which is somewhat understandable because there are so many variables involved in the manufacture of finished PCB assemblies.

Matties: There has to be discipline though. Someone's going to have to drive that data model.

D’Amico: I completely agree. It stands to reason, if the data is inaccurate then the process will ultimately fail. Industry 4.0 depends upon accurate data every step of the way. There is very little room for error.

Matties: It sounds like there's a real front-end need. When we talk about the factory automation part of it, people say, "Well, I have a loader or unloader," and that's factory mechanization. Automation is the ability to move data and have the equipment adjust and process without human intervention.

D'Amico: Yes, unfortunately the proverbial "lights-out" factory is going to require a higher level of discipline every step of the way.

Matties: Do you have any final thoughts that you would like to share regarding Industry 4.0 and how it relates to SMT inspection?

D'Amico: Yes. I recently hosted a workshop at the Comet Group's LabONE facility in San Jose titled "The Future of SMT Inspection" in which I pointed out that to truly attain Industry 4.0, and become "lights-out" at some point, feedback is going to be required after each stage of the manufacturing process. This translates to a requirement for more inspection equipment throughout the line. The fact of the matter is that in order to achieve Industry 4.0 capability in the future, SMT manufacturers must invest in Solder Paste Inspection (SPI) equipment followed by Post-Placement AOI, Post-Reflow AOI and X-Ray Inspection. This is a significant investment which must be understood moving forward.

Matties: And people used to look at inspection equipment as non-value added.

D'Amico: Yes, I know. But I believe that paradigm is changing.

Matties: We should start changing the term "inspection" to the phrase "process management." You need inspection to get your process right, so it's a process management tool.

D'Amico: Agreed. The absolute goal with any piece of inspection equipment is not only to catch defects but to provide the data necessary to perfect the manufacturing processes thereby preventing defects from ever occurring in the first place. Unfortunately, there are far too many variables in the manufacturing process to guarantee zero defects which is why manufacturers must continue to reply upon automated inspection.

Matties: There are variations, climate changes, and employee and chemical changes. There are so many variables that you need the process management tools to keep it in line.

D'Amico: I completely agree.

Matties: Thank you so much, Brian.

D'Amico: It's been a pleasure as always Barry.