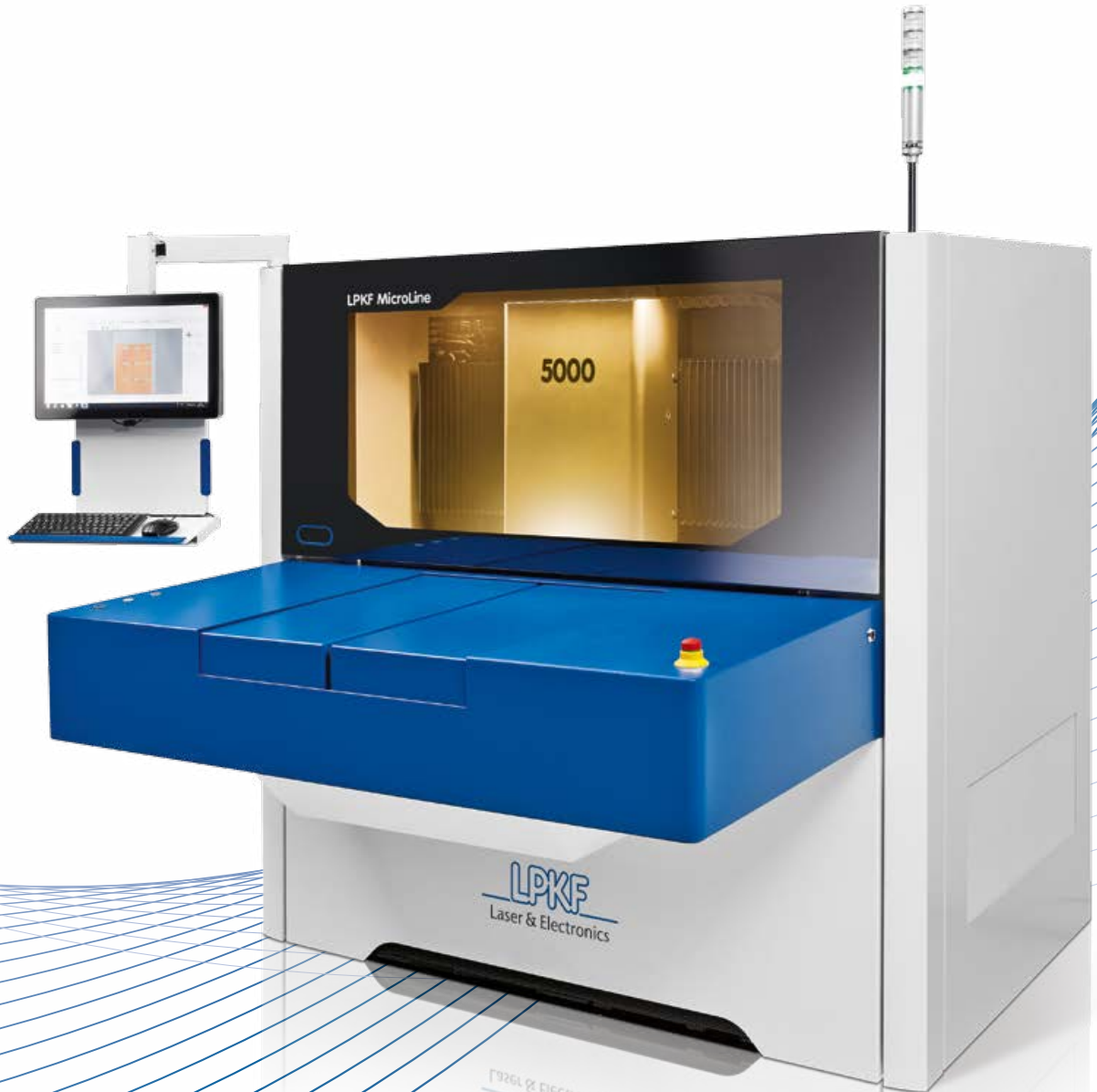


State of the Art Laser Processing of Flex PCBs

LPKF MicroLine 5000 Series





UV Laser System for Flex Drilling and Cutting

LPKF MicroLine UV laser systems don't compromise quality or precision over cost-efficiency. These three principles, which are critical to any manufacturing operation, are the driving force behind the development of the MicroLine 5000 series UV lasers systems from LPKF for the drilling and cutting of flexible PCBs.

