



Inspection and Test Philosophy

Lectronix's manufacturing team has been an early adopter of several advanced manufacturing techniques (BGA placement, no clean solder process, etc.) and our approach to inspection and test is no different.

Simply put, the core job of any EMS provider is to put parts in the right place and to make good solder joints. That is essentially what we do. As such, Lectronix has focused on inspection and test to ensure we do our job as well as it can be done.

Our approach is to use automated inspection equipment (AOI and AXI) to ensure we place parts accurately, in the right location and orientation, and that the solder joints are good. We then use final functional test to ensure the product functions according to the customer's test or product specification. (This is where we find defective components.)

AOI (Automated Optical Inspection) is defined by Lectronix as a way in which to verify a PCB assembly against a known good visual sample that is consistently repeatable. This type of inspection can find all types of defects such as missing, rotated, skewed, tombstone, and wrong parts just to list a few.

AXI (Automated X-ray Inspection) is defined by Lectronix as way in which to inspect all types of solder joints on all types of PCB assemblies and is consistently repeatable. This type of inspection can find all types of solder defects such as insufficient, excess, open and shorted solder joints just to name a few and it can inspect all types of solder joints such as BGA, uBGA, fine pitch and all other types of pad configurations and some solder joints that may not be visible by the human eye.

There are 4 significant stages in which this inspection approach is beneficial not only to Lectronix but also you, the customer. The stages are Prototype Inspection, First Production Run, Production, and Customer Site.

Prototype Inspection:

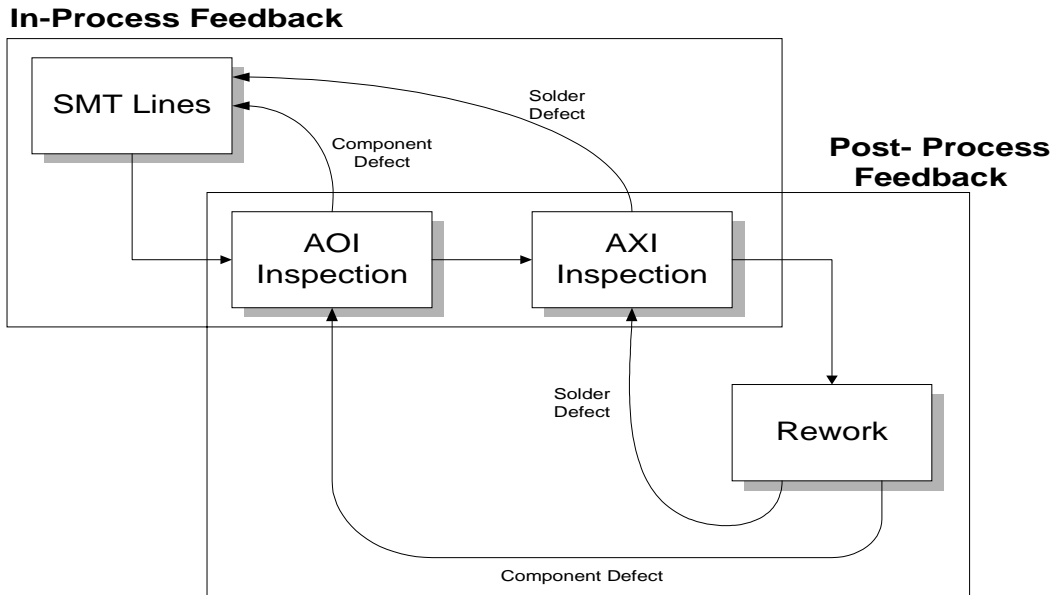
Very few, if any, prototype runs justify ICT test fixtures either in terms of money or time. Typical prototype builds only get visual inspection, and result in added time and expense because engineers spend time debugging manufacturing errors instead of verifying design issues. We use AOI and AXI whenever possible for prototype builds. If we have the PCB design or gerber files, we can quickly generate AXI files that give an extremely good initial inspection routine. We also manually verify BGA and Fine Pitch QFP's. AOI is also used to quickly find differences among the boards, which can then be verified by trained technicians. This inspection combination allows us to quickly get high quality prototypes into the hands of engineers, thus reducing total prototype cost, and providing faster time to market.

First Production Run – “First Article” & Change Overs:

Quality product starts with the first board off the line on the first production run. Our AXI and AOI equipment allows us to quickly have inspection routines ready for the first board. This saves time and money by being able to ensure quality from board one. Our standard procedure is to verify through AOI and AXI the first five boards of all production run set ups, and at the beginning of each shift. This does not only verify our setup but it also verifies that all of our SMT processes are in control.

Production:

Process control is the key to quality product. AOI and AXI allow us to constantly monitor our SMT process. Each board produced has a specific detailed inspection plan (Control Plan). Either the AOI and/or AXI operators can shut down the production line if any of the inspection results get out of range. This constant feedback and improvement loop improves the process, and prevents costly rework from happening. Additionally, any errors that occur are pinpointed so that they can be communicated and fixed immediately, and the board is put back into the manufacturing process quickly. This also saves the client the initial cost of having to develop ICT test fixtures, which normally ranges from \$15,000 to \$45,000 for an average product.



Customer's Site:

Not only does our inspection process benefit the customer in terms of lower cost because our rework is less, but the ultimate benefit is seen as significantly reduced field failures. Our inspection and test process dramatically improves the reliability of your product in the field. Because AXI can detect marginal solder joints (something not detectable by traditional ICT), our customers experience fewer product returns, resulting in lower warranty cost, thus lower overall product cost.

Summary

Lectronix does not use traditional ICT as a way to verify our process or process capabilities. We also do not typically use ICT as a way to verify if a product functions. Our normal process for any production program would be to 100% X-Ray (AXI) and 100% optical inspect (AOI) every board we assemble. We do this in place of ICT for process verification. Typically ICT is done after a kit is completed. We run the assemblies through AXI and AOI as they come off the end of the SMT line. This allows us to have faster feedback to the operators in case there are any issues. Our inspection and test plan is to focus on reducing any potential rework, and we pass this cost savings on to you. This also offers another feature that the ICT cannot; ICT only tells you if there is conduction between the component and the pad on the PCB. ICT does not recognize marginal solder joints, so it has no way of aiding in the overall reliability of the product whereas AOI and AXI specifically reviews the solder joints and will reject joints that may be marginal. Once these rejections are fixed, this dramatically increases your reliability at test and in the field. To verify that the unit is functional, we perform an end of line test (functional test) once the units are completely assembled. This is done to ensure the product meets the client's functional specification prior to leaving our facility. We have done a lot of statistical process yields at test and we show DPMs on first run programs normally less than 50 DPMs. Industry accepted average for mature programs is around 100 DPM. We are lower at start up than the normal industry production standard. For programs, once we are up and running and we start to apply group problem solving techniques, we typically bring the average DPM level down to 10 to 20 DPMs.