

# Manufacturing Efficiencies

## The Concept

The electronic assembly and semiconductor industries have now matured to the point where most of the remaining manufacturers have learned to run volume production with consistent quality. Unfortunately that is no longer enough to stay in business. The accelerated outsourcing trend, and the intensifying competition between OEMs and between Contract Manufacturers, is causing further consolidation in the industry. It is also forcing weaker players out of the market altogether. *The new rules of the game are characterized by a never ending battle to reducing the cost of operations while maintaining an acceptable level of quality.*

To succeed in this environment, manufacturers must learn to get the most out of their production equipment and their factory personnel, regardless of where they operate in this global economy. KIC has recently introduced technologies that allow manufacturers to do exactly that. The following examines the functionality of these technologies in the context of three key issues:

1. Process Development
2. Process Control
3. Personnel Efficiency

## Process Development

### Step one:

Define the process specifications (process window). For the thermal processes these specs are generally set by solder, flux, solder paste, or component suppliers. KIC has implemented the [Process Window Index \(PWI\)](#) as an objective means to define the process specifications and determine the process' fit to these specs. The calculation of the PWI is demonstrated in Figure 1.

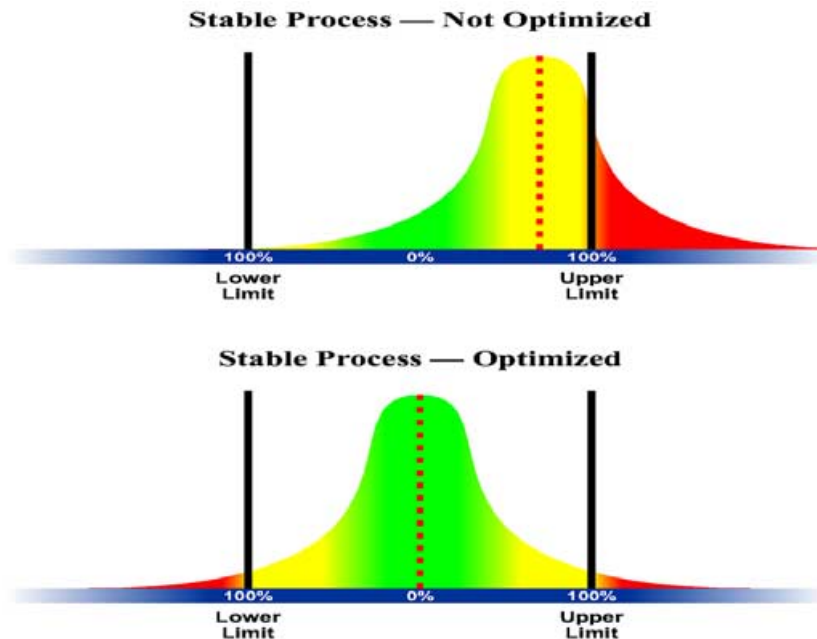


Figure 1: The PWI is used to optimize the process within the defined specs

### Step two:

Improve the process. A modern reflow oven for example, may have a dozen or more variables (zone temperature settings and conveyor speed) with a wide range of potential settings. The total number of alternative settings can therefore run into the millions. Manual trial and error methods will not identify the best setup, even when performed by an experienced process engineer, as there are simply too many alternatives to test. [KIC's Navigator™](#) is an oven recipe search engine which identifies hundreds of millions of potential oven setups and analyzes their resulting product profile and PWI. The Navigator then automatically determines the single best oven

setup, based on the process engineer's criteria, in less than 90 seconds. The most stable process (the profile most centered in the process window) is selected by choosing the profile with the lowest PWI number. It is also possible to maximize throughput by selecting the fastest conveyor speed that yields an acceptable profile.

Process development is not limited to a single production line. The concept of the PWI and the Navigator search engine allow a company to transfer the optimal process to multiple lines and facilities.

## Process Control

Once the oven or wave solder machine is setup, production can start. But what does the process look like one hour or one day later? In a conventional facility, nobody will know until a profile is run. A better method is required in order to achieve the desired results of increased quality at lower cost. The [KIC® 24/7](#) automatically calculates the profile with the corresponding PWI number for each product processed by the oven. It also calculates in real-time the Cpk for every product. The KIC 24/7 warns when the Cpk drops below a preset level, and it alarms on any out of spec situation. The alarm may turn on a light tower light, or it may automatically shut down the feed conveyor to the reflow oven. By flagging an out of control process *prior* to having reached an out of spec situation, the KIC 24/7 acts as a zero defect process tool.

The KIC 24/7 operates continuously, without interfering with production, until a problem arises. It provides the following manufacturing efficiency benefits:

- Increased production uptime
  - Eliminate periodic profiling
  - Faster line troubleshooting (in a yield problem situation)
  - Quicker oven changeover
  - Reduced cycle time
- Improved Quality
  - Optimized process
  - Zero defects
  - Continuous documentation

## Personnel Efficiency

An architect may design a building and witness it being constructed without personally having to hammer the nails and raise the walls. Up until recently, a process engineer was required to both define and develop the process and even check the process on a regular basis. This is not the best use of his/her skills and time, nor is it cost effective for the factory. The advent of the PWI concept, the [SlimKIC® 2000](#), and the [KIC® Pilot](#) allows significantly improved resource allocation. As in the architect analogy, the process engineer will define the process window and production parameters (i.e. minimum conveyor speed), while delegating all daily tasks to technicians or line operators. Because the process development and process control is highly automated and password protected, the process engineer can rest assured that production is in control, and thus can spend their time on higher value work.

Another factor is that in the current economy, electronics assembly facilities often experience a significant employee turnover rate, which results in increased training costs. The above mentioned products require minimal training, reducing both training time and costs.

## Conclusion

KIC technology gives users the tools they need to win the battle to reduce the cost of operations while maintaining an acceptable level of quality.

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If you have any questions regarding this paper or any KIC products, please feel free to contact us at:

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