

CUTTING-EDGE EFFICIENCY

THERE'S PROBABLY *nobody as good as Highyag when it comes to building a fiber laser head that can be automatically adjusted in wide ranges with the cutting machine and therefore suitable for a vast range of cutting tasks.*

A light source, a resonator, an optical fiber, a few lenses and bundled light is pretty much how a lay person imagines a laser. But the reality is completely different and, unfortunately, much more complex. Materials, in our case metals, have to be melted, so that they can be joined or separated, for instance, and this has to take place as efficiently as possible and in the manner needed. This means that one or more laser beams have to be generated, measured, divided, combined, widened, concentrated, diverted, guided and focused - all of this depending on the application and what's required.

There's not one laser system that can do everything and even if we focus on cutting metals and the laser head, there is still not one solution that fits all. But there are very diverse products, like those from Highyag, a laser specialist company that was founded in

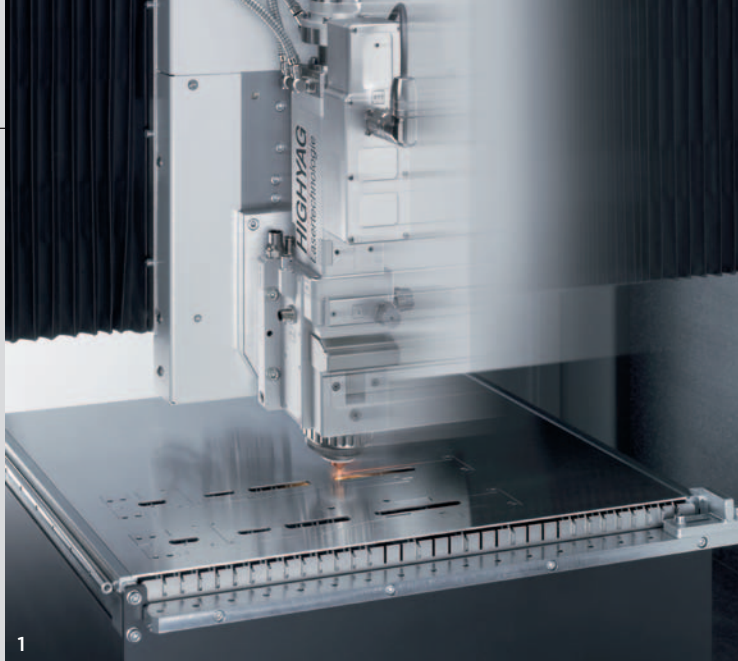
1995 in Stahnsdorf to the south of Berlin and whose founders originally come from the development of beam sources. The company now employs a staff of 140 – a figure that is soon likely to rise. As current construction work indicates, Highyag is growing. Dr. Björn Wedel, one of Highyag's cofounders, tells us about just how fast this is happening: »Due to continuously high demand, we have been persistently expanding our production in recent years and hiring new staff. Over the past three years, for instance, our company has recorded growth of 40% each year.«

A glance at the company's endorsements shows that this company, which specializes in solid-state laser beam delivery systems and heads, ranks among the best in its industry. In addition to many automotive firms, including all of those producing in Germany, you will also find supplier companies, representatives →



1 and 2 Fully-automatic, independent adjustment of the focus position (three images at page 1) and diameter (two images at page 2) during the cutting process: Bimo-FSC

3 Solid-state laser systems are expensive. That's why it's so important to make the most of the beam energy. That's exactly what Highyag's cutting head Bimo-FSC does.



1 6 KW on the spot enables extremely high cutting speeds paired with high quality.

2 Welding on the fly: remote laser welding head RLSK

3 The focus can also be freely positioned for welding.



from the aviation industry, system integrators, laser manufacturers and research institutes. More than 3,500 laser heads have already been sold worldwide! Volkswagen was the first carmaker to use Highyag laser heads in mass production. While the company operates its own branch in the US, it is also working on the international market with distribution partners in countries like China and Japan.

