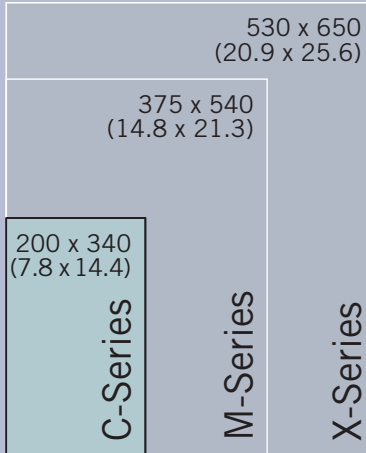


# LPKF ProtoMat® C-series



Working area in mm (inch)

## Training for LPKF ProtoMat® C, M, and X-series

All LPKF products are supplied with comprehensive operating instructions, with easy to understand manuals to make installation and commissioning quick and simple for the user.

Additional software assistant and multimedia training CD allow complete self-conducted training at the user's convenience.

We also provide private installation and training classes, both on-site or at one of LPKF's worldwide service facilities.

## LPKF ProtoMat® C20

### Simple and affordable 2-sided PCBs

This circuit board plotter is an ideal entry-level system for users that demand precision prototypes on an affordable budget. This model is particularly popular in schools, colleges, and universities. The ProtoMat® C20 is ideal for single and double sided boards using analog and digital technology with medium layout density.



## LPKF ProtoMat® C40

### Robust basic model with quick tool change

Instant prototypes right out of the lab at a higher level – The ProtoMat® C40 is setting a new standard in the industry combining the capability to create precision single and double sided PCBs with the operating comfort of a quick-release tool collet and the high performance of 40,000 rpm programmable motor speed. This makes this entry-level circuit board plotter the perfect fit for users from small businesses to corporate engineering.



## LPKF ProtoMat® C60

### For tight specs and diverse applications

The 60,000 rpm programmable speed motor allows the use of an extended range of tools, including small rectangular profiled endmills with diameters as small as 0.25 mm (10 mil). These tools have superior characteristics for RF and microwave applications and allow maximum precision with minimum penetration into the substrate. The high-speed motor also allows the production of dense digital designs with track/gap geometries of 100 µm (4 mil) and 0.2 mm (8 mil) drill holes as well as multilayer applications.



## LPKF ProtoMat® C100/HF

### Ideal for RF substrates and flex

This system, especially designed for RF and microwave PWBs, takes prototyping to extremes. A motor speed of 100,000 rpm allows the widest range of tools including 0.15 mm (6 mil) endmills for high performance designs. In addition the ProtoMat® C100/HF is extremely versatile. A contact-less air bearing depth limiter is ideal for use on flexible or gold plated circuits. Micrometer depth adjustment can be used to mill precise pockets into brass or aluminum backed circuits or to route beryllium copper sheets.

The ProtoMat® C100/HF is fully compatible with multilayer applications and all common materials including FR4, Rogers RO 4000® and TMM®, as well as Teflon® substrates such as RT/duroid®, UltraLAM®, TLX®, TLY® and many others.







Applications	LPKF ProtoMat®			
	C20	C40	C60	C100/HF
1 and 2-sided circuit boards	■	■	■	■
FR3, FR4, FR5, G10	■	■	■	■
Flexible substrates	■	■	■	■
RF & microwave substrates	■	■	■	■
Front panels/sign engraving	■	■	■	■
Machining cut outs in front panels	■	■	■	■
Contour routing of circuit boards	■	■	■	■
Multilayer PCBs up to 4 layers*	■	■	■	■
Multilayer PCBs up to 8 layers*	■	■	■	■
Test adapter drilling	■	■	■	■
Milling film artworks	■	■	■	■
SMD solder stencil cutting	■	■	■	■
Rigid-flex circuit milling	■	■	■	■
Depanelization and reworking of bare and populated boards	■	■	■	■
Solder frames for circuit board assembly	■	■	■	■
Housing production	■	■	■	■

■ Suitable for application

\* combined with MultiPress II and Contac III/MiniContac III



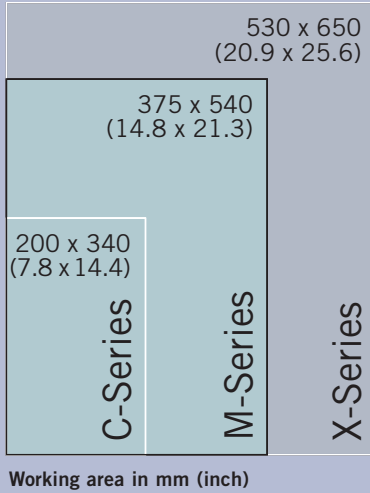
	<i>Simple and affordable 2-sided PCBs</i>	<i>Robust basic model with quick tool change</i>	<i>Multifunctional for tight specs and diverse applications</i>	<i>Ideal for RF substrates and flex</i>
				