Unsurpassed Drilling Performance

The MicroLine 5000 is the flex PCB industry's answer to high through-put, high-yield drilling applications. With the ability to drill holes down to 20 μm , a variety of both organic and inorganic substrates can be processed such as:

- Flexible PCBs
- IC substrates
- High Density Interconnect PCBs

Common applications include the drilling of through holes and blind vias, with the additional ability to cut large mounting holes, or full perimeter cuts of irregular board contours.

Quality and Precision

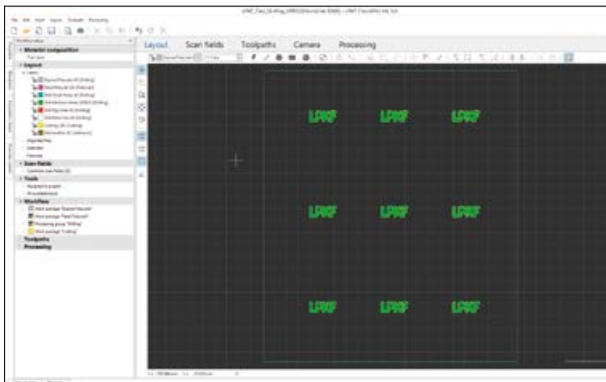
The high-quality attributes of the UV wavelength allow for the cutting and drilling of delicate materials with minimal heat affected zone – and the proof is in the results: clean side-walls with precise dimensions and virtually zero debris.

- Robust and streamlined system configuration
- Future-proof: Easily exceed current industry requirements with room to grow
- International service structure to support a world-wide customer base
- Turnkey system with LPKF-manufactured OEM laser source

Safe Investment

As circuitry designs become increasingly more dense and sophisticated, with higher counts of blind/buried vias, the LPKF MicroLine 5000 series is capable of meeting high yield requirements while maintaining unsurpassed through-put. Capable of drilling vias down to 20 μm diameter, this proven UV laser platform features a wide process window with a programmable range of variable laser parameters.

The ability of the MicroLine 5000 series to achieve results beyond what the industry demands today helps to “future proof” the system – as customers’ needs for smaller holes and tighter tolerances increase, owners of LPKF MicroLine 5000 systems can keep the pace.



Efficient LPKF CircuitPro Software

System control is accomplished with the user-friendly software, LPKF CircuitPro. The CircuitPro software platform enables separation between programming and production mode. The proprietary LPKF software converts conventional artwork formats such as Gerber, Gerber-X, and DXF files into production-ready data in just a few easy steps. All production data parameters can be saved and easily recalled for future use.

Process Monitoring

The MicroLine 5000 systems are equipped with an integrated vision system for fast fiducial recognition, ensuring accurate alignment. The camera’s ability to use virtually any board feature as a fiducial alignment point provides operator flexibility from job to job. In addition, an integrated power measurement system at the work surface ensures reliable, repeatable control.

Various Handling Options

The MicroLine 5000 series may be configured to work with various material handling options such as reel-to-reel solutions.

