

Integration Systems for Laser Plastic Welding

LPKF InlineWeld Systems





Precision, Security, Economy ...

Laser plastic welding is opening up new markets; laser systems and welding techniques are becoming ever more economic, so that more and more applications are benefitting from the precision and quality of laser technologies. The systems making up the LPKF InlineWeld family allow laser plastic welding to be integrated seamlessly in client production processes.

Optimum Joining Processes

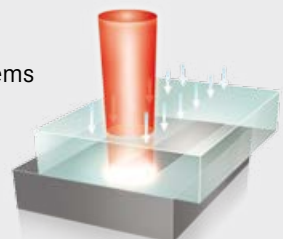
The market for joining plastic components with laser light is growing fast because laser systems are now highly persuasive, maintenance-friendly and do not require skilled operators. LPKF goes the extra mile working with customers to design customized workpiece carriers and to develop optimized welding processes.

The InlineWeld family contains systems which can be directly integrated into existing client installations. Appropriate tool configuration allows categorization as laser class 1.

Transmission Laser Welding

Transmission laser welding involves the laser beam penetrating the upper laser-transparent component and heating the lower laser-energy absorbent component along the weld. The transmitted heat plus moderate pressure on the joint causes the upper component to join to the lower. After cooling, the result is a robust welded seam satisfying the highest visual quality requirements.

LPKF laser welding systems for plastic use quasi-simultaneous, radial and contour welding techniques.



LPKF Laser Plastic Welding:

- High welding quality
- Low mechanical stressing of components
- Fast variation change
- Short cycle times
- Integrated interfaces allow full traceability

Flexible and Economic

Laser plastic welding is now firmly established as a high quality welding technology in the automotive, medical and electronic industries. The advantages are easy to see.

The integratable LPKF laser welding systems guide the laser beam on to the component using scanner optics. Adjustments to the control data allow lightning fast and straightforward adaptation of the welding contour. The equipment package software stores all parameters after each single process.



Water-tight welded seams for a pool lighting system

Laser welding is also a near stress-free process, with no mechanical vibrations or high temperature input as you may see from other welding methods. A component is generally only subject to that clamping pressure needed to hold it firmly in place, usually 4 to 6 N per mm² weld seam area. Clamping tool conversion is a matter of minutes.

Transmission laser welding also benefits from short cycle times. Depending upon customer handling requirements, this helps cut down-times. LPKF laser systems are designed for 24/7 operations, are basically maintenance-free and are ready for full tracking & tracing depending upon interface.

Test and correction routines take place during the actual welding process. This approach allows changed material parameters or geometric deviations to be determined quickly and in most cases compensated for during the welding process.



Lean Joining Solution

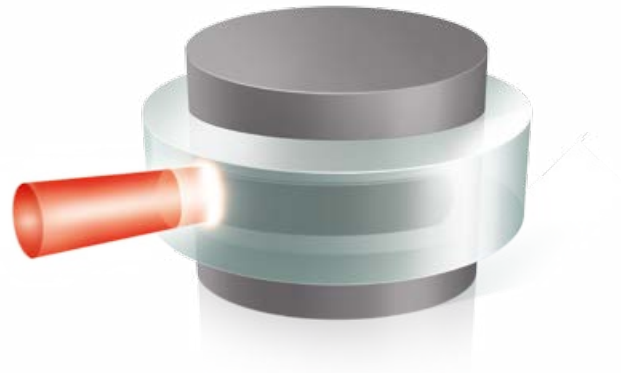
Low cost, low space needs, short cycle times: LPKF InlineWeld systems can be integrated as black box units in customer environments, and simply do their job. There is no need for specialized laser technicians or complex protective measures in production areas.

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LPKF InlineWeld 2000 – An Integration System for Radial Welding

Radial welding has proven its capabilities in rotation-symmetrical welding operations. In radial welding, either the component is turned under the laser beam or the laser beam is dynamically guided around the component using mirrors (Fig. right). Radial welding has the advantage that it can usually do without any additional clamping tools in cases where the necessary pressure is provided by the design fit of the components – e.g. pipes.



Radial handling of the welded seam for the laser beam is possible with all LPKF welding systems, depending only on the component holding method. LPKF InlineWeld 2000 units take a different approach: a rotating mirror system guides the pre-focused laser beam around the component. This makes fitting and removing the component much easier.



LPKF InlineWeld 2000 comprises a processing head and a separate laser/control unit. The compact control unit can be located independently of the processing head and therefore takes up no space in the machining area.