<b>Specifications</b>	<b>LPKF ProtoMat® C20</b>	<b>LPKF ProtoMat® C40</b>	<b>LPKF ProtoMat® C60</b>	<b>LPKF ProtoMat® C100/HF</b>
<b>Part number</b>	<b>109419</b>	<b>110517</b>	<b>106511</b>	<b>107973</b>
Minimum track width	0.2 mm (8 mil)	0.1 mm (4 mil)	0.1 mm (4 mil)	0.1 mm (4 mil)
Minimum gap	0.2 mm (8 mil)	0.2 mm (8 mil)	0.1 mm (4 mil)	0.1 mm (4 mil)
Minimum hole diameter	0.5 mm (20 mil)	0.3 mm (12 mil)	0.2 mm (8 mil)	0.2 mm (8 mil)
Working area	340 mm x 200 mm (13.4" x 7.8")	340 mm x 200 mm (13.4" x 7.8")	340 mm x 200 mm (13.4" x 7.8")	340 mm x 200 mm (13.4" x 7.8")
Resolution	7.937 µm (0.312 mil)	7.937 µm (0.312 mil)	7.937 µm (0.312 mil)	7.937 µm (0.312 mil)
Repeatability	+/- 0.005 mm (0.2 mil)	+/- 0.005 mm (0.2 mil)	+/- 0.005 mm (0.2 mil)	+/- 0.005 mm (0.2 mil)
Front-to-back registration accuracy	+/- 0.02 mm (0.8 mil)	+/- 0.02 mm (0.8 mil)	+/- 0.02 mm (0.8 mil)	+/- 0.02 mm (0.8 mil)
Milling motor	DC, 20,000 rpm	EC (brushless), 10,000 - 40,000 rpm, programmable	3-phase motor, 10,000 - 60,000 rpm, programmable	3-phase motor, 10,000 - 100,000 rpm, programmable
Tool change	Semi-automatic	Semi-automatic	Semi-automatic	Semi-automatic
Collet	1/8" collet	1/8" quick-release collet	1/8" quick-release collet	1/8" quick-release collet
Drilling capacity	78 holes/min	78 holes/min	90 holes/min	120 holes/min
Positioning speed (max.)	35 mm/sec (1.38"/sec)	35 mm/sec (1.38"/sec)	35 mm/sec (1.38"/sec)	35 mm/sec (1.38"/sec)
Depth adjustment	Mechanical scanning, coaxial foot	Mechanical scanning, coaxial foot	Mechanical scanning, coaxial foot	Non-contact air bearing
X/Y positioning system	stepper motors, precision lead screws ActiveCAM® anti-backlash Supernuts®	stepper motors, precision lead screws ActiveCAM® anti-backlash Supernuts®	stepper motors, precision lead screws ActiveCAM® anti-backlash Supernuts®	stepper motors, precision lead screws ActiveCAM® anti-backlash Supernuts®
Z drive	electromagnetic with hydraulic damper	electromagnetic with hydraulic damper	electromagnetic with hydraulic damper	pneumatic, 14 mm (0.55") movement
Machine table base	75mm (3") cast aluminum	75mm (3") cast aluminum	75mm (3") cast aluminum	75mm (3") cast aluminum
X/Y linear system	precision linear bushings and dual shafts	precision linear bushings and dual shafts	precision linear bushings and dual shafts	precision linear bushings and dual shafts
Dimensions (W/H/D)	16.5" x 13.75" x 22.25" <sup>1)</sup>	16.5" x 13.75" x 22.25" <sup>1)</sup>	16.5" x 13.4" x 22.25" <sup>2)</sup>	16.5" x 13.0" x 22.25" <sup>3)</sup>
Weight	24 kg (53 lb)	24 kg (53 lb)	24 kg (53 lb)	25 kg (55 lb)
Power supply	120/240V, 50 - 60 Hz/150VA	120/240V, 50 - 60 Hz/150VA	120/240V, 50 - 60 Hz/200VA	120/240V, 50 - 60 Hz/200VA
Compressed air supply	--	--	--	6 bar (87 psi), 50 l/min (1.7 cfm)
<b>Options/accessories</b>				
Software package CircuitCAM LITE	•	•	–	–
Software package CircuitCAM PCB	+	+	•	•
Dust extraction unit	+	+	+	+
Dust extraction AutoSwitch	+	+	+	+
Tooling starter kit (board material/tools etc.)	+	+	+	+
Measuring microscope	+	+	+	+
Mobile sound enclosure	+	+	+	+
Head illumination	++	++	++	++
CircuitView camera system	+	+	+	+
Micrometer depth adjustment	+	+	+	•
3-phase motor, 10,000 to 100,000 rpm	++	++	++	•
3-phase motor, 10,000 to 60,000 rpm	++	++	•	–
EC motor, 10,000 to 40,000 rpm	++	•	–	–
DC motor, 20,000 rpm	•	–	–	–
Pneumatic Z-stroke	++	++	++	•
Pneumatic non-contact air bearing	++	++	++	•
Raising Z-axis by 30 mm (1.2")	++	++	++	++

- standard equipment
- + optional (can be retrofitted)
- ++ optional (needs to be factory mounted)
- not available

■ recommended basic equipment

- Dimensions (W/H/D)
- 1) 420 mm x 350 mm x 565 mm
  - 2) 420 mm x 340 mm x 565 mm
  - 3) 420 mm x 330 mm x 565 mm

# LPKF ProtoMat® M/L-series



## LPKF ProtoMat® M30/s

**Robust basic model with quick-release collet for 2-sided PCBs, large panels**

The large table size makes the ProtoMat® M30 very valuable for large analog and digital boards with medium population density as well as production of multiple copies of the same or different layouts. For increased operating comfort, this system provides programmable spindle speed and quick-release tool collet.



