SUPERSCAN IVHL-15

RAYLASE

LASER CLEANING – LASER DRILLING – ELECTRODE CUTTING

MAXIMUM PERFORMANCE FOR SHORT SCAN VECTORS

Whether for **laser cleaning** of surfaces, **via-hole drilling** or **notching of electrode foils,** precise and dynamic vector movements are essential. However, high-frequency jumps and accelerations often generate significant heat that can affect the process. The **SUPERSCAN IVHL-15** offers the optimum solution for these tasks. With optimized water cooling and integrated temperature sensors, it ensures **effective thermal management** even under extreme conditions. These features minimize temperature drifts, increase reliability, and thus lead to **consistently high processing quality** – even in highly dynamic applications.

Thanks to its high dynamics and precise control, the SUPERSCAN IVHL-15 is perfectly suited for applications with **short vector movements of less than 20 % of the scan field.** The robust design ensures a stable process, especially in via-hole drilling, which requires many short vectors and rapid jumps. Users can achieve higher cycle rates without the risk of interruptions due to overheating - a decisive advantage for economical and efficient production.

Highest processing speed

Versatile use

Optimized for industrial production

www.raylase.com

DYNAMIC LASER PROCESSING WITH OPTIMIZED WATER COOLING

The SUPERSCAN IVHL-15 is an evolution of our established SUPERSCAN IV-15, optimized for applications with high dynamics requirements. The mechanical setup and thermal management have been extensively revised to guarantee first-class performance. These innovations ensure stable and reliable operation, even in demanding laser applications such as notching electrode foils, laser cleaning, and via-hole drilling.

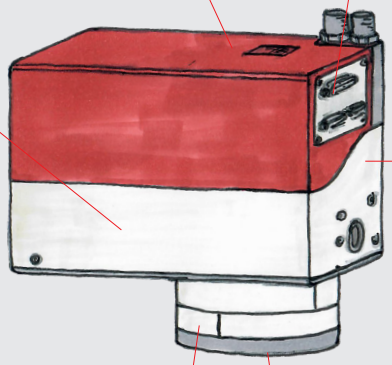
The SUPERSCAN IVHL-15 is, therefore, the ideal solution for production environments where dynamics and reliability are essential. See for yourself:

Optimized cooling for galvanometer scanners and electronics

Even reliably dissipates the heat generated during dynamically demanding scanning movements

Digital control with XY2-100 or SL2-100 protocol

Enables high-precision control and read-back of position and status signals for process monitoring and optimization



Additional temperature sensors on the galvo mountings

Ensures precise and reliable monitoring of the scanning system

Dustproof housing (IP64)

Allows the use of high laser power even under harsh production conditions

A selection of tunings and mirror substrates

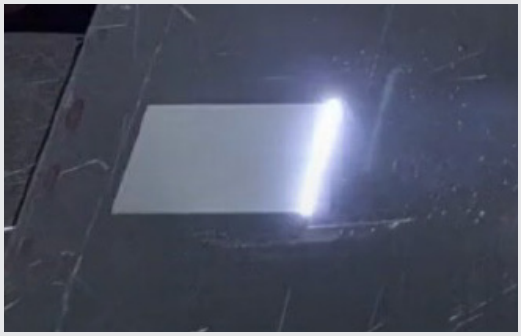
Enables dynamics performance optimally matched to the process

Suitable F-Theta lenses

Enable different field sizes and spot diameters. Telecentric lenses also make minimal angles of incidence possible.

EFFICIENT LASER CLEANING WITH SHORT VECTORS

Laser cleaning has established itself as an indispensable tool in industrial surface treatment. It enables the precise and gentle removal of contaminants, coatings or rust layers without chemical or abrasive processes. In sectors such as the automotive and aviation industries, which place high demands on cleanliness and surface quality, laser cleaning offers significant advantages over conventional processes.

