TECHtips

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Electronics Manufacturing Insights from ACI Technologies, Inc.

Selective Soldering and the Modular Approach

High mix production is the mainstay of many electronics assembly plants. Lot sizes and board complexities vary and the boards are often mixed technology, comprising a blend of both surface mount and through-hole technology. Modularizing a production line enables a clear distinction between one type of assembly process and another. This article assumes a modern factory where a job can be routed to the selective soldering machine module, the hand assembly bench, or a combination of both. The decision rules of routing a circuit board through hand assembly versus automated selective soldering are discussed. Hand assembly soldering operations require no explanation.

Selective soldering machines are an automated way to solder through-hole components onto a circuit board. The machine contains a heated solder tank which generates a small fountain of molten solder with approximately 0.375 in. height and 0.25 in. diameter. The leads to be soldered are positioned into this fountain of molten liquid for soldering (Figure 1) using a programmable XY translation table. The operator places the circuit board into the motorized XY table (Figure 2) and by using a program (either input by the operator or imported from circuit board drawings), directs the circuit board to move above the solder jet, lower a specific component into the solder fountain for soldering, raise the circuit board, and translate the circuit board to the next component to be soldered.

Modularizing the production plant enables planning by the manager to match the production rate and precision requirements of a specific job with the correct machine or machine operation. A clear example of this modular approach is a comparison between routing a job between a hand soldering operation and a selective soldering machine. Some decisions are obvious. After programming and set-up of a selective solder machine, the process operation will always yield the same quality solder joint repeatedly. Hand soldering can vary depending on the operator. This variation can be minimized if the assemblers are all trained to an industry standard like IPC J-STD-001, “Requirements for Soldered Electrical and Electronic Assemblies.” This standard must be applied to the finished assembly regardless of the method of assembly, manual or automated.

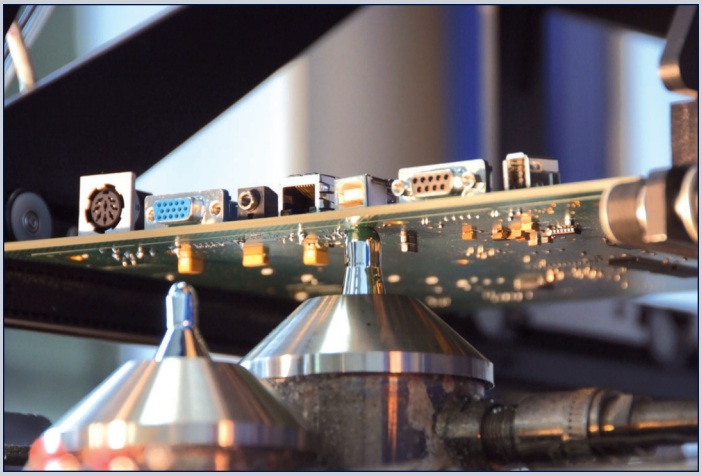

Figure 1: A dual solder wave in action.

Even though surface mount is the dominant form of components today, some components may only be available in a through-hole format (such as power transistors and connectors). When a modular production line is set-up, the decision of routing the job through the selective soldering machine may be based on the number of solder joints. If there are dozens to hundreds of joints to be soldered, the selective soldering path is a superior choice over a manual bench operation. If there are only a few joints to be soldered, hand assembly is a good choice.

Whether using manual soldering or selective soldering, the board must be inspected by a human operator. This can reduce the efficiency of the automated process. With this in mind, the best modular location for the selective soldering machine might be in the hand assembly department where the employees have the necessary experience to inspect the output of the selective soldering machine to industry standards.

Purchasing decisions of capital equipment are justified by their rate of return. A twenty percent return or better is usually considered acceptable. Considering that the cost of a well-equipped selective soldering machine is about $65,000, to be affordable the machine

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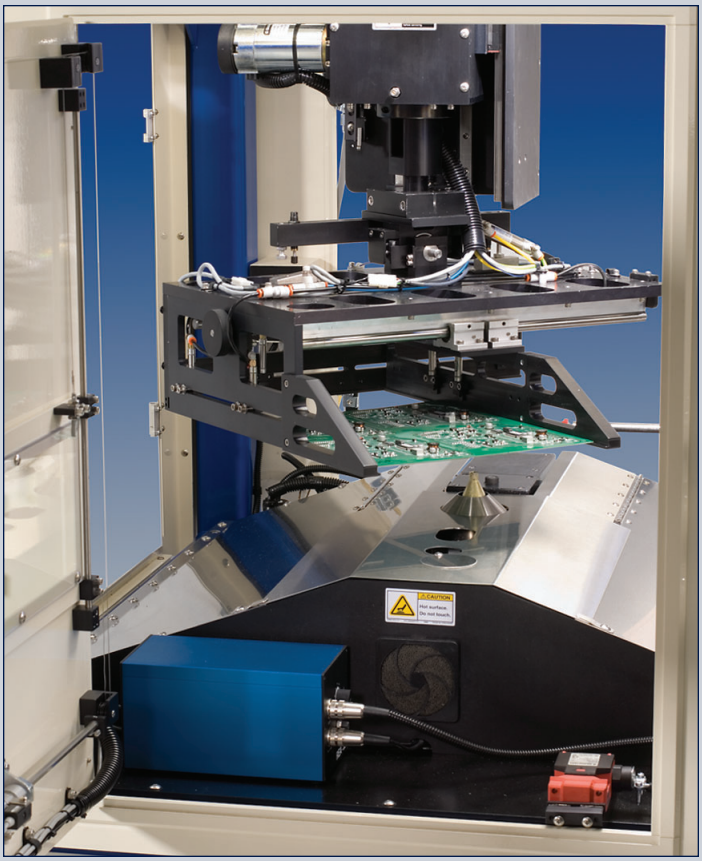

Figure 2: Selective solder equipment with rotating table.

must generate at least $13,000 a year of additional cash flow to be affordable. Provided there is ample work, the machine is twice as fast as a human operator, achieving the added $13,000 per year is reasonable. For contract manufacturers (CM), there is also the need to be competitive enough to get the business in the first place. If a CM manufacturer cannot quote the best price per assembly because he has no automated capability, he will lose the bid to a competitor who can quote to build the assemblies at a lower unit cost. An affordable piece of equipment also means you cannot afford to be without it.

For more information or demonstrations of the selective soldering machine and other capabilities at ACI Technologies, please contact the Helpline at 610.362.1320, email helpline@aciusa.org or visit www.aciusa.org.

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