## LPKF ProtoMat® M60

**For precise large and multilayer boards**

The ProtoMat® M60 is truly a multi-talented system. Its large table size allows the production of large circuit boards. This is especially helpful when producing multilayer boards as this plotter can handle multiple layers simultaneous.

A 60,000 rpm motor guarantees perfect drill hole quality, which is essential for proper interconnection on multilayer boards, and produces dense circuitry from DC to RF.

It is also able to engrave and route inspection templates, aluminum panels and other two-dimensional mechanical items.



## LPKF ProtoMat® L60

**For extremely long circuit boards, antennas and front panels**

This circuit board plotter provides a long working area that accommodates extra large circuits including antennae and front panels. It is equipped with a 60,000 rpm motor capable of handling small endmills for RF and microwave circuitry and a pneumatic Z-axis with extra clearance for thick substrates.






Applications	LPKF ProtoMat®		
	M30/s	M60	L60
1 and 2-sided circuit boards	■	■	■
FR3, FR4, FR5, G10	■	■	■
Flexible substrates	■	■	■
RF & microwave substrates	■	■	■
Front panels/sign engraving	■	■	■
Machining cut outs in front panels	■	■	■
Contour routing of circuit boards	■	■	■
Multilayer PCBs up to 4 layers*	■	■	■
Multilayer PCBs up to 8 layers*	■	■	■
Test adapter drilling	■	■	■
Milling film artworks	■	■	■
SMD solder stencil cutting	■	■	■
Rigid-flex circuit milling	■	■	■
Depanelization and reworking of bare and populated boards	■	■	■
Solder frames for circuit board assembly	■	■	■
Housing production	■	■	■

■ Suitable for application

\* combined with MultiPress II and Contac III/MiniContac III



	<i>Robust basic model with quick-release collet for 2-sided PCBs, large panels</i>	<i>Multifunctional system for precise large and multilayer boards</i>	<i>For extremely long circuit boards, antennas and front panels</i>
			
<b>Specifications</b>	<b>LPKF ProtoMat® M30/s</b>	<b>LPKF ProtoMat® M60</b>	<b>LPKF ProtoMat® L60</b>
<b>Part number</b>	<b>108001</b>	<b>108002</b>	<b>109797</b>
Minimum track width	0.1 mm (4 mil)	0.1 mm (4 mil)	0.1 mm (4 mil)
Minimum gap	0.2 mm (8 mil)	0.1 mm (4 mil)	0.1 mm (4 mil)
Minimum hole diameter	0.3 mm (12 mil)	0.2 mm (8 mil)	0.2 mm (8 mil)
Working area	540 mm x 375 mm (21.3" x 14.8")	540 mm x 375 mm (21.3" x 14.8")	375 mm x 1,250 mm (14.75" x 49.2")
Resolution	7.937 µm (0.312 mil)	7.937 µm (0.312 mil)	7.937 µm (0.312 mil)
Repeatability	+/- 0.005 mm (0.2 mil)	+/- 0.005 mm (0.2 mil)	+/- 0.005 mm (0.2 mil)
Front-to-back registration accuracy	+/- 0.02 mm (0.8 mil)	+/- 0.02 mm (0.8 mil)	+/- 0.02 mm (0.8 mil)
Milling motor	EC (brushless), 10,000 - 30,000 rpm, programmable	3-phase motor, 10,000 - 60,000 rpm, programmable	3-phase motor, 10,000 - 60,000 rpm, programmable
Tool change	Semi-automatic	Semi-automatic	Semi-automatic
Collet	1/8" collet	1/8" collet	1/8" collet
Drilling capacity	78 holes/min	90 holes/min	120 holes/min
Positioning speed (max.)	35 mm/sec (1.38"/sec)	35 mm/sec (1.38"/sec)	35 mm/sec (1.38"/sec)
Depth adjustment	Mechanical scanning, coaxial foot	Mechanical scanning, coaxial foot	Non-contact air bearing
X/Y positioning system	stepper motors, precision lead screws ActiveCAM® anti-backlash Supernuts®	stepper motors, precision lead screws ActiveCAM® anti-backlash Supernuts®	stepper motors, precision lead screw assemblies with internal ball recirculating system
Z drive	electromagnetic with hydraulic damper	electromagnetic with hydraulic damper	pneumatic, 14 mm (0.55") movement
Machine table base	75mm (3") cast aluminum	75mm (3") cast aluminum	precision milled aluminum bed
X/Y linear system	precision linear bushings and dual shafts	precision linear bushings and dual shafts	precision linear bushings and dual shafts
Dimensions (W/H/D)	620 x 420 x 760 mm (24.4" x 16.5" x 29.9")	620 x 420 x 760 mm (24.4" x 16.5" x 29.9")	620 x 420 x 1,543 mm (24.4" x 16.5" x 60.7")
Weight	43 kg (94.6 lb)	43 kg (94.6 lb)	110 kg (242 lb)
Power supply	120/240V, 50 - 60 Hz/150VA	120/240V, 50 - 60 Hz/200VA	120/240V, 50 - 60 Hz/200VA
Compressed air supply	--	--	6 bar (87 psi), 100 l/min (3.528 cfm)
<b>Options/accessories</b>			
Software package CircuitCAM LITE	•	–	–
Software package CircuitCAM PCB	+	•	•
Dust extraction unit	+	+	+
Dust extraction AutoSwitch	+	+	+
Tooling starter kit (board material/tools etc.)	+	+	+
Measuring microscope	+	+	+
Mobile sound enclosure	+	+	–
Head illumination	++	++	++
CircuitView camera system	+	+	+
Micrometer depth adjustment	+	+	+
3-phase motor, 10,000 to 100,000 rpm	++	++	++
3-phase motor, 10,000 to 60,000 rpm	++	•	•
EC motor, 10,000 to 40,000 rpm	•	–	–
Pneumatic Z-stroke	++	++	•
Pneumatic non-contact air bearing	++	++	++
Raising Z-axis by 30 mm (1.2")	++	++	++