The InlineWeld 2000 means LPKF has added a high performance system to its product portfolio, offering a laser welding system which is simple to integrate and designed specifically for radial welding.

At radial welding the necessary pressure is provided by the design fit of the components – additional clamping tools are not necessary

Technical Data	InlineWeld 2000	Dimensions (mm)
Laser power	20 W to 500 W	
Clamping Force	Optional max. 1 kN	
Power supply	400 V / 16 A CEE	
Processing field	Standard: Diameter 0 mm (0") to 80 mm (3") Optional: Diameter 0 mm (0") to 250 mm (10")	
Dimensions (W x H x D)	With fixture: 415 mm x 652 mm x 160 mm (16" x 26" x 6")	

Reduced Production Space Requirement – LPKF InlineWeld 6200 and 6600

A unique design feature shared by both the InlineWeld 6200 and 6600 systems are the separate housings for the control electronics and the low maintenance laser source. The link with the compact laser head is electronic. Each laser head contains the high precision laser optics and clamping technology. The separate integration systems in combination with the right tools are categorized as laser class 1.

LPKF InlineWeld 6200

The latest arrival in the InlineWeld family is the LPKF InlineWeld 6200. The new generation of integration systems boasts a new machine layout – and not just on the outside. Costs are reduced and system performance boosted, thanks to a clever combination of the most up-to-date components.

The welding field measures up to 100 mm x 100 mm. The system conforms to the laser protection stipulations, and corresponds to laser class 1 during production operations. In addition, the clamping technology, the cylinder unit and the component holder are all equipped with safety sensors. This makes it really easy to realize installation in production lines in conformity with EN-ISO 11553.

The InlineWeld 6200 is supplied with the LPKF CAM software ProSeT – to set up the welding contour quickly and easily. A ProfiNet interface enables the connection to the client's own manufacturing execution system (MES). The system comes with integrated melt travel monitoring and time-route control. Other monitoring technologies include pyrometer surveillance, burn detection and reflection diagnosis.



Technical Data	InlineWeld 6200
Laser class	1 (after integration)
Laser power/spot diameter	Max. 200 W / 1.8 mm or 2.1 mm
Clamping pressure range	580 N – 1750 N
Max. working area	100 mm x 100 mm
Welding head dimensions (W x D x H)	400 mm x 450 mm x 1300 mm
Control cabinet dimensions (W x D x H)	950 mm x 600 mm x 1350 mm
Power supply	400 V, 16 A, max. 3 kW
Compressed air	4.5 bar – 10 bar
Ambient temperature	18 °C – 35 °C
Options	Remote Maintenance Module, Interface Box



LPKF InlineWeld 6600

The LPKF InlineWeld 6600 integration system can weld both contours as well as more complex scanner-based components with sizes of up to 215 x 215 mm. It is designed for tripleshift round-the-clock operations and high throughput. The laser output has a range of 50 W to 500 W.

The housing measures 800 x 2000 x 800 mm (W x H x D), the processing head takes up a space of 400 x 650 x 700 mm (W x H x D).

Technical Data	InlineWeld 6600	Dimensions (mm)
Laser power	50 W to 500 W	
Clamping Force	Min. 200 N, max. 2.2 kN	
Power supply	400 V/16 A, power consumption: max. 3 kW	
Processing field	Up to 234 mm x 317 mm (9.2" x 12.5")	
Dimensions (W x H x D)	Welding unit: 400 mm x 650 mm x 700 mm (16" x 25.5" x 27.5") Control housing: 800 mm x 2000 mm x 800 mm (31.5" x 79" x 31.5")	

Applications for LPKF InlineWeld 6200 and 6600

Automotive, medical, consumer: Examples for laser plastic welding.



Break fluid reservoir



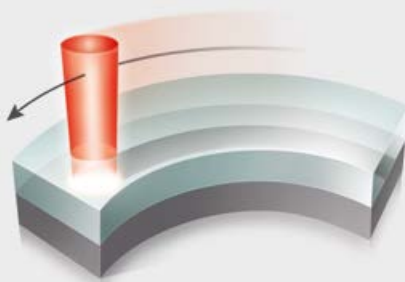
Monitoring device for blood bag



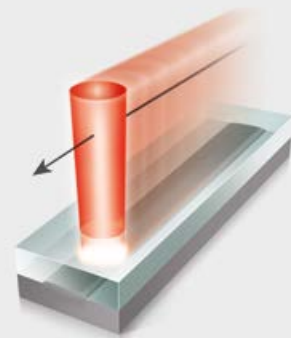
Razor casing

Established Processing Methods

At contour welding the laser beam is guided once along the joint line.



