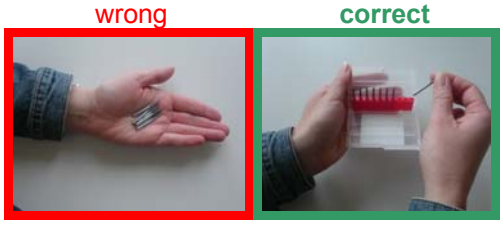
Following facts influence the mechanical routing process of PCB's:

Factors	Description	⇒ GCT's recommendation
Base material	Usually, the type of base material is pre-determined and can be influenced rarely.	⇒ In order to achieve optimum conditions GCT recommends adjusting routing parameters to the material.
Tool	Normally, spiral and diamond patterned routers are used upon processing inner and outer contours. Usually, the geometry is right twisted, i.e. up cut version. Left twisted routers cause minor burr when routing boards with copper on the outer contours. Diamond coated routers increases the tool life by a factor of 12.	Spiral patterned routers offer enormous advantages in relation to dimensional accuracy (less deflection) and generate a superior surface quality. Diamond patterned routers with diameter ≥ 2.00 mm offer fewer advantages in life time. ⇒ GCT recommends spiral patterned routers type 1 100 (diamond coated router) and type 2 100 (solid carbide router).
Handling	The tool handling has a high influence on quality and router tool life. The risk of damaging the cutting edges is very high.	wrong correct  ⇒ GCT recommends ordering routers with set rings from your supplier, if required.
Machine / Spindle	The routing machines in operation must fulfill the quality demands. The maintenance of the machines has to be conducted according to manufacturer's specification.	Upon investing the correct spindle speed is decisive. ⇒ GCT recommends a spindle speed of min. 20–80000 rpm.
Pressure foot	The PCB is additionally fixed on the machine table by a pressure foot. Furthermore the pressure foot protects the surface against damages. Brush inserts with strong plastic bristles are ideal.	The tip of the router should be above the brushes. ⇒ GCT recommends 1.50–2.50 mm height.
Collet / Maintenance	It is important to maintain the collet regularly and properly in order that process capability of the routing machine as well as product quality can be guaranteed. The maintenance should be carried out according to manufacturer's specification.	The correct maintenance increases the life time of collet as well as of spindle, the tool life of the router, the dimensional accuracy and the surface quality. The run-out should be checked regularly. ⇒ GCT recommends ≤ 25 µm run-out and daily cleaning of the collets.
Extraction	The efficiency of the extraction influences the tool life and the quality of the router very much. You should prefer a centralised exhaust system.	The value can be compared only if the efficiency of the extraction is measured at the pressure foot directly. ⇒ GCT recommends at least 50 mbar at the pressure foot.

Factors	Description	⇒ GCT's recommendation
Parameter	The most important facts are feed rate and cutting speed / spindle speed. Both facts depend on diameter as well as on base material.	⇒ GCT recommends a cutting speed of v = 220 m/min for FR4. Individual recommendations for different kinds of material will be furnished upon request.
Spindle speed	The spindle speed [n] arises from: cutting speed [m/min] x 1000 divided by router diameter [mm] x Pi [3.1416] ⇒ $n = (v \times 1000) / (d \times \pi)$	Detailed parameter recommendations are available under www.gctool.com ⇒ Technology / Parameter
Feed rate	Dependent on base material and router diameter the XY-axes feed rate should be chosen.	⇒ GCT's parameter recommendation. The feed rate should be reduced by approx. 40 % for inner contours and cycles.
Infeed	The feed rate of the Z-axis depends on the fact if PCB's are pre-drilled or not. Refer to pre-drilling	With pre-drilling the feed rate of the Z-axis can be increased by at least factor 4.
Pre-drilling	The accuracy and the life time of the router will be increased upon pre-drilling at the beginning and at the end of the routing distance.	⇒ GCT recommends pre-drilling with a drill of the same diameter.
Routing direction	The surface quality, dimensional accuracy and tool life are influenced by the routing direction.	⇒ GCT recommends routing outer contours anticlockwise and inner contours clockwise.
Routing depth / Stack height	The routing depth / stack height influences the productivity, the dimensional accuracy as well as the routing parameter. You have to consider the unused flute length due to the point geometry, too. Working length = stack height + depth into the backup.	⇒ GCT recommends D routing depth/stack height 0.80-0.90 mm ≤ 3.20 mm 1.00-1.40 mm ≤ 4.80 mm ≥ 1.50 mm ≤ 6.40 mm The working length should be max. 0.85 x L (flute length).
Router run-out / Deflection	There are always dimensional deviations between the top and bottom panel. They depend on the router diameter.	Upon routing outer contours the router will be pulled into the material, i.e. the bottom panel will become smaller compared to the top panel. When routing inner contours it will be the opposite way around.
Diameter compensation	The diameter compensation helps to rectify different influences affecting the routing process.	The routers run-out, router wear as well as influences of the system can be considered and adjusted due to the diameter compensation.
Tool life	The tool life of routers are influenced by: - quality demands - base material - type and diameter of router - parameter - stack height - periphery of machinery and - extraction	⇒ GCT recommends for FR4 D tool life 0.80-0.90 mm 5-10 m 1.00-1.40 mm 10-25 m 1.50-1.90 mm 20-50 m ≥ 2.00 mm 30-80 m
Backup	Dependent on the batch size - thick and stable tooling plates for multiple applications or - thin backup boards of wood fibre or phenol paper are used for single- or double-sided application.	⇒ GCT recommends pre-routing the backup material approx. 0.50 mm deeper. By routing additional transverse slots the air volume can be increased and improved further.