Contour Cutting

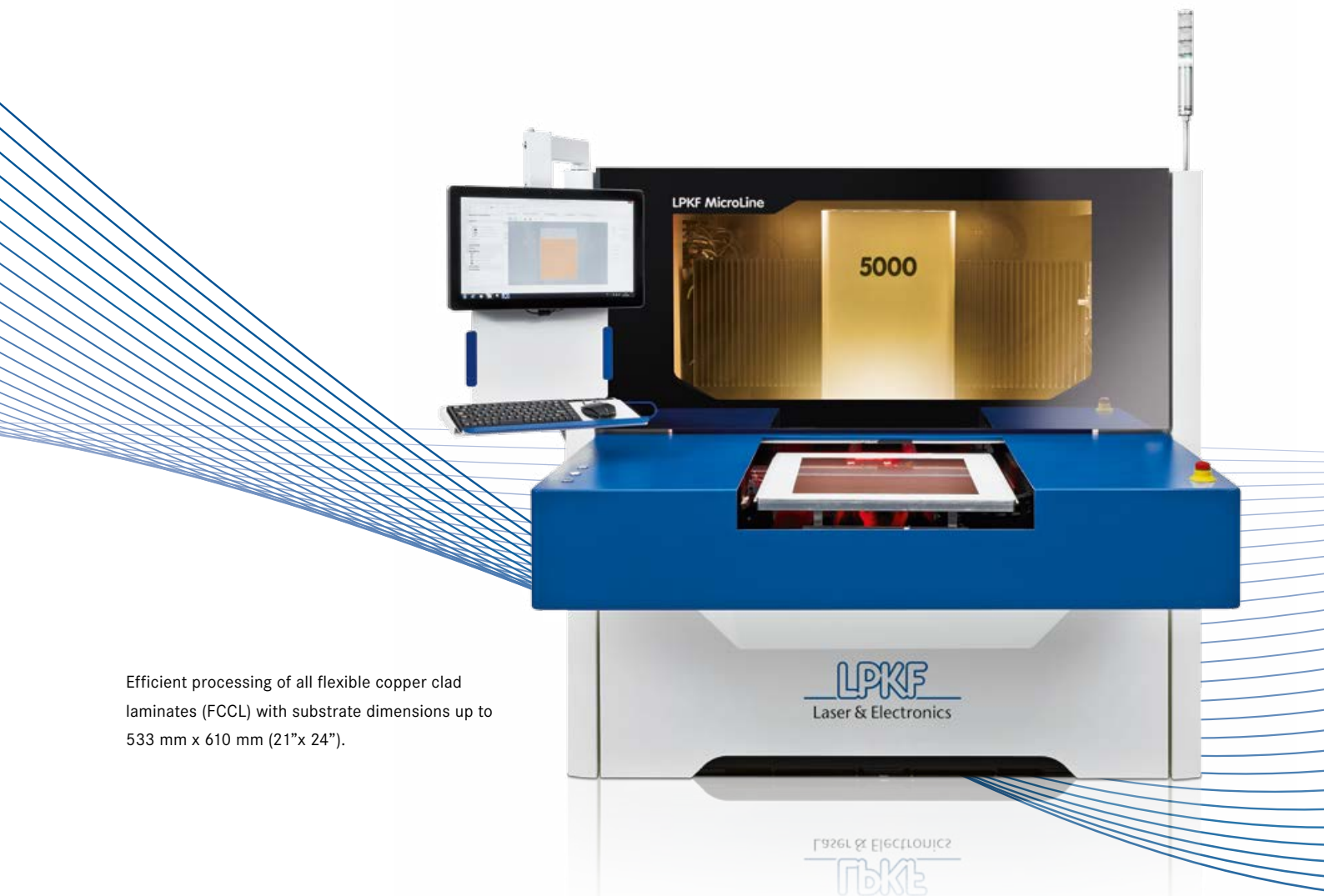
The MicroLine 5000 UV laser is a universal tool – and thus suitable for cutting all industry-standard panel sizes with dimensions of up to 21” x 24” (533 mm x 610 mm). The 20 μm high quality UV laser kerf width allows for cutting of even the most delicate contours at high speeds.

Unique Laser Know-how

The MicroLine 5000 features proprietary 10 W or 15 W laser sources, which were developed by LPKF laser engineers specifically for the most advanced microvia drilling and intricate cutting of flex and rigid-flex materials.

LPKF’s capability to design and manufacture its own laser sources and then combine them with its highly dynamic motion system enables robust and effective solutions – that are not more complex than necessary. This leads to a very attractive total cost of ownership.

Proven Quality



Efficient processing of all flexible copper clad laminates (FCCL) with substrate dimensions up to 533 mm x 610 mm (21" x 24").

The MicroLine 5000 series meets all the requirements for the microvia formation process.

The main requirements for microvias are:

- Clean vias without residue
- No delamination of copper and substrate
- Slightly tapered sidewalls without undercut
- No perforation of the bottom side copper layer

UV-laser processing is characterized by short pulse lengths in the nanosecond range with high pulse peak powers. Combined with a higher level of material absorption when compared to longer wavelengths, material ablation is carried out with considerably less thermal influence on the material. This avoids the

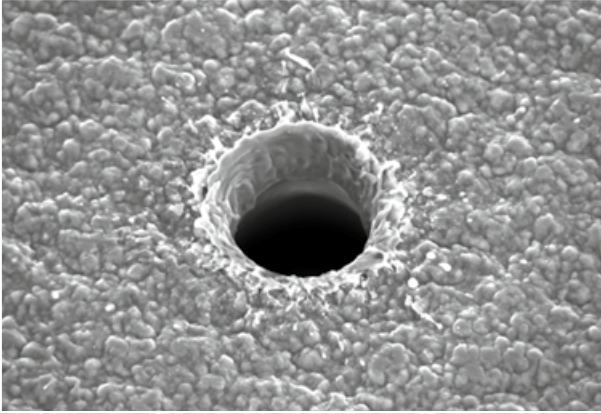
delamination of copper and dielectric, the pink ring effect is significantly minimized as well. The laser processing therefore guarantees excellent via quality combined with high throughput.