In the quasi-simultaneous welding method, the whole joint line is plasticized at the same time. The laser supplies energy continuously until the specified welding depth has been reached.



Material Qualification with LPKF TMG 3

The optical transmission of a plastic is crucial for the quality of the welded joint. This material property can be influenced by the upstream processes of compounding and injection molding. A quick and easy measuring of the optical transmission prior to laser plastic welding is an essential part of integrated quality assurance.

The calibrated measuring tool LPKF TMG 3 enables the transparency properties of plastics to be quickly and easily checked and proved. It only takes a few seconds to check that the actual transparency metrics match the set values in the process definition. Testing reveals any deviations in the materials before an unsuitable component enters the production process. The LPKF TMG 3 is calibrated with a measurement standard according to DIN EN ISO/IEC 17025 and is shipped with a works calibration certificate.



LPKF InlineWeld 6900

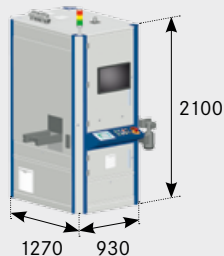
The LPKF InlineWeld 6900 laser welding system is comprised of standard modules from other LPKF series and creates an enclosed welding cell with conveyor belt system, laser source, welding head and control unit in standardized housings. No extra external enclosure is needed. This gives the system the benefit of a remarkably small footprint of only 930 x 1 270 mm.

On the design side, the system is ready for a wide range of client-specified conveyor belts. The modular housing concept also allows return lines for conveyor systems to be integrated, side-by-side or one above the other. The LPKF InlineWeld 6900 is a plug-and-play design and can be integrated into existing or new lines.

This unit is available for delivery with conveyor belt drives, control is then via either LPKF systems or customer in-house.

This unit's extraordinary flexibility is underpinned by continued process technology innovation: a novel bottom-up clamping module gives ultimate levels of process reliability and flexibility. In conjunction with an optional tool swapping system, this allows automatic welding of components of different heights. Together with a component identification unit, this system is suited to high variability coproduction processes because tooling change-over times are reduced to a minimum.



Technical Data	InlineWeld 6900	Dimensions (mm)
Laser power	50 W to 400 W	
Clamping Force	Min. 80 N, max. 3.5 kN	
Power supply	400 V/16 A, power consumption: max. 3 kW	
Processing field	Up to 133 mm x 238 mm (5.2" x 9.4")	
Dimensions (W x H x D)	930 mm x 2100 mm x 1270 mm (36.6" x 82.5" x 50")	