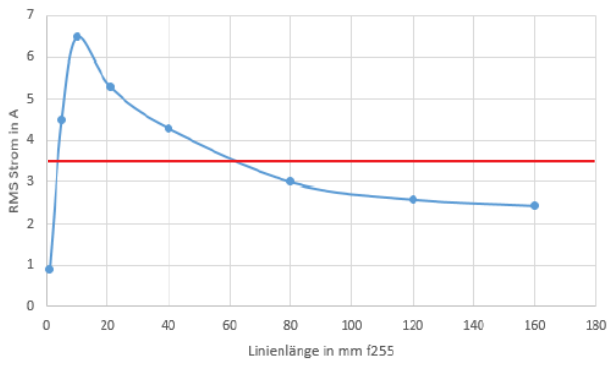


The laser can be used to gently remove paint coatings and impurities from materials. (Source: Laserax)

Challenging temperature management in highly dynamic laser processes

A common problem with laser cleaning is overheating of the beam deflection unit. As the laser beam has to be guided over the surfaces to be cleaned in a highly dynamic manner, short vectors and rapid changes of direction are required. These movements generate high acceleration forces, which place a heavy load on the galvo motors. Especially with very short vectors with a length of less than 20 % of the processing field, heat development increases significantly. This can lead to overheating of the deflection units which may result in a decline in system performance and even production interruptions that cannot be ruled out.

Current consumption with different vector lengths (v = 40 m/s at f = 255 mm)



The current consumption of the galvo motors depends on the vector length. Already for vector lengths of less than 50% of the scan field an efficient galvo cooling is advantageous. It becomes particularly important for vector or step lengths < 20% of the scan field.

Improved water cooling and temperature sensors prevent overheating and temperature drifts

The SUPERSCAN IVHL-15 offers a decisive improvement in thermal management due to its optimized cooling of the galvanometer scanners. Efficient heat dissipation from motors and electronics ensures high process speeds and precision without the risk of overheating, even in highly dynamic applications. Integrated temperature sensors enable precise monitoring of heat development. The improved cooling not only reduces temperature drifts but can also increase the dynamics of the deflection unit by accessing the total available power for acceleration processes.

Long-term benefits through higher efficiency and lower operating costs

The SUPERSCAN IVHL-15 offers significant advantages through increased process stability and reduced downtime. Optimized cooling combined with precise temperature monitoring allows the scan parameters to be adjusted during the process. This creates the ideal balance between speed, dynamics, and precision, improving process results and reducing the likelihood of unforeseen failures. As a result, the service life of the components is extended, and operating costs are reduced. The SUPERSCAN IVHL-15, therefore, makes a decisive contribution to the efficiency and profitability of the entire production process.

SOFTWARE TOOLS FOR PROCESS SUPPORT

RAYBOARD PROCESS DATA ANALYZER

DATA VISUALIZATION FOR PROCESS OPTIMIZATION

Important status information, such as data from the integrated temperature sensors, current consumption (RMS) of the galvanometer scanners, unwanted current peaks, etc. can be recorded and analyzed depending on the position. This enables comprehensive optimization of the scan strategy.

PRECISION AND THROUGHPUT FOR VIA-HOLE-DRILLING

In the production of printed circuit boards, vias are crucial for making electrical contact between the individual layers. The vias are created using precise laser drill holes that are filled with conductive material. For the scanning system, via-hole drilling involves numerous short vectors and fast jumps between individual via-positions. The frequent acceleration and deceleration phases lead to significant heat generation, which increases the risk of temperature drifts and can jeopardize drilling precision and product quality.

Improved galvanometer cooling enables process optimization
With its improved cooling concept at the galvanometer scanners, the SUPERSCAN IVHL-15 offers an ideal solution for the challenges of modern production. The efficient heat dissipation stabilizes the operating temperature and reduces temperature drifts. This thermal stability is particularly important when drilling small-diameter vias, as even minor deviations can affect the quality of the end product. In addition, the optimized thermal management enables higher frequencies in the drilling process without the risk of overheating. This allows manufacturers to increase process speed and throughput without compromising the drilled vias' quality.

