Interview


Ersa HR 600 XL

# Reworking Big Boards is a solvable Challenge

Reworking printed circuit boards is considered the highest discipline in modern electronics manufacturing. A high level of expertise and the latest equipment are absolute necessities for the professional handling of refinishing, also called Rework. The desoldering and soldering of BGAs or QFPs require a great deal of dexterity and experience. This is more important when the boards in question are so-called "Big Boards", which contain several challenges. For this reason, Ersa GmbH developed the Hybrid Rework System HR 600 XL.

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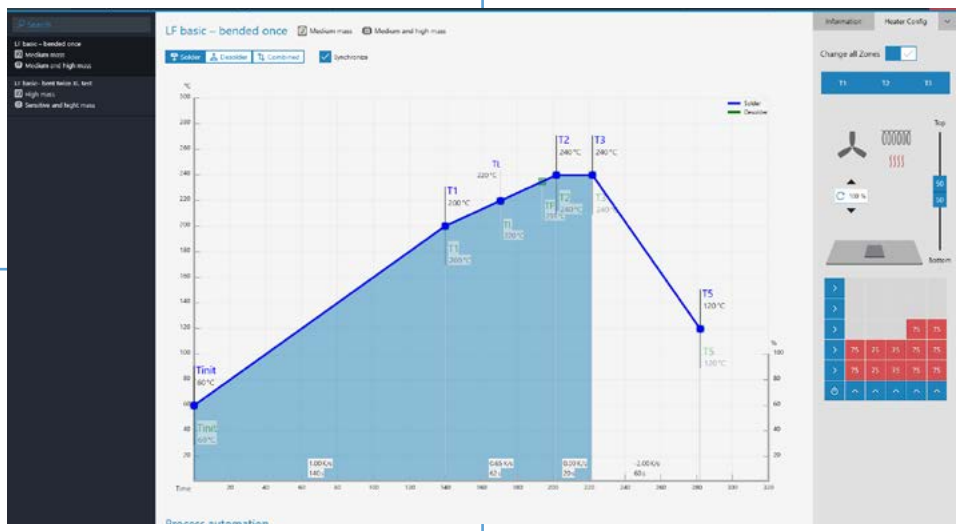
*Jörg Nolte, Product Manager for Soldering Tools, Rework and Inspection Systems, describes these challenges and presents Ersa's solution approaches.*

**Miniaturization is one of the key topics in the development of electronics today, in contrast there are big boards. When we talk about big boards, which areas of application are they used today?**
Miniaturization doesn't stop at big boards, closer packing densities are also an element of these boards. Reworking is therefore particularly challenging here too. We refer to big boards when they have a width of at least 380 mm and have more than 6 layers. We have also processed printed circuit boards with up to 48 layers to a certain extent, the thickness of the boards are between 3 and 10 mm. These circuit boards are used everywhere, where large volumes of data are processed, such as in telecommunications, for data transmission, in so-called super computers, in large format screens or in military applications.

**How have big boards been reworked to date?**
There are already rework systems in existence that can process large printed circuit boards. However, these systems are not able to accommodate assemblies with dimensions of 24 x 24 inches. In addition, these systems have conventional modules for preheating.

**What special attention must be paid to the reworking of big boards?**
I would like to say that the reworking of big boards is a solvable task when the user is aware of the challenges. First, board dimensions and the resulting weight of the assembly require that warping during heating be avoided. The glass transition temperature is like that of the small assemblies, but due to the weight and large dimensions, there is a strong tendency for the board to warp. Once a board is warped, it no longer returns to its original shape. In the worst case it cannot be used after reworking due to warping, since vias have been torn and SMD solder connections have sheared off. Preheating the board in an external oven can be helpful since it saves time. The removal of large metallic components, such as frames or mounting rails, can also help, because they conduct heat in undefined areas of the board that should not be heated, or only slightly. However, in general high quality materials are used in manufacturing big boards that are less sensitive to heat input.

**How does the reworking of big boards differ from conventional assemblies?**
The process is identical. However, given the size of the boards, we have a few challenges that we must face with different technical developments. As a result, we generally need a higher but nonetheless even heat input to separate components. Due to the size of the circuit boards, as already indicated this can lead to problems relating to the expansion coefficients of the circuit board material. Therefore, very homogeneous heating of each board area is essential.




*Process visualization with HRSoft 2 software: Perfect temperature profiles due to the homogeneous heating power of the 25 zone segmented heating system.*

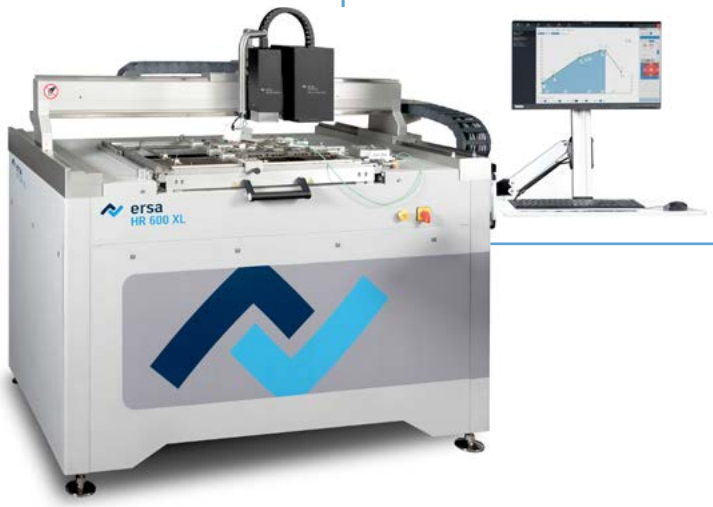
**So, must special attention be paid to heat input and heat management with big boards?**
Yes. For preheating, very big boards require more thermal energy over the entire surface area of the assembly, because their thermal capacity is high. Apart from that, they also need more time to reach the target temperature and to cool down again.