Highyag develops laser processing heads for welding, remote welding and brazing and also for cutting. Thanks to its fully automatic, machine-controlled adjustment of focus diameter and position, the new Bimo-FSC cutting head marks a new dimension in the already diverse possibilities offered by flat bed cutting systems with solid-state lasers. The head can work with a laser power of up to 6 KW and makes the most of it! While conventional solid-state lasers are no longer considered to be feasible beyond a sheet thickness of 6 mm (steel, stainless steel), the Bimo-FSC has extended this limit, so that sheet metal of more than 15 mm in thickness has been cut with this head. How?

The more adjustable, the more diverse

Dr. Wedel explains: »Between the beam source and the application, we need two connecting pieces, tools that apply the laser beam in suitable form to the workpiece, i.e. a beam delivery system and a laser head. The more flexible the head is, the more diverse are the options for use. And that's important because the customer wants to be able to work with a wide range of sheet metals.«

Since there are other producers of laser heads, Dr. Wedel explains a special feature, one of several, we might add: »Our heads allow the focus diameter and position to be adjusted independently and to a high degree – in a fully automatic process carried out by the cutting machine during the cutting process! You won't find this anywhere else in the cutting market. There is high demand for this because customers want to be able to cut different sheet thicknesses without manual intervention.«

And getting into more detail, he adds: »The key elements at the point of interaction are laser power and the beam parameter product. The power is determined by the laser source while the beam parameter product of the focus diameter and beam angle determines the optics. This means that with a 100-µm fiber and a 200 mm focal length, the focus diameter can be adjusted in a range from 160 to 420 µm. Regardless of this, the focus position can be varied more than 25 mm along the optic axis.«

Setting these values is essential, but more is required in order to cut with maximum efficiency. That's because the extreme power density of the laser not only changes the workpiece material, which it is, of course, supposed to do, it also changes that of the tool, i.e. of the laser head. Thanks to its optical design and a selective choice of material, Highyag is able to minimize these physical effects to such an

WELDING ON THE FLY

HIGHYAG'S REMOTE laser welding head RLSK is the key to maximizing productivity. Free focus positioning in the 3D work field of the RLSK allows for »welding on the fly« while the robot is moving. In addition to saving time between welding seams, it also means better utilization of the welding robot and laser.

extent that the focus shift caused by interaction between the laser light and the lenses has practically no effect on the process.

One other important adjustment is fast and precise distance measurement because a lot of sheet metal is not completely even. A fixed focus would therefore change its position in the z axis of the metal sheet and this would adversely affect the quality of cutting and/or productivity. The Bimo-FSC continuously measures the distance between the nozzle and the workpiece in a 100-µs-cycle and corrects the position of the head with its cutting nozzle in relation to the sheet metal accordingly. Thanks to the low weight of the optical elements, this all happens very quickly and can still take place at processing speeds of more than 20 m/min. Despite its low weight, the head is robust and can easily withstand acceleration rates of 6 G.

Simple maintenance, long life

»Long life is another important criteria,« says Dr. Wedel. That's why Highyag supplies the Bimo-FSC ready for operation with sealed optics. No soiling thanks to sealing means that customers can expect our product to have a very long life. The focusing lens is positioned at the maximum distance possible from the cutting nozzle and fitted with a cover slide. Therefore, the lens is well protected against spatter. The cover slide is fitted in a special drawer so that it can be replaced quickly and easily. The degree of soiling on the cover slide is permanently monitored so that the user can take action on time without the risk of a loss in power or quality. All

other maintenance and adjustment, like centering the nozzle, can be done quick and easy.

The laser cutting head has a modular design and can hence be later adapted to suit different tasks and demands, and – more importantly – to different cutting machine systems. »We have attached great importance to simple and logical system integration,« explains Dr. Wedel.

Decisive: simultaneous focus setting

The most important aspect, however, is the extensive focus setting range of the Bimo-FSC. Since the focus can be set during the cutting process, the head can be used for many cutting tasks and can remain on the machine for a very long time without the need for retrofitting. This, in turn, boosts both productivity and quality because the customer can cut a variety material types and thicknesses and achieve better cutting quality. And that's the key to greater efficiency for the customer – cutting-edge efficiency. Dr. Björn Wedel can now self-confidently claim: »The Bimo-FSC is currently the absolute benchmark for laser cutting heads.«

Hans-Georg Schätzl
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Translated by HIGHYAG Lasertechnologie GmbH



EFFICIENCY IN FOCUS

Laser Cutting. Laser Welding.