HIGHER SPEED FOR NOTCHING OF ELECTRODE FOILS

The notching of electrode foils is an essential process in the production of battery electrodes. It is typically carried out as "processing on the fly", with the laser focus following the moving foil and continuously separating the tabs at millimeter intervals. For the scanning system involved, fast movements with numerous acceleration phases and frequent direction changes are required. The continuous motion sequence leaves hardly any time for cooling between cycles, often leading to overheating. Without adequate thermal management, the risk of a temperature shutdown increases, potentially endangering the entire production batch.

Optimization of production through advanced thermal management
A modern beam deflection unit such as the SUPERSCAN IVHL-15 optimizes this process through improved cooling and precise temperature sensors on the galvanometer scanners. The advanced thermal management enables the system to operate at higher speeds without overheating, allowing increased production rates to be realized. The temperature sensors play a crucial role in monitoring heat build-up during the cutting process. They provide real-time data to ensure optimum system performance. In addition, these sensors act as an early warning system for unexpected temperature rises, allowing proactive adjustments to the cutting speed to minimize heat build-up and avoid the loss of valuable production batches.

OTHER SUITABLE ACCESSORIES

RAYGUIDE

INTUITIVE PROCESS SOFTWARE
Our software solution for a quick and easy programming of your scanning solution. User-friendly set-up and calibration of the deflection unit and effortless automation through the built-in API.

SP-ICE 3

CONTROL CARD WITH FEEDBACK FUNCTION
The control center for runtime-critical process steps. Allows synchronous control of deflection unit, laser and peripherals and a combined readback of scanner and of scanner and sensor signals.

THIS MAKES RAYLASE SPECIAL

Technical specifications are important and often decisive. But at RAYLASE, we believe that there is more to it than pure technology that matters. For this reason, we are your partner for reliable and successful laser processes and offer more than just technical components.

Systems view instead of components

Modern production systems for laser processing are usually designed specifically for one process step and are highly optimized. It is therefore important to consider the interplay with the other machine components when selecting suitable beam deflection units. At RAYLASE, we therefore always have the entire solution in mind and offer our customers assistance in putting together suitable components.

Broad application knowledge

For many processes, the beam deflection unit is a decisive component. Often it determines whether the desired spot parameters and processing speeds can be implemented on the component. To identify the optimal solution here, we support our customers in selecting the right beam delivery components and sensor technology. and perform simulations of the laser processes developed by our customers. In addition, we provide support in the parameterization of the laser and deflection unit or software functionality through the experts at our Technical Competence Center TCC.

On-site support for implementation and service

Our customers are the experts for their application – we are the experts for our beam deflection units. That's why we support our customers during the commissioning of our products – if necessary also directly on site. In this way, we at RAYLASE ensure that our system is optimally adjusted and permanently delivers what it is capable of.

Education & training on the system

Modern laser deflection units are complex systems. Therefore, it is important to have a good knowledge of their characteristics. Because only when users know how the various parameters interact the optimum process becomes possible. For this reason, we at RAYLASE put a high priority on training for our products. In addition, we also offer our customers on-site training directly on the system, if required, to enable users to operate the system independently.

The POWER OF WE

Together you achieve more. At RAYLASE, we are convinced about this. That's why we place great value on cooperation in a spirit of partnership and open communication at equal level – from expert to expert. Because only when we jointly find the best solution and successful integrate it into the machine, everyone involved benefits in the end – our customers, us and also the end users.