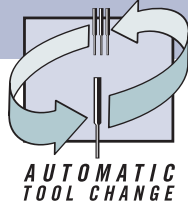
- standard equipment
- recommended basic equipment
- + optional (can be retrofitted)
- ++ optional (needs to be factory mounted)
- not available

# LPKF ProtoMat® H-series

380 x 420  
(14.9 x 16.5)

**95s/II, H100**

Working area in mm (inch)



## Installation and training for LPKF ProtoMat® 95s/II and H100

These systems are offered with installation and training packages to support users in their correct operation for the many applications that the high end LPKF ProtoMat® 95s/II and ProtoMat® H100 can perform.

Applications	LPKF ProtoMat®	
	95s/II	H100
1 and 2-sided circuit boards		
FR3, FR4, FR5, G10		
Flexible substrates		
RF & microwave substrates		
Front panels/sign engraving		
Machining cut outs in front panels		
Contour routing of circuit boards		
Multilayer PCBs up to 4 layers*		
Multilayer PCBs up to 8 layers*		
Test adapter drilling		
Milling film artworks		
SMD solder stencil cutting		
Rigid-flex circuit milling		
Depanelization and reworking of bare and populated boards		
Solder frames for circuit board assembly		
Housing production		

■ Suitable for application

\* combined with MultiPress II and Contac III/MiniContac III

## LPKF ProtoMat® 95s/II

### Precision system with automatic tool change

The LPKF ProtoMat® 95s offers high-speed and precision combined with the convenience of a 30-station fully automatic tool change. A contact-less air bearing depth limiter is ideal for use on flexible or gold plated circuits.

This circuit board plotter is designed for PCB labs with a high volume of prototypes in any technology including analog, digital, power supplies, flex boards as well as RF and microwave circuits. The high production speed is also a substantial advantage for the in-house fabrication of quick turn multilayer circuit boards and small batch production.



## LPKF ProtoMat® H100

### The fastest prototyping system yet

This system allows significant reduction in the production time of prototype PCBs. The maximum milling speed is now almost doubled compared to prior top-of-the-range systems and the integrated smart following-vector path generation allows the system to maintain a higher average speed. The combination of both of these features pushes the performance factor of this machine 2-3 times. Now prototype production of multilayer boards is accomplished in-house comfortably. The resolution has been increased five fold to 1 µm, which combined with 100,000 rpm milling motor allows this plotter to partially create 80 µm (3.1 mil) tracks with 100 µm (4 mil) spacing which accommodates all state of the art packages including BGA and µBGA®.

Along with the increased performance, the H100 also includes many new features derived from high volume production systems, which up to now have been unknown in this class of prototyping equipment. These features include automatic tool change, automatic tool adjustment by scanning sensor, and a camera system for automatic fiducial recognition. This eliminates user interaction and simplifies the board alignment process. The H100 system also includes an integrated vacuum tabletop allowing proper mounting of thin and flexible substrates on the plotter.