Examples of Applications



Automotive seating comfort electronics



Welded display of a process control unit for a forklift



Backlighting door sill of a premium class car



Lab-on-a chip: microfluidic cartridge in the size of a mobile



Topping for a bedside infusion management system



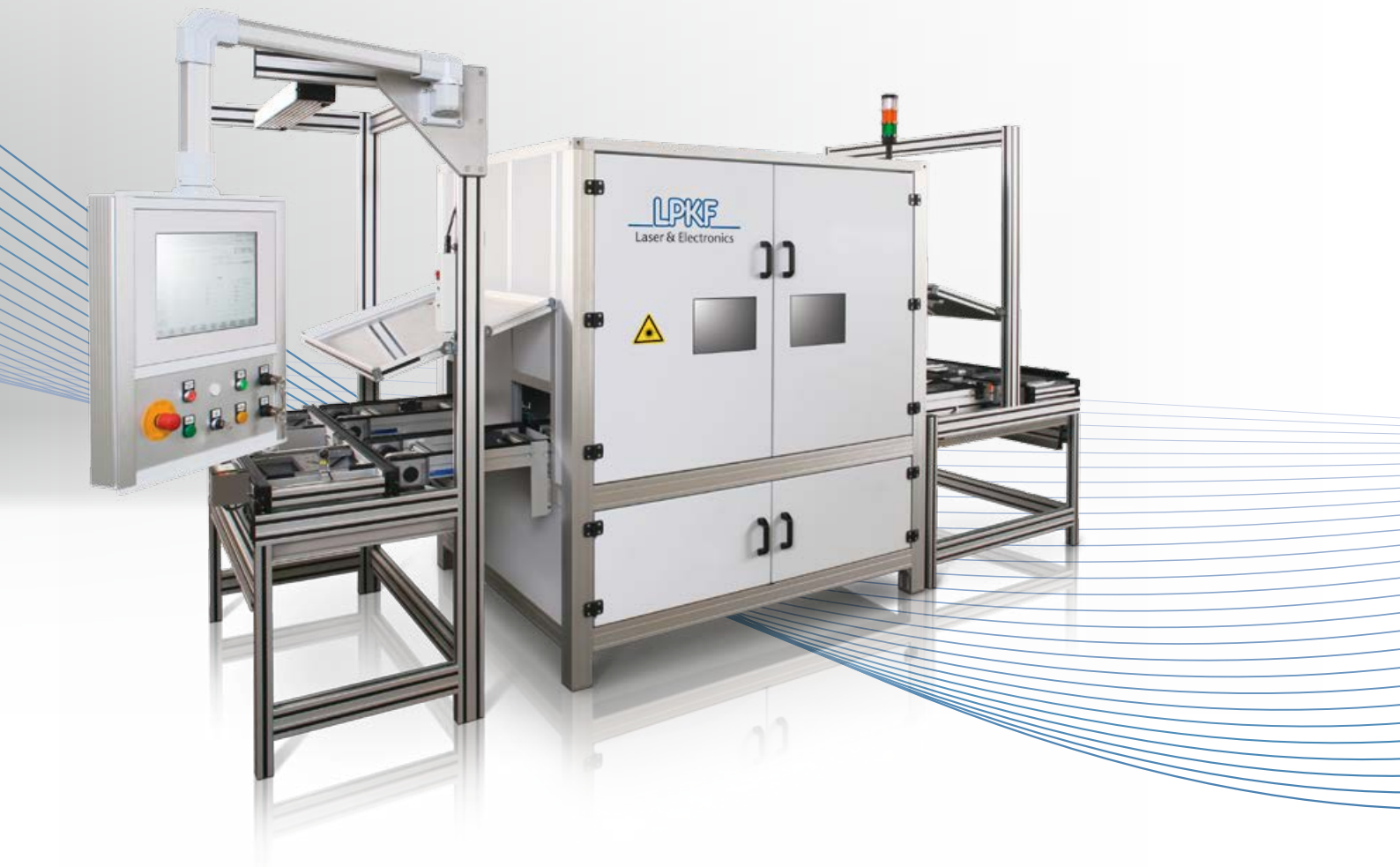
Sealed insulin pump for high-performance sportspersons

LPKF Software ProSeT

The tried and tested LPKF ProSeT control software is perfect for programming weld contours. The software uses data from CAD layout programs and enables adaptation and optimization of the welding contour. ProSeT is supplied with all LPKF laser welding systems as standard. The pilot laser helps adjust the welding contour to the component.



LPKF InlineWeld 9000



LPKF has been producing and selling systems for laser transmission welding since 2001. The LPKF InlineWeld 9000 is a modular system built upon the success of previous generations of LPKF laser welding systems. The modular design allows for easy customization of various optional components and features in order to meet the demands of each customer's specific needs in regards to laser power, clamping configuration, and handling methods – or even configured as a stand-alone, turn-key unit. These systems can also be precision-adjusted to customer specifications, e.g. with special sensors, footprints and handlings methods.

The InlineWeld 9000 series by LPKF already includes a large number of proven solutions. The unit illustrated above is fitted with two independent manual workstations fed via a continuous conveyor. The system is capable of performing up to six individual welding procedures on an assembly and replaces a highly complex adhesive solution with an annealing oven – delivering high performance in a compact unit with a small footprint.



Easy Welding

Production data in, components out: this is the concept implemented in LPKF systems for laser plastic welding. For each and every product the welding parameters need to be determined just the once: they are memorized and can be reused again and again. The welding contour is configured based on design data taken from the CAD system while integrated QM functions offer unequivocal verification of welding success.

- Customer-specific solutions based on LPKF module catalogue/platform
- Up to 20 welding operations feasible in one single plant



Example of application:
Control device for electronic steering systems

LPKF Clamping Technology

The clamping technology needed for transmission laser welding can be kept relatively simple: the clamps do not need to transfer either vibrations or temperatures up to the melting point. A relatively low clamping pressure is sufficient for transferring heat between the upper and lower component. LPKF developed its patented dual clamp device to create even pressure on both sides of the weld line, a development which helps reduce dimensional tolerance still further.