Innovative laser processing heads and beam delivery systems of HIGHYAG optimize production efficiency and improve productivity. The new cutting head BIMO-FSC can cut various sheet thicknesses and is fully controlled by the cutting machine without manual intervention. Thus, you increase the degree of automation in manufacturing. High uptime, user-friendly operation and logical system integration - welcome to HIGHYAG. www.highyag.com

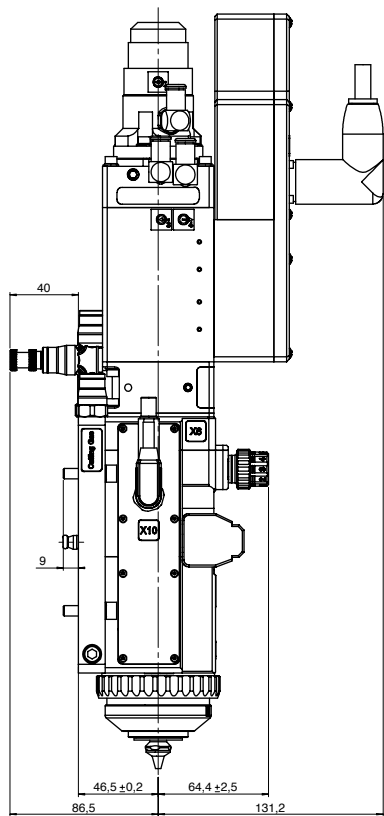
HIGHYAG
Lasertechnologie

Defining Cutting Edge Quality

Laser Cutting Head BIMO-FSC



Modules



Laser light cable receiver



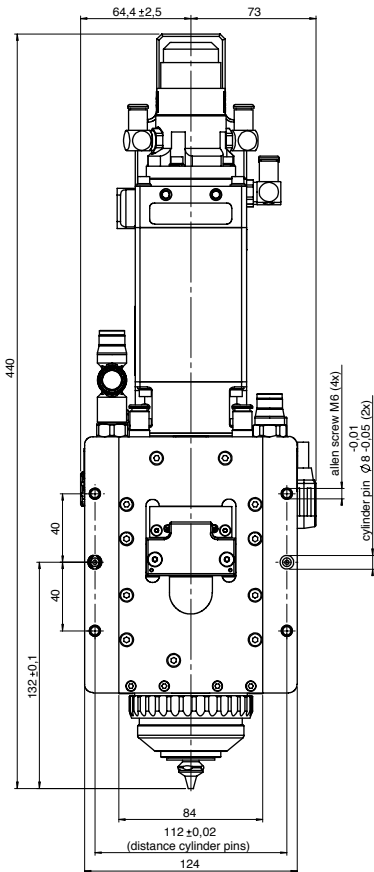
Cover slide in front of collimation



Collimation module with manual adjustment of focus position



Collimation module with machine controlled adjustment of focus position and/or diameter



Base module with X,Y alignment for centering of focus to nozzle tip



Monitored cover slide for protecting the focusing lens



Cutting nozzle with adapter for using different nozzle tips



Distance measuring module FJB

Laser Cutting Head BIMO-FSC for Flexible Flat Sheet Cutting

The use of fibre lasers for cutting applications is growing steadily. The design of HIGHYAG's new BIMO-FSC cutting head takes all of the special requirements of these lasers into account.

Maximum Productivity

Productivity is key for flat sheet cutting machine operators. The BIMO-FSC meets this need exactly. It has the capability to adjust the focus position and focus diameter automatically via the CNC. This allows for cutting of different sheet thicknesses without any manual intervention. In combination with the BIMO-FSC's rapid focus movement on the work piece, efficient flat sheet cutting and maximum productivity are guaranteed.



Cutting Edge Quality

In addition, the cut quality is of particular importance. A determining factor of the cut quality is the optical design. The design of the BIMO-FSC allows for a reduction of the laser power-induced focus shift as well as for diffraction-limited imaging quality being the condition for best cut quality.