**Available from  
mid 2003**



*Precision system with automatic tool change*

*The fastest prototyping system yet!*

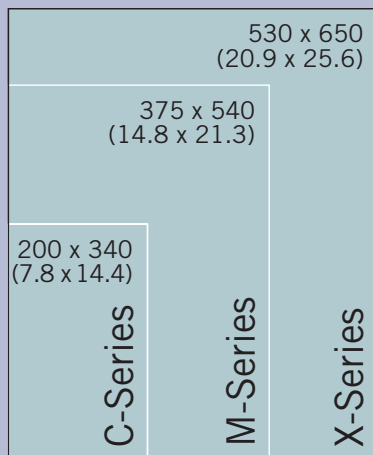


**Available from mid 2003**

Specifications	LPKF ProtoMat® 95s/II	LPKF ProtoMat® H100
<b>Part number</b>	106333	111424
Minimum track width	0.1 mm (4 mil)	0.1 mm (4 mil); 0.08 mm (3.1 mil) partially
Minimum gap	0.1 mm (4 mil)	0.1 mm (4 mil)
Minimum hole diameter	0.2 mm (8 mil)	0.15 mm (6 mil)
Working area	420 mm x 380 mm (16.5" x 14.9")	420 mm x 380 mm (16.5" x 14.9")
Resolution	5 µm (0.2 mil)	1 µm (0.04 mil)
Repeatability	± 0.005 mm (0.2 mil)	± 0.001 mm (0.04 mil)
Front-to-back registration accuracy	± 0.02 mm (0.8 mil)	± 0.02 mm (0.8 mil)
Milling motor	3-phase motor, 10,000 - 60,000 rpm, programmable	3-phase motor, 10,000 - 100,000 rpm, programmable
Tool change	Automatic, 30 positions	Automatic, 30 positions
Collet	1/8" pneumatic-release collet	1/8" pneumatic-release collet
Drilling capacity	90 holes/min	120 holes/min
Positioning speed (max.)	60 mm/sec (2.36"/sec)	100 mm/sec (3.94"/sec)
Depth adjustment	Non-contact air bearing	Non-contact air bearing; automatic setting
X/Y positioning system	stepper motors, precision ball screw assemblies with internal ball recirculating system	stepper motors, precision ball screw assemblies with internal ball recirculating system
Z drive	pneumatic, 14 mm (0.55") movement	pneumatic, 14 mm (0.55") movement
Machine table base	75 mm (3") cast aluminum	75 mm (3") cast aluminum
X/Y linear system	precision linear bushings and dual shafts	precision linear bushings and dual shafts
Dimensions (W/H/D)	650 mm x 430 mm x 750 mm (25.6" x 16.9" x 29.5")	650 mm x 430 mm x 750 mm (25.6" x 16.9" x 29.5")
Weight	50 kg (110 lb) (without acoustic cabinet)	50 kg (110 lb) (without acoustic cabinet)
Power supply	120/240V, 50 - 60 Hz/240VA	120/240V, 50 - 60 Hz/240VA
Compressed air supply	6 bar (90 psi), 100 l/min (2.4 cfm)	6 bar (87 psi), 100 l/min (3.528 cfm)
<b>Options/accessories</b>		
Software package CircuitCAM LITE	-	-
Software package CircuitCAM PCB	•	•
Dust extraction unit	+	+
Dust extraction AutoSwitch	+	+
Tooling starter kit (board material/tools etc.)	+	+
Measuring microscope	+	+
Mobile sound enclosure	•	•
Head illumination	++	•
CircuitView camera system	+	+
Micrometer depth adjustment	+	•
3-phase motor, 10,000 to 100,000 rpm	+	•
3-phase motor, 10,000 to 60,000 rpm	•	-
EC motor, 10,000 to 40,000 rpm	-	-
Pneumatic Z-stroke	•	•
Pneumatic non-contact air bearing	•	•
Raising Z-axis by 30 mm (1.2")	-	-

- standard equipment
- recommended basic equipment
- + optional (can be retrofitted)
- ++ optional (needs to be factory mounted)
- not available

# LPKF ProtoMat® X-series



Working area in mm (inch)

## LPKF ProtoMat® X60

### Drilling, Routing & Depaneling

The ProtoMat® X60 is placed between two worlds – rapid PCB prototyping plotter on one hand and versatile production drilling and routing system on the other. The large table holds panel sizes of 650 mm x 530 mm (26" x 21"). The X60 is equipped with pneumatic z-stroke and non-contact air bearing depth limiter. The extended Z-axis range enables depaneling and milling of deep trenches for rigid and rigid-flex boards.

The ProtoMat® X60 is also ideal for producing anti-static inspection templates for circuit boards.



Applications	LPKF ProtoMat® X60
1 and 2-sided circuit boards	
FR3, FR4, FR5, G10	
Flexible substrates	
RF & microwave substrates	
Front panels/sign engraving	
Machining cut outs in front panels	
Contour routing of circuit boards	
Multilayer PCBs up to 4 layers*	
Multilayer PCBs up to 8 layers*	
Test adapter drilling	
Milling film artworks	
SMD solder stencil cutting	
Rigid-flex circuit milling	
Depanelization and reworking of bare and populated boards	
Solder frames for circuit board assembly	
Machining of enclosures	

■ Suitable for application

\* combined with MultiPress II and Contac III/MiniContac III

Model for use in series production.  
Working area matches standard  
PCB production panels



Specifications	LPKF ProtoMat® X60
Part number	109643
Minimum track width	0.1 mm (4 mil)
Minimum gap	0.1 mm (4 mil)
Minimum hole diameter	0.2 mm (8 mil)
Working area	650 mm x 530 mm (25.6" x 20.9")
Resolution	1 µm (0.04 mil)
Repeatability	± 0.001 mm (0.04 mil)
Front-to-back registration accuracy	± 0.02 mm (0.8 mil)
Milling motor	3-phase motor, 10,000 - 60,000 rpm, programmable
Tool change	Semi-automatic
Collet	1/8" collet
Drilling capacity	120 strokes/min
Positioning speed (max.)	50 mm/sec (1.97"/sec)
Depth adjustment	Non-contact air bearing
X/Y positioning system	stepper motors, precision ball screw assemblies with internal ball recirculating system
Z drive	pneumatic, 14 mm (0.55") movement
Machine table base	75mm (3") cast aluminum
X/Y linear system	precision linear bushings and dual shafts
Dimensions (W/H/D)	750 mm x 420 mm x 900 mm (29.5" x 16.5" x 35.4")
Weight	69 kg (151.8 lb)
Power supply	120/240V, 50 - 60 Hz/240VA
Compressed air supply	6 bar (87 psi), 100 l/min (3.528 cfm)
Options/accessories	
Software package CircuitCAM LITE	–
Software package CircuitCAM PCB	•
Dust extraction unit	+
Dust extraction AutoSwitch	+
Tooling starter kit (board material/tools etc.)	+
Measuring microscope	+
Mobile sound enclosure	–
Head illumination	++
CircuitView camera system	+
Micrometer depth adjustment	+
3-phase motor, 10,000 to 100,000 rpm	+
3-phase motor, 10,000 to 60,000 rpm	•
EC motor, 10,000 to 40,000 rpm	–
Pneumatic Z-stroke	•
Pneumatic non-contact air bearing	•
Raising Z-axis by 30 mm (1.2")	+

