



DEPANELING

Challenge and solution:
How to optimize depaneling
with efficient processes

Depaneling

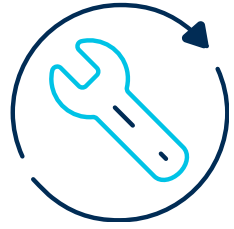
Challenge and solution

The process of depaneling is unavoidable in electronics manufacturing and involves a high potential of requirements. Low-stress separation methods and intelligent processes that include the production steps of sorting and testing are therefore of utmost importance. Individual solutions that cover product requirements and keep an eye on the two fixed points of cost and quality are therefore more in demand than ever.

For production-related reasons, printed circuit boards are manufactured in so-called PCB panels. PCB panels consist of several PCBs that are combined on a base carrier. The circuit boards are either completely connected on this panel or the panel has webs between the individual circuit boards. Production in panels has several advantages: handling is easier, production costs are lower and the entire logistics chain can be organized more cost-effectively. For further use in electronic devices, these printed circuit boards must be separated. Today, there are various processes for depaneling. Some of them are less stressful, others less.

Depaneling with tools such as punches, roller cutters or impact shears are

processes with a high mechanical stress. This almost inevitably leads to a relatively high failure rate for the separated PCBs. In order to minimize this stress, to meet the trend of ever smaller PCBs as well as the increasing quality requirements and specifications of equipment manufacturers and suppliers from sectors such as the consumer, industrial, health and automotive industries, low-stress separation processes with minimized mechanical stress on the PCB are used for depaneling. Depanelizers that cut by means of milling (end mill) and / or sawing (saw blade) are used here. Laser depaneling is also a possible process.



The right separation process select

In order to find the right separation process, the first question to ask is about the quality requirements and the nature and contours of the printed circuit boards. Do complex shapes have to be separated? How large are the printed circuit boards on the panel? How closely is the panel populated? How stable is the PCB blank? How much stress may the PCB panel be subjected to?

Depaneling with tools such as punches, rolling knives or impact shears

Depaneling with these tools is associated with relatively low investment costs and prior knowledge by the personnel. However, there are some disadvantages in the separation process of the PCBs. For example, the PCBs are subjected to high stress, the risk of fraying at the separation point and low separation accuracy are the main disadvantages resulting from these processes. Furthermore, it is not possible to separate very small and complex PCBs from one panel, the PCB panels have to be pre-scored and also the labor costs are higher than with inline panel cutting.



Depaneling by saw

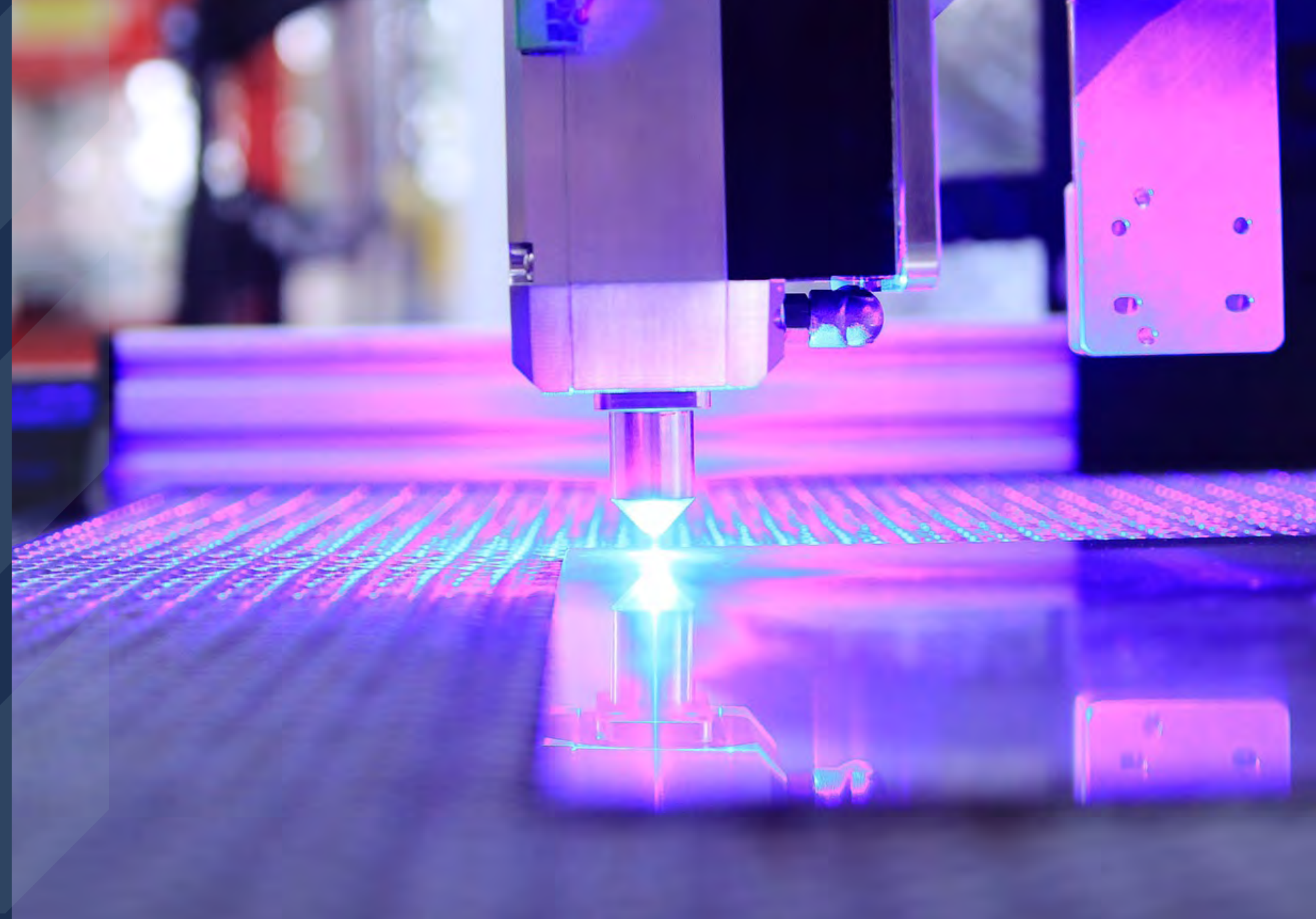
— Depaneling by milling cutter and / or saw

