LISTA WHITE PAPER

How Workstations Have Changed to Meet Today's Surface Mount Technology Needs

In the beginning, there were workbenches. A workbench was a fairly simple and straightforward affair with little concern given for issues such as ESD protection, modularity, ergonomics, or flexibility. Benches were often little more than simple wood or laminate worksurfaces over crude frames. It was not unusual for manufacturers on a budget to simply set up sawhorses and create a worksurface out of a piece of plywood, or even an old door!

Assembly of circuit boards was essentially a mechanical process with through hole components relying on bent leads to secure a component to a PC board before applying solder. Benches were also used for component preparation, often a manual or semi-automated process needed to straighten, form, or cut leads to facilitate assembly.

Rows upon rows of benches, populated by semi-skilled assemblers, were typically piled up with boards, components, cleaning and soldering materials, and hand tools. Board stuffers were people who manually inserted components according to a diagram and written work instructions, and batches of boards often moved from process to process in tubs or racks.

When stations were benches

In those days, factory layouts were fairly static, and benches were seldom moved or reconfigured. When a new task or modified process was introduced, inflexible benches were often reworked or scrapped at significant cost, or new benches built to accommodate the changed need. Often, end users just lived with a sub-optimal bench at the expense of productivity – and often, worker safety.

Benches were typically overly large to allow for tools and materials to be spread out, though they were often out of comfortable reach, and vertical space above or below the bench was poorly utilized. Materials, supplies, tools, equipment, etc. were often stored on the shop floor on shelves or in cabinets, hidden away and hard to find or account for. Large volumes of WIP (Work in Process), representing inventory, could usually be found at and around the bench.

Test equipment, where utilized, was larger and heavier than it is today. Test benches often needed to support many hundreds of pounds of test equipment, even for relatively simple test procedures, and many inspection and testing stations were needed to keep pace with production. Manual, visual inspection of boards depended on the keen eyesight, experience, and

often large numbers of technicians seated at benches. Process control, as we know it today, was not practiced.

The following example illustrates the evolution of the modern workstation. In the early 1970's, an electronics products company came to Arlink (now a part of Lista International) with a problem. New products were being introduced to a facility that was essentially "hard tooled" to assemble large lots of similar products. The introduction of these new products would require a complete refitting of the factory, which was populated with hundreds of crude, welded, "static" workbenches, many dedicated to tasks, equipment, or layouts that were no longer applicable. The production manager complained of the difficulty of adapting these benches to any new tasks, of their poor functional and aesthetic qualities, and their complete lack of flexibility.

What he envisioned was a modular "spine" which would offer the ability to create varied layouts of production lines, coupled with an ease of assembly and reconfiguration so they could be easily and cost-effectively adapted to new tasks and process flows.

From this conversation, the precursor to the Arlink® 8000 workstation was developed, and it was unlike any workbench that had been seen before, with the ability to be quickly set up, linked together in any combination of module sizes and any layout, adjustable for ergonomic comfort, fitted with a wide range of productivity accessories, and maximizing full use of vertical space above and below the worksurface. The "workbench" had evolved into a production tool that accommodated process changes instead of inhibiting them, providing users with the ability to accessorize and adjust their station for optimal comfort and efficiency. The space-saving design also revolutionized the look of the factory, resulting in a pleasing, contemporary aesthetic and a more conducive work environment. The modern modular, flexible workstation was born, and workbenches as we knew them would rapidly be phased out as the wide-ranging benefits of the new style modular workstations became evident.

New processes, new uses

With fully automated machinery now handling the great majority of component assembly; with automated optical inspection or X-ray inspection of completed PC boards; and with automated in-line functional testing of circuits at speeds that pace the assembly machinery, where and how are workstations used in the modern SMT assembly process today?

The promise and promotion of the "lights out" factory has yet to be realized in any meaningful way. People can't see in the dark, and electronics assembly facilities today are filled with skilled workers in support of the SMT assembly process. Although some of the companies in this industry are very large, most are actually small to mid-size, and may not be able to afford large investments in automation.

Today's workers are in many ways similar to their predecessors, but new technologies have also created new supporting tasks. Today's production staff is generally required to have a higher skill level, and is often cross-trained to be able to do several different jobs at different workstations as product type, volumes, or processes change. Productivity is more important than ever, as profit margins for electronic products continue to be squeezed and often only through superior productivity can North American factories compete with offshore facilities.

