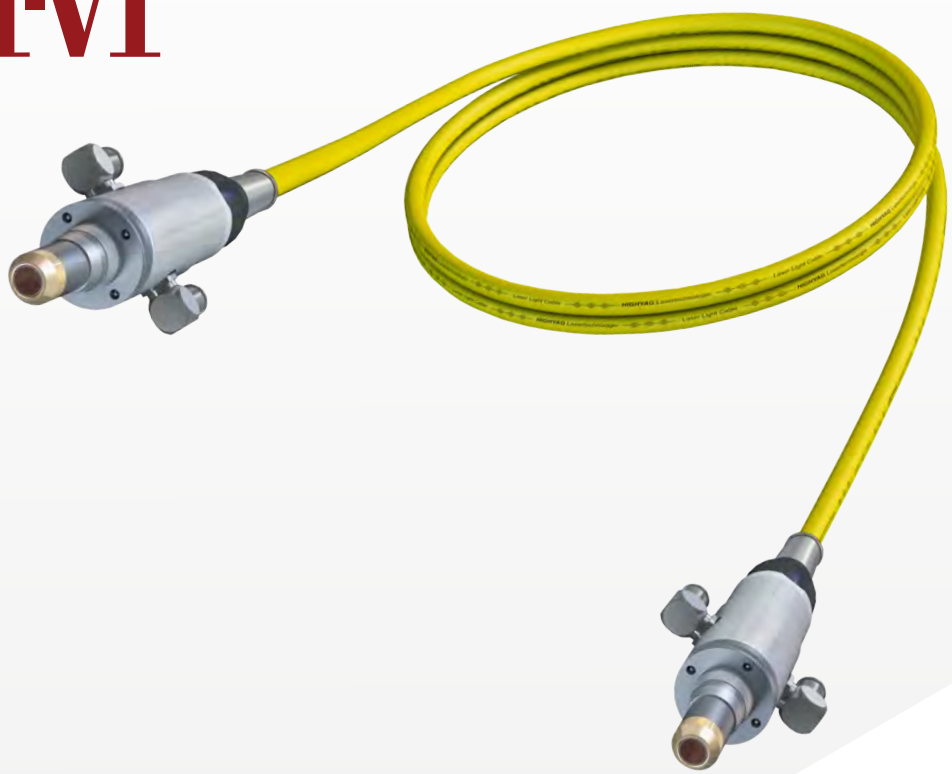
II-VI



Optical Perfection

Beam Delivery Products

PERFECT BEAM DELIVERY

Many years of experience in design and production of laser light cables give us all the excellence to meet the most demanding industrial requirements. Our reliable and robust products are fi rst choice for laser material processing applications with all current 1 µ laser sources, from fi ber lasers via disc lasers to diode lasers.

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Beam Delivery Products

Optical characteristics

Focusing on multimode beam quality, HIGHYAG laser light cables come with core diameters from 30 µm to 2000 µm. Due to their innovative and compact design, they offer protection against back refl ection and misalignment of the laser source.

For maximum laser effi ciency, all AR connector types are equipped with anti-refl ection coated end caps. These high-performance coatings are designed for highest beam intensities and reduce Fresnel losses at the fi ber tip to a minimum. Specifi c optical materials and splice technologies also contribute to best beam quality preservation, high transmission and hence a more effi cient laser process.

Mechanical characteristics

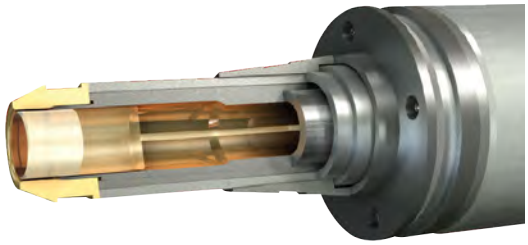
Micrometer precision in every detail offer Plug-&-Play capability through prealignment. This permits replacement without the need to realign. Flexible protective hoses guarantee process stability over millions of operating cycles.

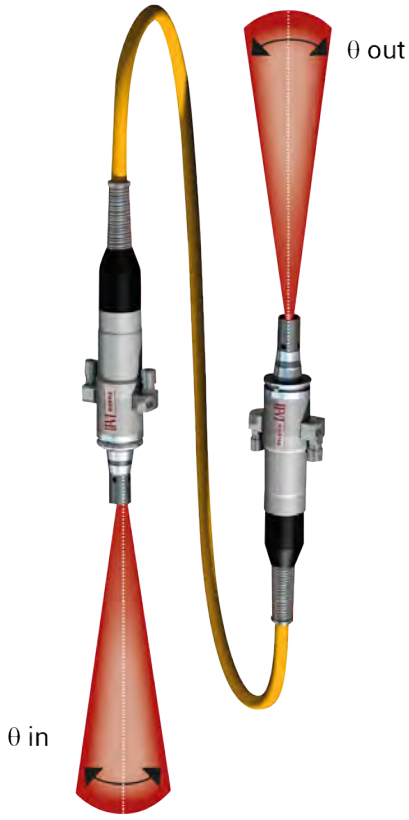
Electric characteristics

A monitoring system for fi ber breakage, temperature and plug-in control is a standard feature for HIGHYAG high-power cables. Integrated scattered light sensors at the input and/or output connector side are available as an option.

