Part 1. Rapid PCB Milling Machine – Short Form

1.01 PCB MILLING MACHINES

A. The PCB milling machine shall be the ProtoMat S43/S63/S103 as manufactured by LPKF Laser and Electronics, Inc., or equivalent.

1. The PCB milling machine shall be designed for use in a laboratory environment and include an acoustic cabinet featuring an integrated safety switch.

    a. The PCB milling machine shall be able to recover from the accidental tripping of the safety switch without restarting the project.

2. The PCB milling machine shall be capable of being set up on a general lab table

3. The PCB milling machine shall utilize microprocessor based control of X, Y, and Z axis of the milling head.

4. The PCB milling machineshall be controlled by USB connection to a user supplied computer.

5. The PCB milling machine shall have integrated control electronics, located beneath the working table.

6. The PCB milling machine shall have 1.4” of Z axis travel, (S63/S103 – without the vacuum table installed); 0.9” with the vacuum table installed (S63/S103), 1.0” of Z axis travel (S43), controlled by stepper motor.

7. The PCB milling machine shall have software control of the Z axis for precise depth engraving, pocket milling, sign engraving and cutting of thick materials with multiple passes.

8. The PCB milling machineshall have a maximum working area of 9” x 12”.

9. The PCB milling machine shall have a movement resolution of 0.02 mils.

10. The PCB milling machine shall have a repetition accuracy of 0.04 mils.

11. The PCB milling machine shall have a maximum drilling speed of 120 strokes per minute (100 strokes per minute for S43).

12. The PCB milling machine shall have a maximum XY travel speed of 6” per sec/150mm per sec.

13. The PCB milling machine shall have a co-axial milling depth limiter depth sensing foot that focuses heat and debris removal from the working area into the vacuum pickup.

14. The PCB milling machine shall have a non-contact, air bearing depth limiter foot allowing no-touch milling of thin metalized materials (S103 – upgrade option for S43/S63).

15. The PCB milling machine shall have integrated LED head lighting for clear viewing of the tool as it works (S63/S103 only).

16. The PCB milling machineshall have a 40,000/60,000/100,000 RPM software controlled variable speed spindle motor (S43/S63/S103 respectively).

17. The PCB milling machineshall have an integrated vacuum table (S103 – optional on S43 and S63).

    a. The vacuum table shall include a porous insert so no additional backing material is needed.

    b. The porous insert should be useable on both sides and replacements readily available as a consumable item.

18. The PCB milling machine shall include a 15 position tool exchange bar with integrated tool depth positioning ramp (S63/S103 – upgrade option for S43) controlled automatically by the CircuitPro software.

19. The PCB milling machine shall include a paste dispensing system for applying solder paste to finished boards before populating (S63/S103 – upgrade option for S43).

20. The PCB milling machine shall be capable, with the addition of a lamination press and through hole plating solution, of creating multilayer circuit boards of at least 8 layers.

21. The PCB milling machine shall have a fiducial recognition camera system integrated in the CircuitPro software (S63/S103 – optional on S43).

    The camera shall be used for:

    1) Automatic milling width/depth adjustment of tool
    2) Calibration of the machine (tool bar, work table, head to camera offset)
    3) Recognition of fiducial marks/holes and subsequent software adjustment of the milling data to account for any offset
    4) Automatic inspection of drill holes and cut lines to verify size
    5) Reloading of boards for re-work purposes

22. The PCB milling machine shall be powered by standard 120-240VAC, 50/60Hz power and include a power cord, plug and replaceable fuse.

B. The PCB milling machine shall require a vacuum system.

1. Vendor shall supply an optional variable speed dust extraction system, with variable speed, software controlled auto-switch.

2. The dust extraction system shall have a 99.97% efficient HEPA filter

3. The dust extraction system shall employ pressure transducers to signal the software when it is time to replace the dust collection bag

C. The PCB Milling Machine shall include the latest version of CircuitPro software for data preparation and machine control (CircuitPro PCB for S63/S103 – CircuitPro Lite

for S43) and allow for multiple downloads with CircuitPro PCB; up to 10 at no additional cost.

1. The CircuitPro software shall import PCB design files from all popular CAD formats including Gerber, Gerber-X, Excellon, HP-GL, DXF, Sieb and Meyer, and others.

2. The CircuitPro software shall employ arbitrary polygon algorithms to calculate the most efficient tool path for insulation of circuits, rubouts, and contour routing.

    a. The CircuitPro PCB software shall allow for the use of up to four different milling tools for insulation/rubout on each side of the circuit board (S63/103).

    b. The CircuitPro Lite software shall allow for the use of up to two different milling tools for insulation/rubout on each side of the circuit board (S43).

3. The CircuitPro PCB software shall export Gerber files (not included in CircuitPro Lite, supplied with S43).

4. The CircuitPro software shall automatically keep track of the tool lifeand tool usage time.

    a. If the tool is approaching its end of life, the software shall alert the operator of the option to change the tool. If another identical tool is loaded in the tool bar, the machine will retrieve it and continue working unattended (S63/S103).

5. The CircuitPro software shall automatically change the motor speed, dwell time, and step rate for the type of tool and the material being milled.

    a. The CircuitPro tool library can be user customized for use with exotic materials or specialized tools.

6. The CircuitPro software shall keep track of the hours used on the dust extraction system and notify the user if the brushes need to be changed.

7. The software shall be operational without the need of a hardware dongle.

8. All tools supplied by vendor shall be 100% carbide.

D. The PCB milling machine shall be upgradeable.

1. The upgrade parts and installation instructions shall be available as a kit and user installable.

2. If an upgrade is made, the replaced parts shall be usable in the future as spares.

E. The supplier shall have a toll free, technical support phone number open from 7AM to 5PM PST staffed by a technician trained in the use, operation and repair of the equipment.

1. The supplier shall have an online internet presence where a customer can purchase consumables and tools, download user manuals, and contact technical support after hours via trouble ticket.

2. The supplier shall offer technical support free of charge and will continue the free support when the customer is operating the machine with LPKF CircuitPro software within one version of the latest release.