Workstations that are considered "state-of-the-art" can be configured to do far more than just provide a worksurface, and may be adapted for parts delivery,

shelving and storage, tool and equipment stands, test equipment carts, mobile maintenance stations, fitted with conveyors, and so much more. Today, you'll find modular workstations used in a variety of areas on the SMT assembly shop floor, including:

- Machine programming centers
- Solder paste/metrology prep and analysis
- Machine feeder set up
- Machinery maintenance centers
- Post process assembly of non-wets and odd form components
- In-line inspection stations
- Box build assembly stations
- Rework and repair
- Test stations
- Finished product programming and final configuration
- Product packaging
- Quality control
- Supervisory or shop floor management

Governing trends

Workstation design has been impacted by industry and cultural trends that we have all become familiar with. These include:

- Emphasis on R&D, rapid product development and time to market, and proliferation of in-house labs
- Increased awareness of ESD concerns due to increased sensitivity of components
- The adoption of lean manufacturing and 5S programs
- Switch from low mix/high volume assembly to high mix/low volume and the mass customization of (end use) products
- Flexible factories
- Clean room assembly (usually Class 100K or Class 10K)
- Increasing use of material transfer systems to move product to and through workstations

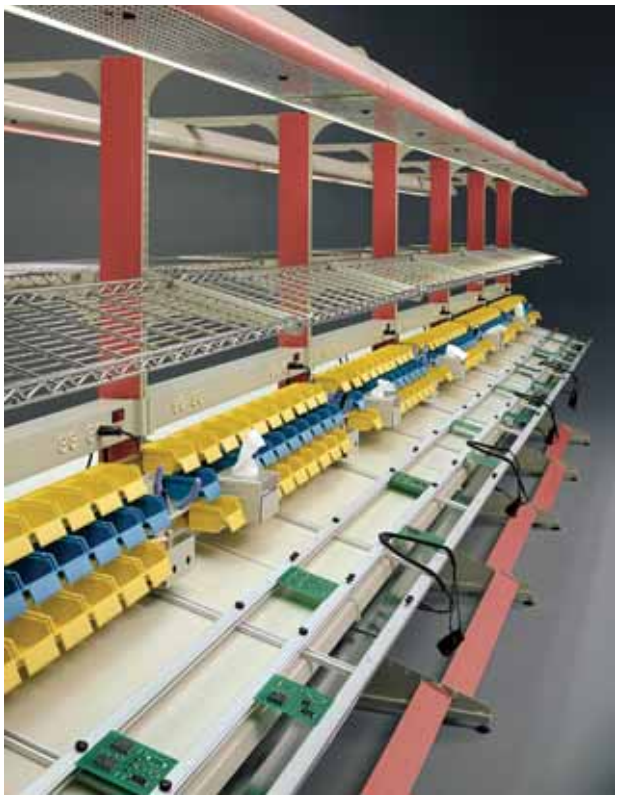
- The proliferation of contract manufacturers and demand for greater productivity per worker and per square foot
- ERP/shop floor control systems
- The globalization of the supply chain; adapting to workers' needs on a global scale
- Health and safety concerns for workers; increasing emphasis on ergonomics and lighting
- The aging workforce and workers with disabilities requiring special accommodations

The above factors are all driving workstation design. Examples of features being built into electronics assembly workstations as a result include:

- Height adjustability, sometimes over a wide range
- Incorporation of various material transfer technologies into workstations (ball transfer, conveyors, flow racking, etc.)

- Provisions for computing equipment and peripherals, wire and cable management
- Rack mount/enclosures for integration of test equipment
- Modifications for clean room use and certification
- Wider ranges of "specialty" accessories to boost productivity
- Tool-free set up and changeover to reduce set up times and simplify changeover
- Use of mobile workstations and production lines; retrofitting of mobile bases to existing workstations, parts carts and equipment carts
- Increased emphasis on the use of vertical space, above and below the worksurface, to shrink workstation footprint and improve reach and grab efficiencies
- Great variety in workstation sizes to accommodate a wider anthropometric range of users
- Use of color to code workstations or processes, such as green for lead-free areas

What will the continuing trends in SMT assembly, or circuit "creation", in general, mean for the workstation industry in the years to come? For example, how will the advent of nano-electronics change the need for people in the electronics assembly workforce; the numbers, the jobs they do; and the equipment they need to do them with? How will state and federal legislation affect the design and requirements for workstations?



As the role of production worker and knowledge worker continue to grow together, what new tools and equipment will need to be incorporated into workstations to facilitate the way in which future jobs are performed? Will factories become larger or smaller? What's next after the lean manufacturing boom has gone bust?

While we can't know the answers to these questions, the workstation industry can prepare by focusing on the development of products that offer maximum adaptability to new and changing tasks and are resistant to obsolescence, enabling the industry to make investments in workstations that will yield superior returns over the years.

LISTA
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