Applications

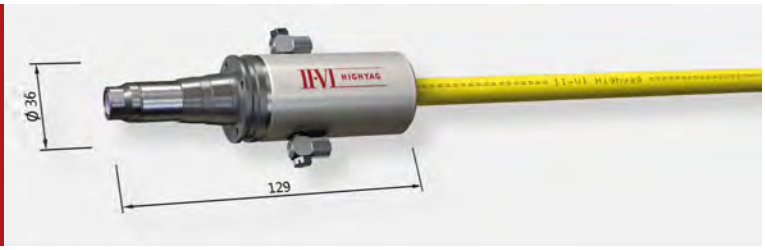
A wide wavelength range from 800 nm to 1120 nm, numerical apertures adapted to different laser sources, and common mechanical standards make HIGHYAG cables suitable for a wide range of industrial laser applications. Whereas laser systems in the multiple kW range use the connectors LLK-Q, LLK-Auto or LLK-HP, laser systems operating below the kW range utilize the connector LLK-LP. HIGHYAG laser light cables are robust for high accelerations and enable maximum process speed and precision for highly dynamic applications such as fl at sheet cutting or body-in-white welding.





Beam Delivery Products

Laser Light Cables

LLK-Q AR		Perfect for multi-kW lasers and high dynamic applications; compliant with laser cutting standards
LLK-Auto NR		Most robust for high beam parameter products (BPP)
LLK-Auto C AR		Compact design; perfect for reduced installation space
LLK-Auto AR		Perfect for multi-kW lasers up to 20 kW
LLK-HP AR		Designed for fiber and disk lasers
LLK-HP		Designed for diode lasers
LLK-LP		Perfect for lasers with an average laser power of up to approx. 250 W

Compliant with automotive standard

Beam Delivery Products

HIGHYAG beam delivery products for 1 µ lasers - from the beam launching unit at the laser via the laser light cable to the laser processing head at the workpiece - are matched in a manner that ensures almost loss-free beam transmission and a safe and reliable integration into your laser application.

Laser Light Cable



Guides the laser beam from the laser source to the laser processing head. It is designed for dynamic use with a robot or on a gantry system.

Laser Light Cable Receiver



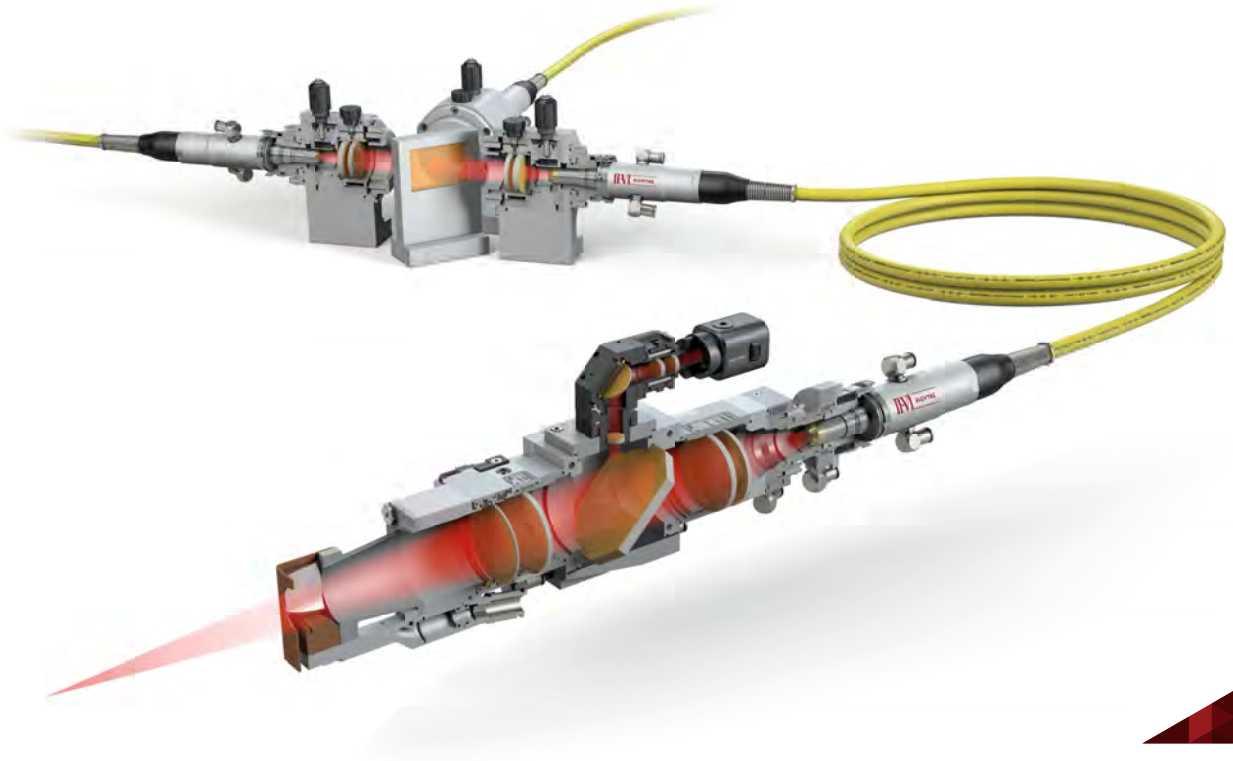
Serves for the precise placement of the laser light cable connector. It allows for a stable positioning of the fiber tip in highly