• standard equipment

+ optional (can be retrofitted)

++ optional (needs to be factory mounted)

– not available

■ recommended basic equipment



# LPKF ProtoLaser

## LPKF ProtoLaser for Rapid PCB Prototyping

### Product features

- 60  $\mu\text{m}$  (2.4 mil) track with 40  $\mu\text{m}$  (1.6 mil) gaps
- Capable of drilling and skiving Alumina and other ceramic substrates
- Fine marking and engraving of components and front panels
- Extremely simple operation
- Powerful software with intuitive user interface
- Laser Safety Class 1

### Ultra fine geometries with laser

To be able to prototype HDI circuitry the LPKF ProtoLaser combines the best of both worlds. This circuit board plotter features a mechanical milling head with fully automatic tool change for milling, drilling and routing as well as a laser beam to create circuit geometries as small as 40  $\mu\text{m}$  (1.6 mil) with 100  $\mu\text{m}$  (4 mil) pitch. The laser is also capable of drilling and skiving ceramic substrates. This system is designed to meet the needs of engineers pushing the envelope with top-level designs without compromising the turnaround time for prototypes.



*Laser cutting head*

### High-end versatility

#### HDI circuit structuring

The LPKF ProtoLaser uses a hybrid cutting head consisting of both a mechanical tool and a laser beam that can be used alternatively. The laser beam creates the critical fine structures, whereas the mechanical milling bit removes larger copper areas, drills holes or routes the board's contour. A completely integrated software tool management automatically handles all tool parameters as well as the interaction between laser and mechanical machining. If particularly high specifications are demanded an optional cleaning process can be applied subsequently.

#### Substrate cutting

Another application of the LPKF ProtoLaser is the cutting of various substrates including aluminium oxide, silicon nitride, polycrystalline silica and others.



*Micro coil*



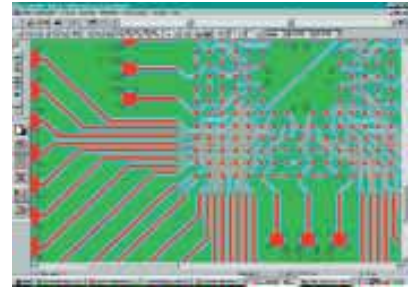
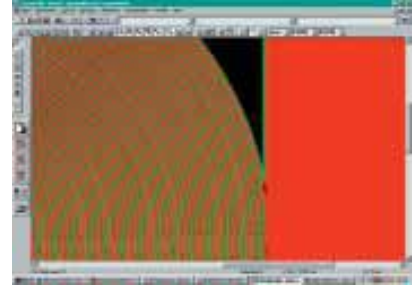
*Laser-cut ceramics*



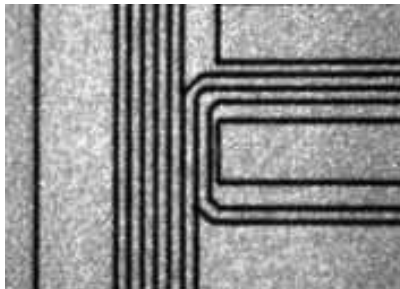


### High-performance CAM software

The LPKF ProtoLaser uses the LPKF CircuitCAM/BoardMaster software package. LPKF CircuitCAM imports the artwork (Gerber® Standard [RS-274-D], Gerber® Extended [RS-274-X], DBF [Barco], Excellon® NC Drill [versions 1 and 2], Sieb & Meier NC Drill, DXF, HP-GL™, ODB++), provides the extensive functionality of a CAM package, calculates the cutting paths for the laser and the milling tools, and transfers the production data to the ProtoLaser control software (LPKF BoardMaster). In addition to numerous control functions, this also incorporates comprehensive tool management and a comfortable WYSIWYG user interface which permanently informs about the current status of the production process.



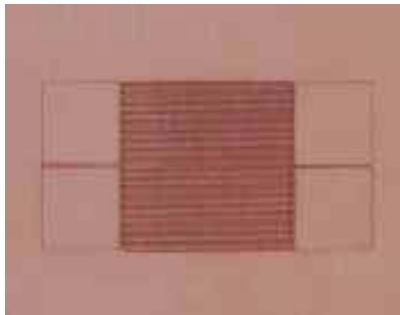
Data preparation with CircuitCAM



60/40  $\mu\text{m}$  (2.4/1.6 mil) ultra fine circuit



Micro coil 50  $\mu\text{m}$  (2 mil)

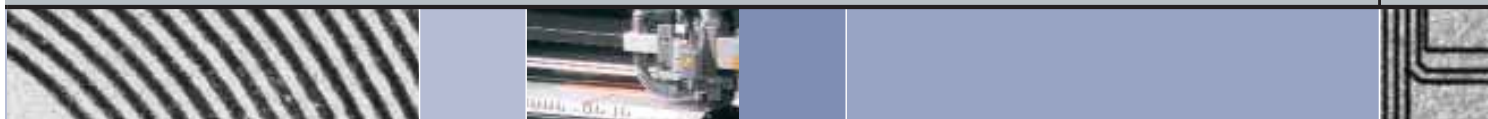


Sensor



Circuit with 40  $\mu\text{m}$  (1.6 mil) geometries

If you have any questions, or inquiries about your special applications, please contact our LPKF application engineers at any time.