Flexible Machine Integration

The modular design enables the easy integration in dynamically moving flat sheet cutting machines. In order to reduce the mechanical strain on the laser light cable system, the collimation module can be installed at an angle of 90°. Consequently, the BIMO-FSC can be integrated into any cutting machine.

Applications

Flat sheet cutting with high-brightness fibre, disc or diode lasers; integration into 2D cutting machines

Features

Modular optical system allows different options for focus control, from simple to highly integrated:

- Manual adjustment of focus position
- Machine controlled adjustment of focus position
- Machine controlled adjustment of focus position and diameter

High process productivity:

- Processing speeds of up to 20 m/min
- Acceleration up to 6 g

Excellent cut quality:

- Reduction of the laser power induced focus shift
- Diffraction-limited imaging quality

Flexible machine integration:

- Collimation module can be installed at an angle of 90°

Simple operation:

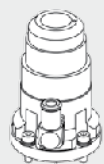
- X,Y alignment for centering the focus to the nozzle tip
- Consumable exchange

Increased lifetime of optical components:

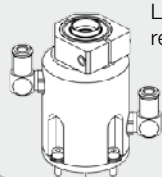
- Sealed optical system
- Optional cover slide in front of collimation
- Cover slide under focusing lens with extended cover slide stand-off
- Optional cover slide monitoring

Highly responsive capacitive height sensing by the distance measuring module FJB

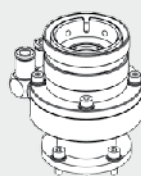
Integrated cover slide monitoring system by the KSGM



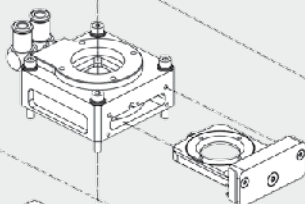
Laser light cable receiver QBH



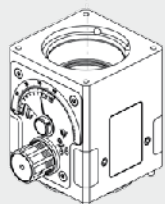
Laser light cable receiver HP



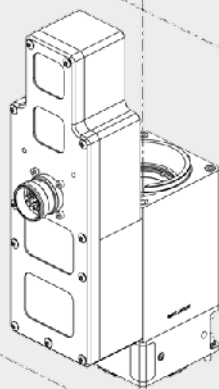
Laser light cable receiver Auto



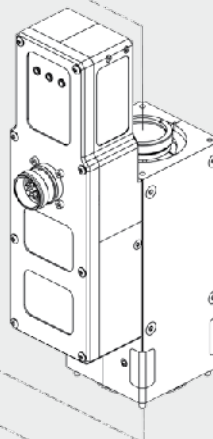
Cover slide



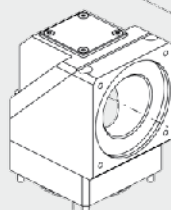
Collimation module: manual adjustment of focus position



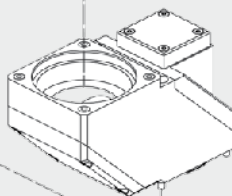
Collimation module: machine controlled adjustment of focus position



Collimation module: machine controlled adjustment of focus position and diameter

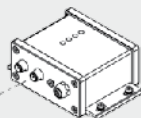
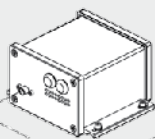


90° Beam bending module

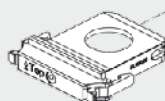


Process monitoring module 0° compact

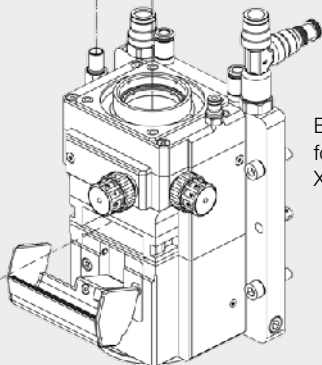
Distance measuring module (FJB)