The MicroLine 5000 systems feature telecentric optics for vertical edges and automatic correction of position and material distortion by fiducial recognition and online scaling. This ensures high precision and position accuracy of holes with ideal geometries.

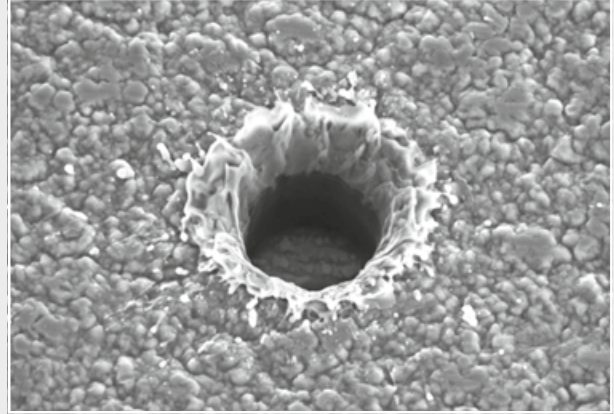
Efficient debris extraction during processing provides for clean vias. The built-in drill depth control of the MicroLine 5000 system removes the dielectric material while leaving the bottom copper layer unharmed.

Microvia Formation with the LPKF MicroLine 5000

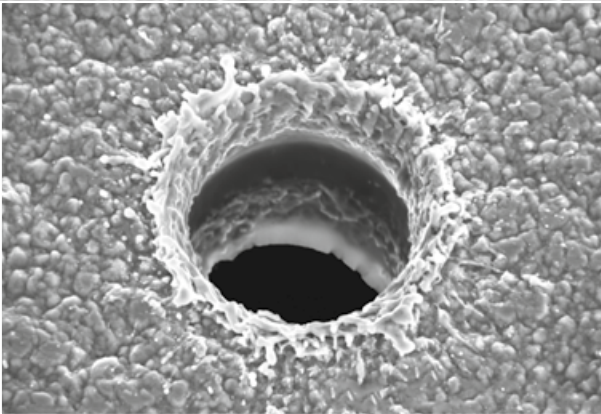
High yields drive cost structures down. Predictable process and lead-times help to keep up with an increasingly competitive and demanding market. The following SEM images show through holes and blind vias laser drilled with the LPKF MicroLine 5000 in a standard double-sided FPC substrate.