GENERAL SPECIFICATIONS

Specification		
Energy supply	Voltage [V]	+48
	Current (RMS) [A]	3
	Max. current [A]	5
	Riple / Noise] [mV pp] [1]	200
Ambient temperature [°C]		+15 … +35
Storage temperature [°C]		-10 … +60
Humidity [%] (non-condensing)		80
IP Code		64
Control signals digital, resolution [µrad]	SL2-100, 20-Bit	0.76
	XY2-100-E, 16-Bit	12
Typical deflection [rad]		0.393
Repeatability (RMS) [µrad]		< 2.0
Position noise (RMS) [µrad]		< 4.5
Temperature drift	Max. Gaindrift [ppm/K] [2]	15
	Max. offset drift [µrad] [2]	< 10
Long-term drift 8 h with water temperature control [µrad] [2]		< 40
Long-term drift 8 h without water temperature control [µrad] [2, 3]		< 60

[1] At 20 MHz bandwidth
[2] Angle optical. Drift per axis. After 30 minutes of warm-up time, at constant ambient temperature and process load.
[3] After 30 minutes of warm-up time, even at changing process load with water cooling at ≥ 2 l/min and water with 22°C.

APERTURE-DEPENDENT SPECIFICATIONS – MECHANICAL VALUES

Specification	
Input aperture [mm]	15
Beam displacement [mm]	18.0
Dimensions (Length x Width x Hight) [mm]	170 x 125 x 118
Weight [kg]	3.7

MIRROR VERSIONS

Wavelength	Substrate
1064 nm	SC [1], QU [2]
10,600 nm	SC
1060-1080 nm	QU

[1] Silicon carbide
[2] Quartz

TYPE-DEPENDENT SPECIFICATIONS – TUNING

Tuning	Description
Vector tuning (VC)	Optimized tuning for a wide application spectrum and with focus on process speed
Cleaning tuning (C)	Optimized tuning for long vectors at highest speeds

TYPE-DEPENDENT SPECIFICATIONS – DYNAMIC BEHAVIOR

Deflection unit	SS IVHL-15 QU		SS IVHL-15 SC	
Tuning	VC	C	VC	C
Proceeding speed [rad/s] [1]	50	200	75	200
Positioning speed [rad/s] [1]	50	200	75	200
Acceleration time (approx.) [ms]	0.36	0.69	0.27	0.52
Tracking error [ms]	0.19	0.30	0.14	0.20
Step response at 1 % full scale [ms] [2]	0.49	0.65	0.37	0.50

[1] See "Calculation of the maximum speed in the processing field".
[2] Regulated to 1/5000 full amplitude.

Calculation of the maximum speed in the processing field

Speed in the processing field = F-Theta lens focal length x positioning speed
Example:
SUPERSCAN IVHL-15-SC with F-Theta lens f = 163 mm, positioning speed 75 rad/s
v = 163 / 1000 x 75 = 12,0 m/s

Deflection mirrors and lens

Lenses with optimized lens holders and scan mirrors are available for all common laser types, wavelengths, power densities, focal lengths and processing fields. Customized designs are also possible.
For more information on possible combinations, please contact the RAYLASE Support Team at:
Tel.: +49 8153 9999 297 or E-Mail: support@raylase.de.

Options

The SUPERSCAN IVHL-15 deflection units offer the option of water temperature control (W) for electronic components and galvanometer scanners. This ensures consistent working conditions as well as excellent long-term stability as well as guarantees reliable operation of high-performance laser applications.
The SUPERSCAN IVHL-15 deflection units can also be operated without water cooling (N). Drift values can rise without water cooling.

WATER TEMPERATURE CONTROL

Specifications	
Water	Clean tap water with additive
Temperature [°C]	22 … 28
Max. water pressure [bar]	< 3
Min. flow rate and pressure drop	2 / 0.4

Caution!

In order to prevent the growth of algae and protect the aluminum parts from corrosion, suitable additives must be used when using cooling water (including deionized water).

Additive recommendations

Please follow the dosing and application instructions of the manufacturer.
Standard industrial applications: Products from NALCO, e.g. CCL105 (finished mixture) or TRAC105 (additive)
Applications in the food / packaging industry: Propylene glycols from Dow Chemical, e.g. DOWCAL N.

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