dynamic applications. It also enables the fast replacement of laser processing heads and laser light cables. Simple adjustment, compatibility to laser light cable standards, an efficient water cooling, as well as, an optimal design for avoiding contamination make HIGHYAG laser light cable receivers the first choice. They are available for LLK-Q, LLK-Auto, LLK-HP and LLK-LP.

Fiber-Fiber Coupler



Enables the low-loss connection of two laser light cables. It can be integrated into existing laser light cable systems and thereby enables the beam delivery system to be extended. It also makes possible the fast replacement of individual laser light cable sections.



Beam Delivery Products

Features Compared

Application	LLK-Q AR	LLK-Auto AR	LLK-Auto C AR	LLK-Auto NR	LLK-HP AR	LLK-HP	LLK-LP
Multi-kW laser	10 kW	20 kW	10 kW	6 - 10 kW	6 kW	6 kW	250 W
Low NA	+ + +	+ + +	+ +	+	+	+	+
Large NA	+	+	+ +	+ + +	+	+ +	+ +
High-dynamic application	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +	-
High-reflective application	+ + +	+ + +	+ +	+ + +	+	+ +	+

Optical Properties

Anti-reflection coated endcaps	■	■	■	-	■	-	-
Mode stripper	■	Optional	Optional	Optional	-	-	-
Pre-aligned fiber position	■	■	■	■	■	■	■
Protected against back reflection from work piece	■	■	■	■	■	■	■

Mechanical Properties

Cooling	active	active	active	active	passive	passive	passive
Pigtailed version	optional	optional	optional	optional	optional	optional	optional
Connector length [mm]	172	257	129	241	252	247	206
Connector diameter [mm]	22	36	36	36	30	30	28

Monitoring

Fiber continuity system (breakage, temperature, plug-in)	■	■	■	■	■	■	■
Scattered light sensor	Optional	Optional	Optional	Optional	Optional	-	-

Compatibility	
	LLK-Q compatible with QBH
	LLK-Auto compatible with LLK-D
	LLK-HP compatible with LLK-B
	LLK-LP compatible with LLK-A

+	Degrees of usability+, ++, +++
-	Not suitable / not available
■	Standard function

Beam Delivery Products

Technical Data

Optical Properties

Fiber core diameter	30, 50, 70, 100, 150, 200, 300, 400, 600, 1000, 1500, 2000 µm, *
	30, 50, 100, 150, 200, 300, 400, 600 µm (for LLK-Q and LLK-Auto C), *
Wavelength	λ = 900 - 1090 nm (for AR Laser Light Cables), *
	λ = 900 - 1080 nm (for LLK-HP, LLK-LP), *
	λ = 800 - 1120 nm (for LLK-Auto NR without protective window)
	λ = 900 - 1090 nm (for LLK-Auto NR with protective window)
Maximum laser power	Up to 20 kW (for LLK-Auto)
(subject to laser beam coupling conditions)	10 kW (for LLK-Q and LLK-Auto C)
	6 kW (for LLK-HP)
	250 W (for LLK-LP)

Numerical Aperture of Laser Light Coupled into Fibre

Numerical aperture	0.05 - 0.22, *

Mechanical Properties

Laser light cable length	5 - 100 m in steps of 5 m, *
Minimum cable radius	150 mm for fi ber core diameter < 800 µm (250 mm recommended)
	300 mm for fi ber core diameter > 800 µm
Maximum cable torsion	90°/m, max. 180° total for fi ber core diameter < 800 µm
	45°/m, max. 180° total for fi ber core diameter > 800 µm
Connector type LLK-Q (compatible with QBH)	LLK-Auto (compatible with LLK-D)
	LLK-HP (compatible with LLK-B)
	LLK-LP (compatible with LLK-A)

Monitoring

Fiber continuity monitoring system	Breakage, plug-in and temperature
	(for LLK-Auto according to German automotive standard)
Scattered light sensor system	Option for all AR connector types and LLK-Auto NR

* Others on request.