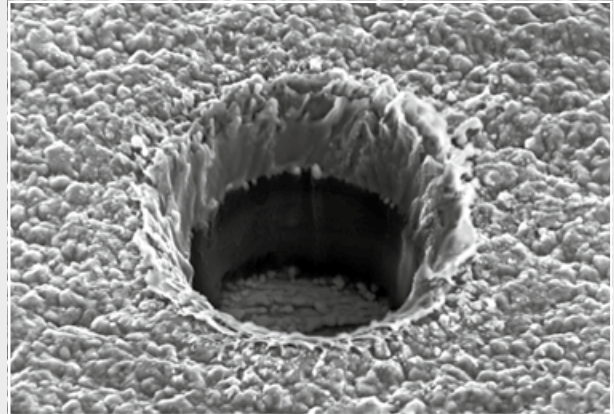
30 µm through hole



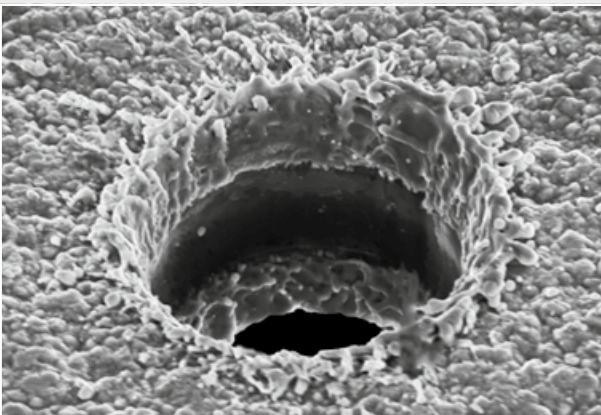
30 µm blind via



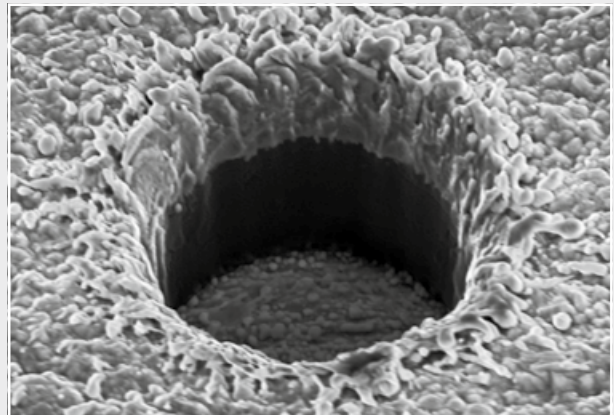
50 µm through hole



50 µm blind via



70 µm through hole



70 µm blind via

Premium Customer Support

The MicroLine 5000 represents everything LPKF is renowned for: Worldwide leadership in designing easy-to-use, world class laser products specifically tailored to customer needs. This leadership is based on decades of expertise in micromachining and consistently meeting customers' demanding requirements – which in turn has increased both the quality and throughput of flexible PCBs in the manufacturing process. From this leadership vantage point, LPKF is uniquely able to provide customers with worldwide premium customer support.

LPKF Support/Service Mission

LPKF's mission is to provide a long-term, trusting business relationship with all of our customers. We accomplish this mission via a two-step process. First, we engage potential customers by offering to process custom sample panels. This initial panel evaluation is to assure all parties that the LPKF laser will meet the potential customer's requirements for cycle-time, accuracy, precision and quality.

Second, we offer each new customer both short term and long term support. In the short term, we provide initial installation and product training support. Long-term, we provide continuing after-sales service, training and technical support through our Global Service Network as indicated below. By effectively implementing this two-step process, LPKF works as a real partner for its customers, ensuring mutual success with the LPKF UV laser and cultivating a long-lasting and successful business relationship.

Global Service Network

LPKF maintains a global service staff with hubs located around the world, providing an outstanding reliable support structure including 24/7 service. A global network of application experts is ready to help with feasibility studies on new materials, sample runs and the handling of specific design requirements.

Extended Warranty

Various concepts for extended warranty and care free maintenance contracts are available.

Fast Response Times

Worldwide warehouses and repair centers ensure easy spare part access and fast shipping to customers. The worldwide network also enables shorter response times for rapid problem solving and quick on-site service. This helps safeguard maximum uptime for production, no matter where LPKF's customers are located.

