

World innovations in the field of machine soldering

Trend-setting soldering processes for the electronics industry

Under the names „Synchronous Motion Selective Soldering“ in the field of selective soldering and „smart Profiling Reflow Technology“, smartTec GmbH presented two groundbreaking world firsts at its Soldering Competence Center Europe during the Soldering Days.

With the development of the new Synchro system, industry giant Nordson has brought a new method from the field of selective soldering to the market. It is fair to call this a groundbreaking innovation.

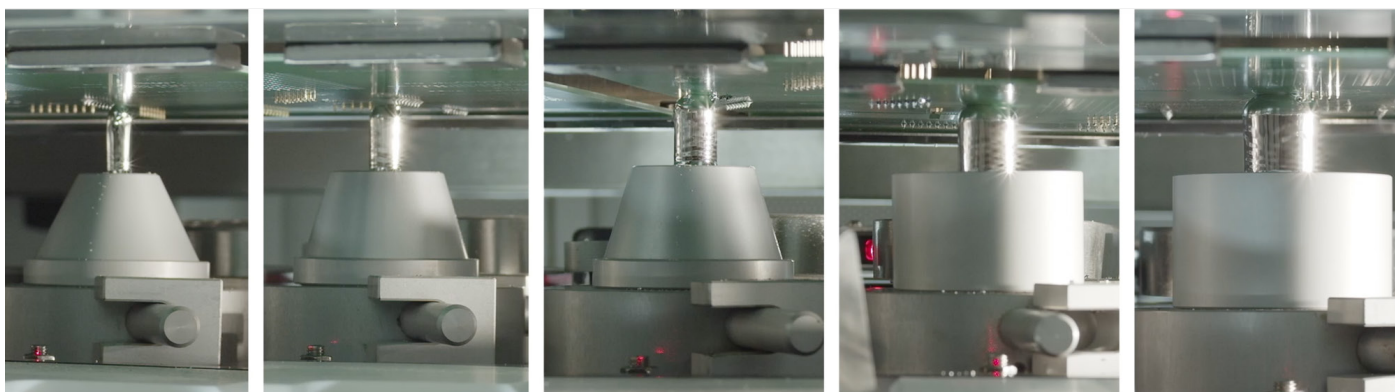
Synchronous Motion Selective Soldering

The advantages of selective soldering over hand and wave soldering are sufficiently well known, recognized and have been published many times. It is therefore not necessary to list the advantages again. Nevertheless, in

many cases the process reaches its limits or presents the producer with great difficulties. In particular, high throughputs, very large PCBs or simply the space problem are factors with which one or the other electronics manufacturer has to contend. Low cycle times and high throughputs go hand in hand with the number of crucibles and solder nozzles. This has the disadvantage that the systems become larger and larger and thus take up a lot of valuable production space. In addition, very long systems have the disadvantage that the quality of the solder joint does not improve with increa-



Nordson's Synchro



Highest flexibility due to different nozzle sizes

The flux system, which has the task of reducing the solder joint and thus protecting it from oxidation, can often no longer do justice to this in very long systems. A burnt or non-activated flux inevitably leads to soldering defects. If one reacts to this with several flux and preheating stations, this leads to even longer systems.

Likewise, very large products pose a problem for the process. Since in all conventional methods the PCB comes to a standstill in the various process steps of fluxing, preheating and soldering, the soldering area is limited by the process zone. Design avoidance of this problem also resulted in longer lines and costly wastage of expensive production space. These were precisely the driving forces behind the development of the new Synchrony system.

At a length of just 2.5 m and with 5 crucibles, the new concept replaces lines that would have to be up to a factor of 4 or 5 longer, depending on the product. In addition, the small powerhouse can also score points in terms of soldering quality thanks to its compact size. Both the fluxer and each of the five solder pots are synchronized with the transport speed of the products. This means that the PCBs do not have to be stopped during the entire process. It therefore makes no difference whether the products are 20 cm or 5 m long. Programming is the same as for conventional systems. The distribution of jobs to the individual nozzles or crucibles is handled by the intelligent software. Perfect balancing ensures the best cycle times. Whether very long circuit boards, little space in production or high throughputs with the best soldering quality, the Synchrony offers the best

return on investment. The Synchrony development enables many producers to also produce pure wave soldering products in almost the same or partly better cycle time with considerably less effort (solder frames, cover masks, etc.).

smart Profiling Reflow Technology

Regardless of the method and the medium used for heat transfer in the reflow process, the defects always arise in the temperature profile. An ideal temperature profile avoids thermally induced soldering defects. However, many influences make life more difficult for the producer. Not least the RoHS directive, which entailed the use of lead-free alloys, has caused the process window in the reflow process to shrink due to a higher melting point. However, developments in the component and printed circuit board sector actually call for a much larger process window. Miniaturization - i.e. ever smaller component shapes - is constantly being driven forward. The goal is more functions on less surface area. However, this fact also leads to an increase in the use of highly integrated, complex component packages. For the reflow process, this means widely varying thermal masses on one product, which in turn is a major challenge for the thermal process.

In addition to the development in the component sector, the market is also driving PCB manufacturers to new technologies. Very thick multilayers or even embedded components in the PCBs ensure an even greater thermal mass.

Conversely, this means that more energy has to be supplied specifically to heat up the PCB. Since the different heavy component shapes also absorb different amounts of energy in the same amount of time, this has a counterproductive effect for the targeted temperature profile. Conventional convection soldering, in which the heat energy is transferred by means of the insulator air or nitrogen, is increasingly reaching its limits. The process also has a negative aspect for larger assemblies. Since the continuous process has different temperature zones and the air flow also creates a „cross-flow“, the PCB can never be heated homogeneously.

Since, as already mentioned, soldering defects can only be avoided in the solder profile - regardless of the process - this is precisely where smart Profiling Reflow Technology comes in. The smartPhase inline system is divided into three process zones. The products enter zone 1 in a line cycle, are buffered here and then enter the large process chamber at the same time. During the entire soldering process, the circuit board no longer moves. The patented process of the manufacturer R&D (developed and built in Germany) is based on the fact that the products stand still and the complete process chamber moves vertically over the assemblies. In this chamber is Galden steam, which has different thermal energy at different heights of this chamber. This fine and precise process allows exact temperature profiles to be run. The products (or the very large pro-

duct) are heated absolutely homogeneously. By using physical quantities, such as the heat of condensation and heat transfer coefficients, the delta T on the assemblies can be reduced to a minimum. Very thick, heavy and oversized PCBs can be soldered accurately and without problems. All arguments previously invoked against condensation brazing can be refuted. Thanks to a process chamber of up to 1,200 mm x 800 mm, large products pose no problem and are heated absolutely homogeneously.

This process chamber also guarantees the lowest cycle times over a maximum length of 4.5 meters. Cycle times of between 12 and 15 seconds can be achieved for printed circuit boards in Eurocard format (160 mm x 100 mm). The incomparably fine profile setting, the good heat transfer, the homogeneous heating, the reduction of the delta T's between large and small components, the finest temperature gradients, the lowest Tal (time above liquid), i.e. the time during which the product remains in the liquid zone, as well as the fact that the maximum temperature that the product can reach is predetermined by the Galden medium - i.e. making overheating or burning impossible - are arguments that are reflected in the sustainable soldering quality. Last but not least, the low energy consumption compared to a convection reflow oven meets the ravages of time.



R&D's smartPhase