<i>Specifications: Laser</i>	
Part number	106821
Wavelength	1,064 nm
Output	70 W multi-mode system
Frequency	0 - 50 kHz (regulated by cutting speed)
Beam diameter	40 µm (1.6 mil)
Minimum track and gap	60 µm/40 µm (2.4 mil/1.6 mil)
Copper thickness	< 35 µm (1 oz.)

<i>Specifications: milling/drilling head</i>	
Milling motor	3-phase motor, programmable 10,000 - 60,000 rpm
Tool change	Automatic, 23 positions
Collet	1/8" pneumatic-release collet
Drilling capacity	120 strokes/min
Positioning speed (max.)	60 mm/sec (2.4"/sec)
Depth adjustment	Non-contact air bearing
Minimum track and gap	0.1 mm/0.1 mm (4 mil/4 mil))
Minimum hole diameter	0.2 mm (8 mil)

<i>General specifications</i>	
Working area	420 x 380 mm (16.5" x 15") for laser applications: 415 mm x 320 mm (16.3" x 12.6")
Resolution	5 µm (0.2 mil)
Repeatability	0.005 mm (0.2 mil)
X/Y positioning system	stepper motors, precision ball screw assemblies with internal ball recirculating system
Z drive	pneumatic, 14 mm / 0.55" movement
<b>Dimensions (W/H/D)</b>	
Machine table unit	730 mm x 1,340 mm x 850 mm (28.7" x 52.8" x 33.5") with housing
Laser control unit	570 mm x 1100 mm x 750 m (22.4" x 43.3" x 29.5")
Unit separation	215 mm (8.5")
<b>Weight</b>	
Machine table unit	110 kg (242 lbs) (with cover)
Laser control unit	180 kg (396 lbs)
<b>Power supply</b>	
Machine table unit	230 V, 50/60 Hz, 240 VA; 6 bar (87 psi) compressed air, min. 100 l/min (3.5 cfm)
Laser control unit	3-phase, 3 x 400 V, 50 Hz, 4 kVA, 10 bar (145 psi) comp. air, min. 120 l/min (4.2 cfm), cooling water 10 l /min (0.35 cfm), 2 - 6 bar (29 - 87 psi), max. 20 °C (68 °F)

<i>Applications</i>	
<ul style="list-style-type: none"> <li>· HDI circuits</li> <li>· Compatible with all common circuit substrates</li> <li>· Engraving of components, front panels, etc.</li> <li>· Machining and circuit structuring of ceramic substrates (max. thickness 635 µm [25 mil])</li> </ul>	

# Accessories/options

The LPKF accessories/options are practical additions to the machines and systems. A very high degree of functionality is guaranteed by the perfect match between each component. High quality materials and precise finishing ensures products with long lifetime.



Front and rear view of the cabinet with optional accessories

## LPKF acoustic cabinets

The acoustic cabinets reduce noise and dust emissions to ensure comfortable operations in electronic design labs or CAD offices. Storage shelves for tools and basic materials, as well as a space for the integrated dust extraction, simplify routine work. LPKF acoustic cabinets are optionally available for all circuit board plotters but are supplied standard with the LPKF ProtoMat 95s/II and the H100 for safety purposes due to the automatic tool change. The protective cover is mobile to ensure easy travel to various locations.

Size cabinets	Small cabinet	Large cabinet	95s/II cabinet
Part number	101097	108731	Standard
Machine	C series	M series	95s/II, H100
W/H/D approx. (mm)*	650/1,320/700	730/1,320/950	730/1,320/850
Noise reduction	Approx. 8 dB	Approx. 8 dB	Approx. 8 dB

\* Dimensions W/H/D (inch)    25.6"/52"/27.6"    28.7"/52"/37.4"    28.7"/52"/33.5"



## Measuring microscope

The measuring microscope magnifies 50 times and has a metric scale for the precise setting of insulation gap widths and quality control.

Part number 104475



## Dust extraction

Milling and drilling dust must be removed from the machining head to ensure the proper operation of the milling depth limiter. The dust extraction system guarantees reliable removal of the dust generated by machining.

Technical data	
Part number	109039
Vacuum pressure	Max. 20,000 Pascal
Air flow rate	40 l/sec (1.411 cfm)
Power consumption	800 W (230 V)
Filter surface	1,200 cm <sup>2</sup> (47.2" <sup>2</sup> ) (cotton wool)
Dim. W/H/D mm (inch)	300/360/400 (11.8/14.2/15.7)
Acoustic pressure	50 db(A)
<b>Absolute filter</b>	HEPA filter
Filter material	Glass fiber
Surface filter cartridge	4,300 cm <sup>2</sup> (169.3 sq. in)
Filter efficiency	Particle size 0.5 - 0.9 µm (0.02 - 0.036 mil) 100 %



## LPKF AutoSwitch

AutoSwitch is a useful addition to the dust extraction system. When fitted, the dust extraction system is switched on and off automatically. This ensures safety, increases the lifetime of the dust extraction system and reduces noise when the machine is not running.