Quick Connect

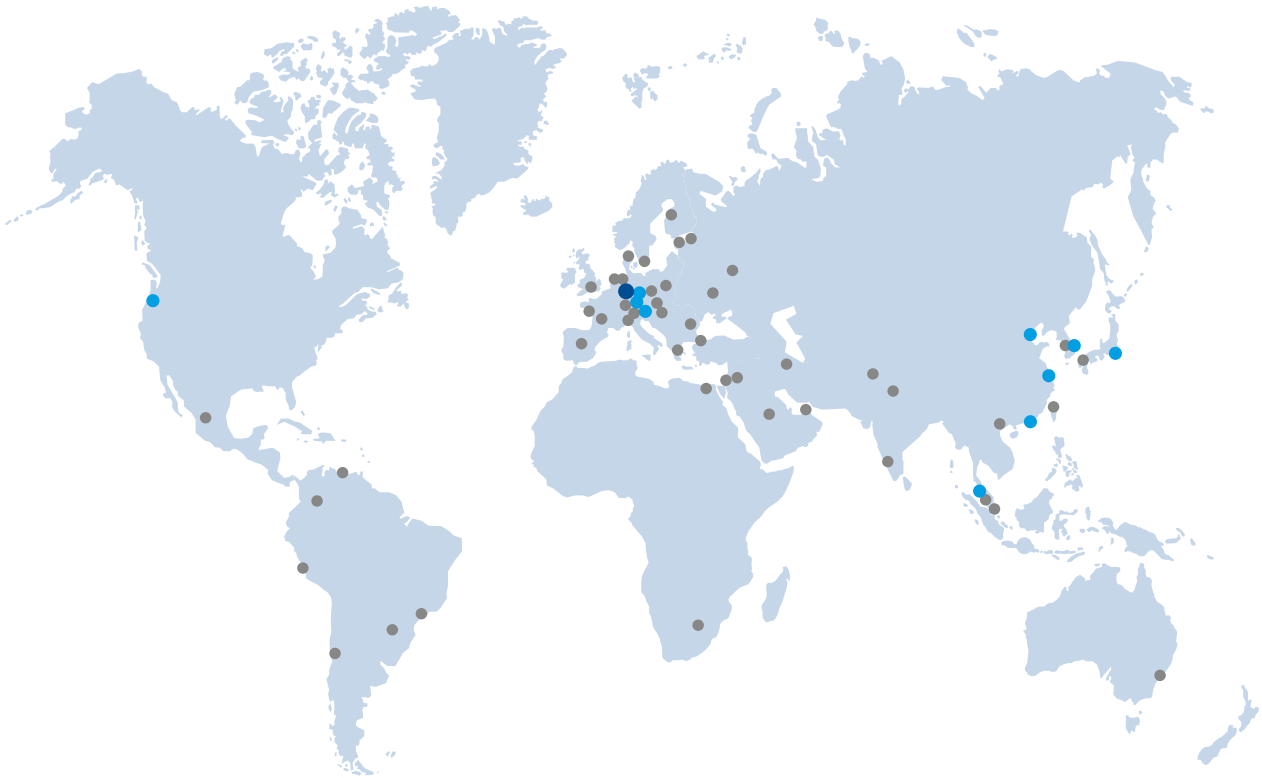
The upper and lower halves of the clamping tool can be installed quickly by one person. This is thanks to standardized adapters. Two minutes – and production is ready to roll with a different product group. The inexpensive clamping tools are much lighter than those needed for vibration processes. Some systems include a clamp coding system which identifies the mounted clamping tool automatically. The Quick-Connect system reduces unproductive downtimes and raises variability options in production planning.

Worldwide Service & Support

24/7 in an industrial environment – no problem for LPKF's successfully tried and tested laser welding systems. For your support we have: highly trained service staff around the world available for commissioning and servicing; an Application Center to help with feasibility studies and machine concepts; job-shop production to tackle production peaks and volume production start-ups. More than just laser welding: LPKF creates solutions – together with its clients.

Full Round-the-Clock Service

The clients of LPKF Laser & Electronics AG enjoy full round-the-clock service to guarantee optimum availability of their equipment. Service technicians or engineers are available for commissioning the LPKF welding systems and to ensure that production starts smoothly. When the welding systems are running, highly qualified service staff provide professional support via hotlines, remote diagnosis or on-site trouble shooting.



The global LPKF network for service and distribution:

- Headquarters
- LPKF Group
- LPKF Distributors



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