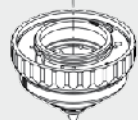
KSGM for cover slide monitoring



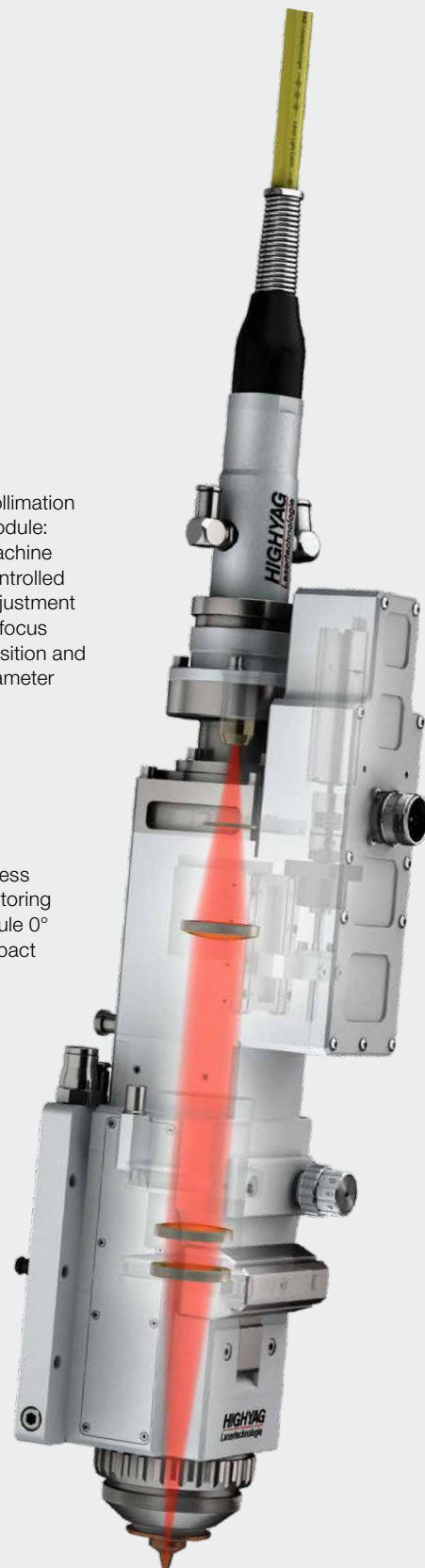
Cover slide



Base module with focusing system and X,Y adjustment



Cutting nozzle with adapter



Optical System

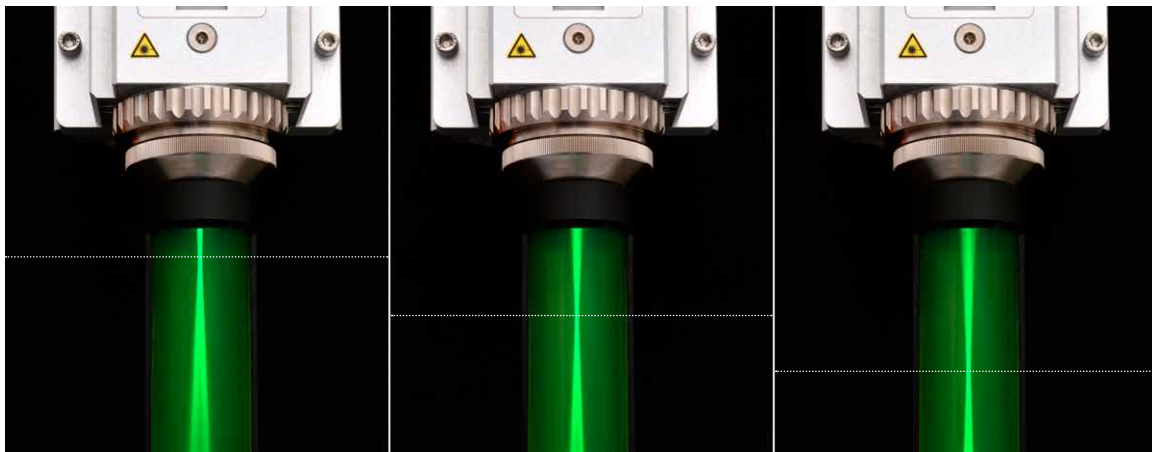
Perfectly Focused on Highest Productivity

The BIMO-FSC's optical system is set-up modularly. This provides different options for focus control. Depending on the cutting application, the customers can choose whether they want to control the focus position and diameter using the cutting machine or if simple manual control is preferred.

