

Compatible with all LLK Available on the Market

The latest generation of 10-kW high power laser cables



High power HPLDautomotive laser cable
 ■ greater output, better safety
 ■ laser material processing up to 10 kW

Frank Optic Products offers today's most up-to-date and innovative high power laser cables in the high end range of the 10-kW class for laser material processing. The high power HPLDautomotive laser cable enables an enormous variety of requirements for applications in laser material processing to be met economically and efficiently by means of fibre-optic beam delivery systems.

As with all fibre systems from Frank Optic Products here, too, the laser machine engineer, developer and laser user can always tune them individually to match their respective laser and application. This system can be combined with other plug-in connector systems. Connection and utilisation of all laser sources commonly to be found on the market is guaranteed. The user alone determines performance and safety and hence obtains maximum individuality.

Higher output and greater safety

By using fibre materials newly developed especially for the high perfor-

mance range it is possible to transport 10 kW laser power. For this purpose the quartz glass fibre was equipped with a multi-cladding structure and the concentricity of the fibre core was substantially improved. This makes it possible to optimise in-coupling of the laser beam and to carry higher energies in the cladding. Besides the fibre material, new metal materials as regards alloy, hardening and resistance to chemicals are being used for the HPLDautomotive plug-in connector system. By combining diverse improved materials it has been possible to significantly optimise temperature behaviour.

At the same time attention was paid to

ensuring optimal heat dissipation when the plug-in connector systems were designed and produced. Active cooling takes place without requiring maintenance and is especially suitable for Di water. With a compressive strength of up to 10 bars it can be connected to any of the existing laser cooling systems.

One entirely new development is the cladding. As a hybrid cladding containing all of the individual electronic and optical wires, it demonstrates significantly better stability, torsion, tensile strength and resilience than the other LLK systems on the market.

Thanks to integrated electrical isolation and electrical and optical shielding, the new cable safety concept with the hybrid cladding is much safer in operative use - particularly when used in robots if short, abrupt movements are made.

The new safety concept has an improved fuse plug and fibre breakage watchdog, which significantly reduce the trigger force or path.

The temperature monitoring is founded on three safety steps:

- The temperature can be accessed at any time on the laser by means of a plug-in **integrated temperature watchdog**.
- A **reversible** temperature switch was introduced to enable the laser to be switched off if it is even slightly overheated, e. g. if the cooling circuit fails. Therefore the laser cable can be used again immediately after it has cooled down.
- An additional **irreversible temperature fuse** means that if the plug-in connector becomes substantially overheated the laser machine is switched off on both the laser head



and the processing head. For safety reasons it can then no longer be activated with this cable. By replacing the laser cable and eliminating the fault it is possible to continue working with the laser immediately.

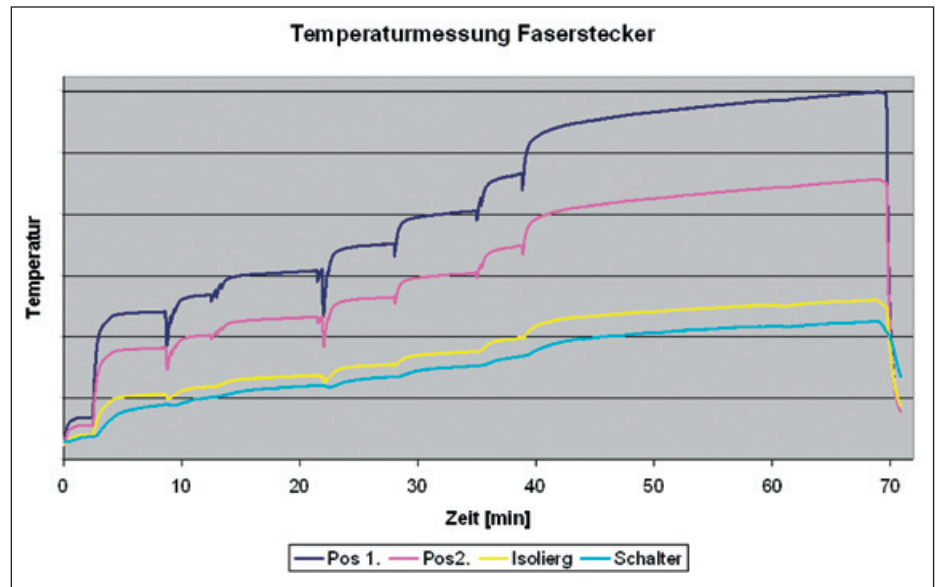
Efficient, reliable and economical thanks to compatibility and individuality