Cutting depaneling using saws and mills is used wherever the quality requirements for the depaneling process are very high, i.e. the precision must be very high, the stress on the printed circuit boards must be very low, and the cycle time and flexibility must be high. Compared to cutting with tools such as punches, rotary knives or impact shears, cutting with a mill or saw does not fray the cut points. The process offers a high degree of flexibility with regard to the variety of types, so that even small and complex PCBs can be separated from the panel.

Whether a PCB panel can be cut with a saw blade or end mill depends on the contour properties of the panel. PCBs that can be separated from the panel with straight cuts are well suited for processing with saws. Here, large PCB panels can be separated very quickly and with very short cycle times. If PCB blanks need more complex cuts, cutting by means of an end mill is a very good option. A combination of saw and cutter is also possible with some depaneling machines on the market and offers even greater flexibility with a short cycle time.

Depaneling by laser

The advantage of separation by laser is the accuracy and the possibility to separate even complex shapes. In addition, the PCBs can be separated from the PCB blank without stress. However, depaneling with laser technology is usually inferior to the cutting process using a milling cutter and/or saw in terms of cycle time, one of the most important parameters in depaneling, since it is mainly very large quantities that have to be cut in a very short time. There is also the risk that the laser process can cause deposits to form on the circuit boards, so-called carbonization, and traces of spatter, which can impair the function of the circuit boards.





Integration into the process chains

In addition to the selection of the appropriate separation process, integration into the process chain with testing and sorting is crucial. Integration into the process chain offers considerable potential for saving costs and improving quality. The integration of the separation process into a turnkey solution offers the certainty that all processes function together perfectly and that no time-consuming and cost-intensive integrations are required here afterwards.

Handling and tray concepts

When depaneling, there are several ways to deposit the separated PCBs.

1. **Deposit in workpiece carrier:** The workpiece carrier is fed and discharged via a special transport system. This solution is particularly suitable when an exact position is required for automated downstream processes.
2. **Transfer to a shuttle system:** This process also ensures an exact position and is mainly used in a subsequent pick & place system.
3. **Deposit on belt:** If manual process steps follow the depaneling, depaneling systems with deposit of the separated PCBs on a belt are the alternative of choice.



Process chain

Testing

Depaneling

Sorting

Finding the right process

The process steps of testing, depaneling and sorting are closely linked in the production of electronic assemblies and printed circuit boards. It is worth taking a close look at the entire process associated with depaneling. Depending on the strategy, the individual process links can be strung together in three different sequences. This results in a number of advantages and disadvantages in each case.

Option 1: Testing, Sorting, Depaneling

If the PCBs are separated from the panel only after testing and sorting, defects caused by the separation process can go unnoticed. An advantage of this method is that no workpiece carrier is needed in the test and repair area, which allows short data paths and very reliable test procedures. However, this procedure can become problematic when the number of panels increases. This is because the more PCBs are contained in a panel, the more often entire panels are rejected in the test procedure. These discarded panels have to be reintegrated into the manufacturing process after they have been repaired, which increases the test repeat rate and reduces line throughput.

Option 2: Testing, Depaneling, Sorting

If the PCBs are already separated from the panel between testing and sorting, the integration of separating and sorting processes means that faulty individual PCBs can be sorted out directly or forwarded for repair. In this way, the production line is not burdened with rejects. However, defects caused by the separation process remain unnoticed and data paths are long, which may require a cost-intensive redesign of the test unit. In addition, the process for sorting is more complex and additional test equipment is required.

Option 3: Depaneling, Testing, Sorting



If the PCBs are already separated from the panel before testing and sorting, the data paths for the test procedures can also be kept short. In addition, faults that occur during separation can be detected, which means that the test only has to be repeated for the faulty and repaired PCBs. From a procedural point of view, this sequence is certainly the best solution. However, in this case, the test procedures have to be carried out in the workpiece carrier and a much more complex sorting process is required. Depending on the line constellation, additional expenses of 15 to 20% have to be accepted.

Depaneling

The best solutions - with strong partners

Depaneling in conjunction with testing and sorting is a complex task that is mainly influenced by the factors of cost and quality. The automation of testing and assembly processes is an important prerequisite for manufacturing products with the highest quality requirements. In order to achieve an optimum result depending on the individual task, it is advisable to consult a technology partner with experience and know-how in the design, planning and manufacture of partially and fully automated depaneling machines, test lines as well as sorting systems.

Only with competent consulting and the use of turnkey solutions can it be ensured that the individual process steps are seamlessly interlinked and solutions are realized that meet individual requirements in terms of costs and quality standards 100%. The goal is to create customized complete solutions that enable products to be manufactured faster, more cost-effectively and thus more competitively.

We help you to find the right solution for
for your depanelization process!
Get in [contact](#) with us now!

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