Part number 101473

### Hot air oven

The hot air oven has an integrated timer and precise temperature controller, creating optimal conditions for hardening paste plated-holes and for laminating solder-resist films.

Technical data	
Part number	102073
Feature	Timer, temperature controller
Power	1,800 W
External dim. W/H/D mm (inch)	580/290/350 (22.8/11.4/13.8)
Internal dim. W/H/D mm (inch)	440/210/290 (17.3/8.3/11.4)



### Compressor

Some LPKF systems (e.g. ProtoMat® C100/HF, H100, 95s/II, MultiPress II, AutoContac) require compressed air. The compressors supplied by LPKF guarantee clean, dry and reliable compressed air supplies.

Technical data	Compressor type	
	Small	Large
Part number	101092	104863
Tank size in liters	9	50
Max. pressure bar (psi)	8 (116)	10 (145)
Output l/min (cfm)	33 (1.1)	165 (5.8)
External dim. W/H/D mm (inch)	360/430/360 (14.2/16.9/14.2)	1,000/770/390 (39.4/30.3/15.4)
Weight kg (lb)	21 (46.2)	56 (123.2)
Acoustic noise level db(A) At a distance of 4 m (L <sub>PAA</sub> )	33	67
For LPKF system	AutoContac, MultiPress	C100/HF, 95s/II, X60, H100



### LPKF precision ring setter

The LPKF ring setter includes a tool ring press, adjusting unit, and a measuring microscope. The precise adjustment of spacing rings allows different tools to be used without readjusting the milling depth settings.

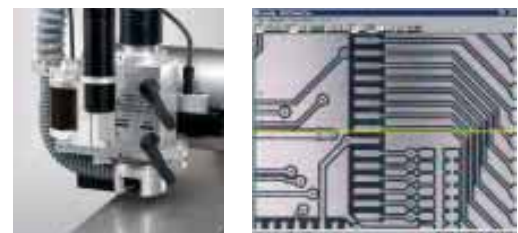
Available for	All LPKF ProtoMat®	LPKF ProtoMat® 95s/II, H100
Part number	110368	Standard



### LPKF CircuitView

The LPKF CircuitView provides a camera option for the visual positioning of the milling head. This system is particularly suitable for the reworking of circuit boards, as well as the coding, and teach-in functions. CircuitView contains a monochrome camera and a frame grabber card. This option is available for all LPKF circuit board plotters.

Available for	LPKF ProtoMat® C & M series	LPKF ProtoMat® 95s/II, H100
Part number	106345	107168



### LPKF StatusLight

LPKF acoustic cabinets for the LPKF circuit board plotters can also be equipped with a multi-colored indicator light. The StatusLight, which is visible from a long distance, indicates the operating status of the machine.

Part number 111093





**Optional accessories** are typically factory mounted to the circuit board plotter and are standard on some systems, however the user can retrofit some options.



#### Integrated head illumination

The high-performance LED ring surrounds the tool holding fixture and guarantees shadow-free illumination of the immediate machining area. This makes direct quality control of drilling and milling faster and easier. The head illumination is available for all LPKF ProtoMat® circuit board plotters.

- for mechanical depth limiter: **part number 109153** (retrofitting upon request)
- for non-contact air bearing depth limiter: **part number 109154** (retrofitting upon request)



#### Micrometer screw

The micrometer screw is for the infinite adjustment of the milling depth when operating on materials without a milling depth limiter. Available for all LPKF circuit board plotters this device works off of a backstop to control milling depth.

**Part number 109688**



#### Pneumatic Z-stroke

The pneumatic Z-stroke makes it possible to machine thicker materials (up to a maximum of 14 mm [0.55"]). It also gives a 15 mm (0.59") z-movement (standard: 5 mm [0.2"]), and can use tools with much smaller diameters thanks to the adjustable lowering pressure.

**Part number is available upon request**

	LPKF ProtoMat®									
	C20	C40	C60	C100/HF	M30/s	M60	L60	95s/II*	H100*	X60
Option	•	•	•		•	•				
Standard				•			•	•	•	•

\* without Z-extension



#### Non-contact air bearing depth limiter

The pneumatic depth limiter has an air cushion which makes it possible to machine sensitive materials without coming into direct contact.

**Part number is available upon request**

	LPKF ProtoMat®									
	C20	C40	C60	C100/HF	M30/s	M60	L60	95s/II	H100	X60
Option	•	•	•		•	•				
Standard				•			•	•	•	•



#### Increased Z-axis height (to max. 30 mm [1.18"])

Setting the Z-axis higher enables the surface machining of thicker material. The system is also suitable for reworking assembled circuit boards. The stroke remains unchanged at 5 mm (0.2") (15 mm [0.59"] in the case of pneumatic stroke). This option is available for all LPKF circuit board plotters with the exception of LPKF ProtoMat® 95s/II, H100 and ProtoLaser.

**Part number is available upon request**

#### 100,000 rpm motor

This motor is capable of using very small endmills (0.15 mm [6 mil]) for RF/microwave applications and drilling very small holes. The higher speed provides longer tool life and also allows higher travel speeds.

**Part number is available upon request**



	LPKF ProtoMat®									
	C20	C40	C60	C100/HF	M30/s	M60	L60	95s/II	H100	X60
Option	•	•	•		•	•	•	•		•
Standard				•					•	