Unique In-house Service and Repair Capabilities

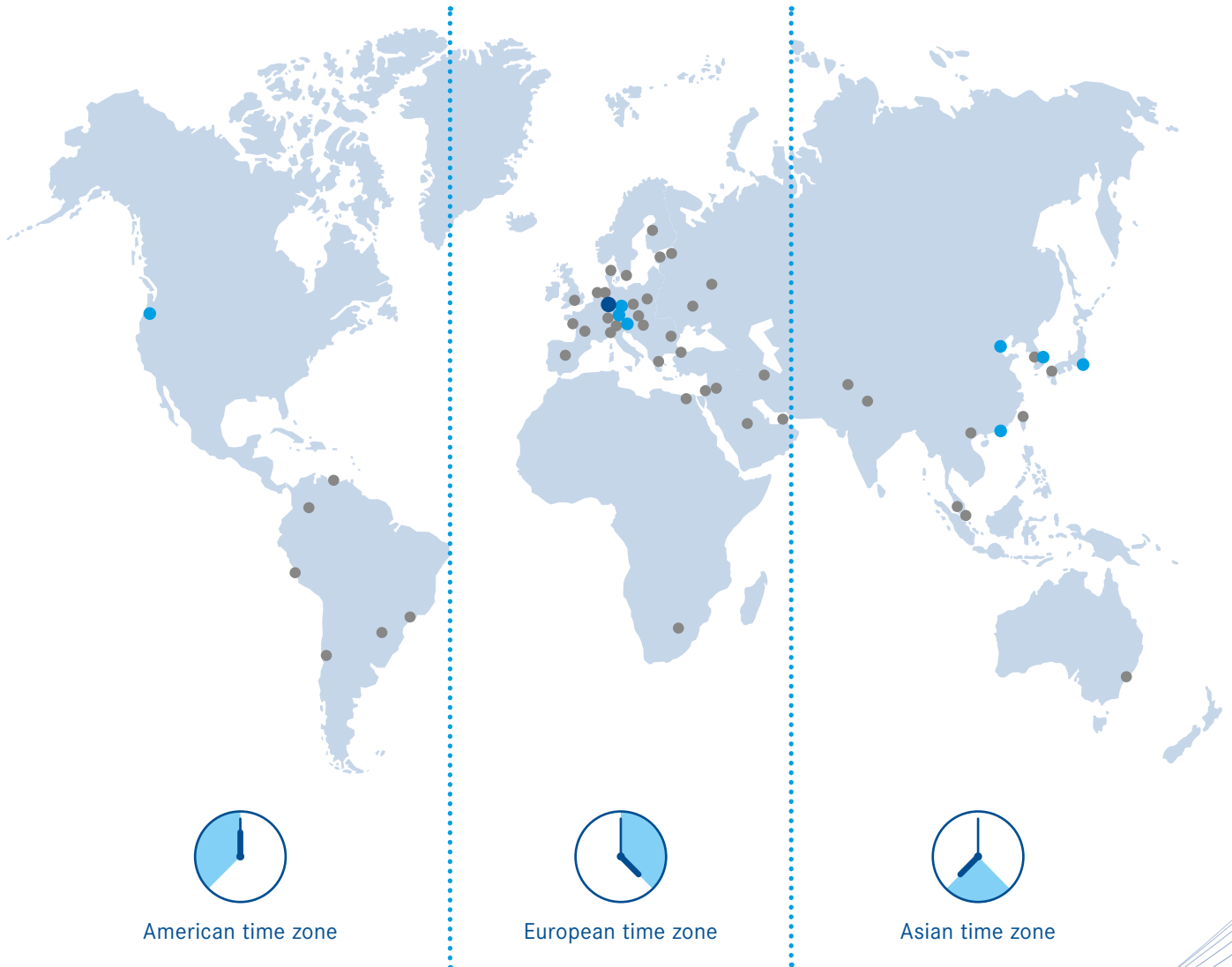
LPKF bundles all laser core competencies in-house including the manufacturing of laser sources and software programming. Over 25 years of experience in precision engineering and laser technology for the electronic industry stand behind LPKF's unique profile.

This gives LPKF a deep, and at the same time, hands-on understanding of all laser processes and their related component efficiencies. In particular, LPKF's in-depth knowledge of the propriety UV laser sources ensures maximum uptimes for the machine.

- Process evaluation and consultancy service
- Easy integration into production lines
- Worldwide 24/7 technical service and telephone support
- Spare part stock in each of the three primary service hubs around the globe
- Short response times for rapid problem solving

The global LPKF network for service and distribution:

- Headquarters
- LPKF Group
- LPKF Distributors



Producing with Light

Since 1976, LPKF has been developing and producing precision machines and technologies for material processing, originally for the production of circuit board prototypes. Today LPKF is one of the world's leading companies in micromaterial processing with the laser.

Laser beams are playing an increasingly central role in equipment used for production and development. Our high capacity laser systems are based on a strong understanding of optical systems and processes, highly precise drive and control technology and material characteristics we have acquired over the decades, supplemented by our own system software for efficient implementation of the production processes. LPKF laser systems are used in the electronics and automobile industries, in medical and plastics technology and in the production of solar cells.

Technical Data: LPKF MicroLine 5000	
Laser class	1
Max. working area (X x Y x Z)	533 mm x 610 mm x 11 mm (21" x 24" x 0.43")
Max. sheet size; max. reel width	533 mm x 610 mm (21" x 24"); 500 mm (19.6")
Positioning accuracy	± 20 µm (0.8 mil)
Diameter of focused laser beam	20 µm (0.8 mil)
Laser wavelength	355 nm
System dimensions (W x H x D)	1660 mm x 1720 mm x 1900 mm (66" x 68" x 75"); height incl. StatusLight = 2200 mm (87")
Weight	~ 2000 kg (~ 4400 lbs)
Operating conditions	
Power supply	400 VAC, 3-phase, 50-60 Hz, 16 A, up to 6.5 kVA
Cooling	Air-cooled (internal water-air cooling)
Ambient temperature; humidity	22° C ± 2° C (72 °F ± 4 °F); <60% (non-condensing)
Compressed air	130 l/min @ 0.6 MPa, air quality ISO 8573-1:2010, class 6.4.4
Required accessories	Fume extraction and filtration unit

**MicroLine 5000 series systems feature multiple variations:
MicroLine 5120 (10 watt laser source) and MicroLine 5820 (15 watt laser source).**

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