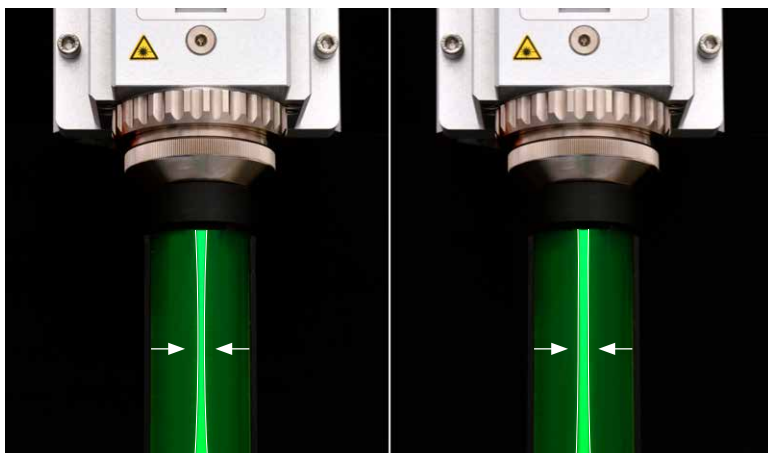
This functionality is realized by the collimation module for controlling the focus. The focus position changes by moving the collimation lens

while the focus diameter can be changed by varying the focal length of the collimation. Independent control of the focus position and diameter makes it possible to cut different sheet thicknesses without manual intervention. Therefore, productivity can be maximized. In addition to the flexible machine integration, the excellent cut quality is an advantage of the BIMO-FSC's optical design. The laser power-induced focus shift in optical elements is minimal and the imaging quality is diffraction-limited.

Adjustment of focus position



Adjustment of focus diameter



Technical Data

Optical System

Focusing system (focal length)	150 mm, 200 mm *
<i>Magnification @ focal length</i>	
• BIMO-FSC with manual z focus position	1.5 @ 150 mm, 2.0 @ 200 mm
• BIMO-FSC with motorized z focus position	1.5 @ 150 mm, 2.0 @ 200 mm
• BIMO-FSC with motorized z focus position and diameter	1.2 - 3.2 @ 150 mm, 1.6 - 4.2 @ 200 mm
Max. laser power	6 kW, 4 kW for BIMO-FSC with motorized z focus position and diameter
Max. beam parameter acceptance (half angle) of laser light exiting fibre	97% power content within 125 mrad
Wavelength	$\lambda = 1025 - 1080$ nm (e.g. for Nd:YAG, fibre and disc lasers), *
Transmission	> 97 % @ $\lambda = 1064$ nm
Core diameter laser light cable	10 - 1000 μm (typical)
Laser light cable receiver	HIGHYAG LLK-HP (LLK-B), LLK-Auto (LLK-D), QBH, *

Cutting Nozzle

Diameter	0.75 - 3.0 mm, *
X, Y adjustment	± 1 mm

Focus to Nozzle Position Range

• BIMO-FSC with manual z focus position	5 mm in head direction - 15 mm in work piece direction
• BIMO-FSC with motorized z focus position	5 mm in head direction - 15 mm in work piece direction
• BIMO-FSC with motorized z focus position and diameter	10 mm in head direction - 30 mm in work piece direction

Distance measuring module FJB

Calibration range	0.1 - 20 mm
Output signal	0 - 10 V for distance
Response time	< 1 msec

Dimensions

BIMO-FSC with beam bending module 0°	Approx. 135 x 115 x 440 mm ³ (WxDxH)
BIMO-FSC beam bending module 90°	Approx. 340 x 115 x 390 mm ³ (WxDxH)
Weight	Approx. 6,5 kg

Supply

Electric	DC 24 V, 8 A*, (BIMO-FSC with motorized z focus position and diameter)
Pneumatics	0.2 MPa
Pressure cutting gas	Up to 2.5 MPa
Gas	Inert and active
Cooling	Flow rate 2 l/min, temperature 15 - 35 °C (avoiding condensation)
PLC / Field bus system	Hard wired

Subject to change without prior notice

*Others on request

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