High compatibility of plug-in connectors of the same system enables the connection and utilisation of all laser sources commonly to be found on the market.

The HPLDautomotive high power laser cable is compatible with all LLK systems for Nd:YAG lasers, diode lasers and fibre lasers. It therefore provides users and laser manufacturers with the option of continuing to use existing and new laser systems with the new high power HPLDautomotive laser cables, or of using them parallel to one another.

The new, geometric cone structure defines the Z position of the fibres exactly and therefore the fibres cannot assume malpositions. Anti-twist protection ensures a constantly reproducible fibre position.

Hence the cable can be exchanged without the laser optics having to be readjusted. When the HPLDautomotive plug-in connector systems were designed special attention was given to the increased concentricity of the



▲ Temperature profile on an operative laser cable

Legend: Temperatur = Temperature; Temperaturmessung Faserstecker = Temperature measurement, fibre plug-in connector; Zeit = Time; Schalter = Switch

<1 μm freestanding fibres in the ferrule. Here the fibre is operated with high precision in a thermally stable fibre ferrule equipped with a reflective coating.

Owing to the protection by reflection integrated in the ferrule behind the fibres, and which must be equipped with an HR coating tuned to the operating wavelength, it is therefore possible to couple-in the critical beam profile, e. g. of diode lasers precisely and with optimal transferral of energy. The cone geometry made it possible to prevent underpressure from arising

when disconnecting on the in-coupling side as it usually does with the conventional LLK systems. This has brought about a significant improvement with regard to the cleanness of the surface of the fibre ends. The plug-in connector housing is splash-resistant.

At Frank Optic Products the experience from operative application are incorporated directly in quality management and current production. For example, cables and accessory parts are delivered in special transport and storage containers and the



▲ Laser cable assembly and control



▲ HPLDautomotive LLK - with multi-pole socket

customer receives an extensive range of aids, e. g. for storing and cleaning the cable systems. Furthermore, the user has a fast repair service at its disposal which covers multiple manufacturers. It is standard for the HPLDautomotive LLK systems to be manufactured with multi-mode quartz/quartz glass fibres with fibre core diameters of Ø200-1500 µm with multi cladding and a numerical aperture (NA) of 0.22. Fibre loss amounts to <3 %. The high power HPLDautomotive laser cables are supplied in lengths ranging from 2 to 200 metres.

Conclusion

The great variety and compatibility of the HPLDautomotive high power laser cables with all commercial LLK and laser systems facilitate efficient application and economy for laser engineers and operators. Furthermore, the operating costs can be reduced thanks to longer uptimes, greater safety and the option of higher performance.

Furthermore, the system provides the option of equipping the laser cable with any desired plug-in connector on the 2nd end as standard.

The wish for better and better performance in conjunction with ever smaller fibre diameters will dominate the development of new laser cable con-

cepts in the coming years. The main focus of development will be on rectangular and hexagonal fibre cross-section formats in order to optimise utilisation of the optical surface for energy transfer and for temperature efficiency. The central issue will be the miniaturization of the fibre cross sections down to 50 to 100 µm for output ranges between 4 kW and 10 kW and the application of multimode light conductor bundles. Diode and fibre lasers will benefit most from this.

Frank Optic Products regards itself as a partner to laser developers and users with its core competence in the joint development and marketing of fibre optic beam guidance systems, and as an innovation driver for the market.

■ INFO

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