**How does the heat input work with the newly developed Hybrid Rework System HR 600 XL?**
For this we use infrared radiation. The medium wave radiation is well absorbed by today's circuit board materials and the SMD components. Due to the dimensions of the circuit boards it is difficult to achieve homogeneous heat input. Because of trapped heat, the center of the circuit board will always heat up faster than the corners and edges. With the infrared-matrix bottom heater we can specifically control up to 25 individual heating elements and distribute the heat evenly to the circuit board, also into the edges and corners. Bottom side supports aid to stabilize the board. Homogeneous heating is especially important when desoldering components, as vertical thermal balance is essential. The temperature differential (Delta T) between the top of the target component, solder connections and the bottom of the circuit board must not be too large in this area. Otherwise, there can be thermal warping and the circuit board can be damaged.

**Can you describe the infrared-matrix bottom heater in more detail?**
Our heating system consists of a top and bottom side heater. The top heater consists of an 800W hybrid heating head that evenly heats the target component and the surrounding area. The component's immediate surroundings must be heated in a defined manner to minimize the loss of thermal energy due to the high thermal mass of the assembly. This ensures lower thermal stress in the area of component and assembly. If necessary, sensitive components in the vicinity must be protected from the topside heat. In contrast, the bottom heater must adapt to the bottom contour of the board. The edges and corners of the assembly, as well as hot and cold areas of the circuit board, require a different heat input. The matrix bottom heater is therefore made up of 25 individual elements, which can be controlled separately. This means that each element can produce different temperatures in the same process.

**Does the heat input also play a role when soldering components on big boards?**
When soldering the heat input only plays a subordinate role. Before inserting the new component, it is recommended that solder paste be applied to improve thermal contact between the component and the circuit board. However, it can be stated that both processes take longer with large boards than with small circuit boards. Care should be taken to ensure that the circuit board is sufficiently cooled so that it is not unnecessarily exposed to a high levels of heat.

**You mentioned the handling of such big boards. What solution have you developed for this?**
Big boards are not only big, but also heavy and consequently unwieldy. We therefore require a mount that also precisely positions heavy circuit boards.




*Hybrid Rework System Ersa HR-600-XL - Professional repair of especially large electronic assemblies.*

In addition, bottom side supports must be user friendly. For this reason, the fixed circuit board can be pulled forward and raised together with the frame, so that the supports can be positioned correctly. We also ensure that the board can expand during the heating process.

**How is the component placement performed on big boards?**
Exactly the same as with small circuit boards. The accuracy of the placement is crucial. The placement system requires a high level of reproducibility and must operate steadily in the very warm areas above the circuit board. This is particularly important with big boards due to the long travel distances. Often large components require reworking, for example LGAs or SMD Sockets, but components smaller than 5mm/1mm such as Chips, QFNs and SOTs must also be placed precisely.

**What methods can be used to apply solder paste and flux?**
The manual application of solder paste or flux is always an option. In contrast, the overprinting of solder paste is complex, because the limited space greatly complicates the process. Solder paste can also be applied with a dispenser but can be time consuming. We therefore recommend dipping the terminal contacts of the component or the external imprinting of the component contacts, through which the solder paste is applied directly to the contact surfaces. The component is then placed and soldered. This fully automatic process is very precise because the quantity of solder paste can be well defined. With multiple applications we can achieve a high level of reproducibility. It is worth mentioning, that components imprinted with soldering paste lead to an even more uniform temperature equilibrium between component and solder pads during the soldering procedure.

**Is re-balling also possible?**
Re-balling is possible with all Ersa rework stations. More equipment is required, however.

**How is the precise placement of the exchanged components performed? Are there different approaches based on the type of component?**
As a rule, the placing of the components is always carried out according to the same process sequence: First, the contact surfaces of the component are automatically identified and placed on the circuit board by means of an image processing software over the contact surfaces. Second, the rework station's axis system calculates the exact position and places the component. The component can thereby be put down on the circuit board or released just above the surface. This depends on whether it is placed on a residual solder depot or on freshly applied solder paste. For the placement of BGAs or QFNs, special optical filters are used. A subsequent manual position correction is also possible.

Ersa presented the HR 600 XL at the Apex 2019, January 29 -31, and it will be shown on SMT Nuermberg 07.05 to 09.05.2019 at booth 111. "We want to sensitize the market and inform about a reliable big board reworking process", explains Nolte. Therefore, all further information, including on regional contacts, is available at **www.big-board-rework.com.** ■

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