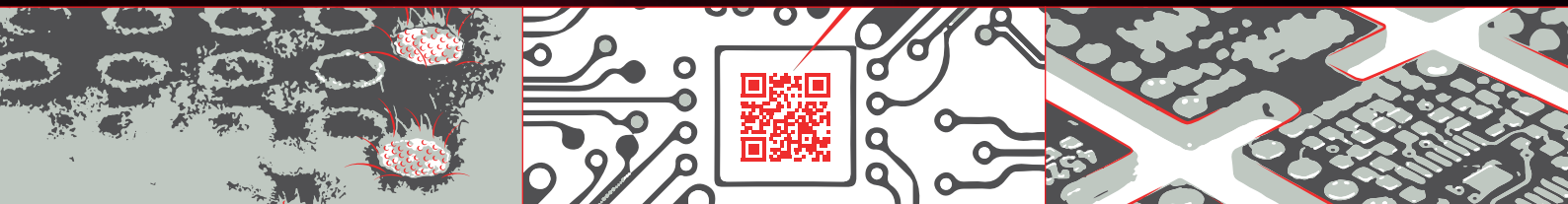


AXIALSCAN RD-14



ADDITIVE MANUFACTURING - PCB MARKING – PCB CUTTING



HIGH DYNAMICS IN LARGE WORKING FIELDS

The AXIALSCAN RD-14 was developed to be able to **efficiently process large workpieces**. It combines the **high dynamics** of a MINISCAN III with the advantages of **dynamic pre-focusing**. In contrast to a solution with an F-Theta lens, the laser is focused in front of the scan mirrors, allowing the deflection angle to be fully utilized. This means that larger processing fields are possible and even large components can be processed with a single deflection unit. This results in a great advantage for the user, who can avoid the time-consuming stitching together of several processing fields.

The AXIALSCAN RD-14 is the ideal solution for all applications where **large fields and high dynamics** are required. Hence, it is particularly suitable for additive manufacturing or the cutting and marking of printed circuit boards (PCBs).

The dynamic pre-focusing also enables the processing of non-planar structures without the need for additional optics. This means that the AXIALSCAN RD-14 can be used for **both layer-by-layer processing (2.5D) and complete 3D processing**.

The **very compact design** of the AXIALSCAN RD-14 and its **versatile mounting options** are almost identical to our FOCUSSHIFTER RD-14. Therefore, it can also be flexibly integrated into laser systems and the integrator can easily select the optimum solution for his laser application.



Highest dynamics



Stable focus position



Large processing fields

FLEXIBLE 3D LASER PROCESSING WITH COMPACT DESIGN

The AXIALSCAN RD-14 is a **3D deflection unit** designed for mid-range laser power and medium to large processing fields. Thanks to the pre-focusing optics for flat field correction, it can utilize the **maximum processing field**, and, thanks to RAYVOLUTION DRIVE technology, it still offers **very dynamic adjustment of the z-position of the focus**.

With its compact housing and multiple mounting options, the AXIALSCAN RD-14 can be flexibly integrated into any laser system, making it the ideal solution for even the most demanding laser processes.

See for yourself:

Highly dynamic z-focusing with RAYVOLUTION DRIVE technology

Ensures stable z-position and penetration depth independent of machining speed

Compact housing with multiple mounting options

Enables optimum integration into almost any laser system

Digital control with XY2-100 or SL2-100 protocol

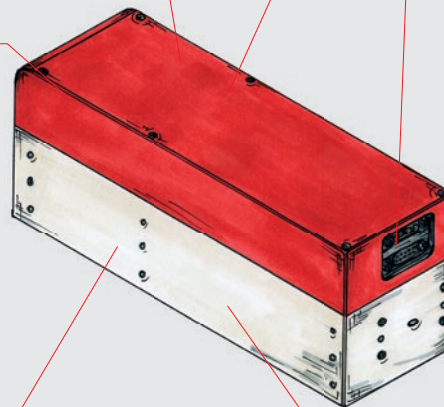
Enables high-precision control and additionally feedback of position and status signals for process monitoring and optimization

Dust-proof housing (IP64)

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

Second protective glass with quick-change mounting frame

Reduces maintenance times and increases productivity and process reliability



Flexible process field sizes

Enables processing of components in processing fields between 200 x 200 mm² and 600 x 600 mm²

ADDITIVE PRODUCTION OF DENTAL IMPLANTS

In additive manufacturing, the goal is often to **increase productivity** and **reduce part costs**. This is particularly true in the market for additively manufactured dental implants. One of the challenges: Though conventional laser systems for this application usually have sufficient dynamic performance, they often do not have the necessary field size. This is because the F-Theta lens can considerably restrict the usable field. For the user, this translates into longer production times and higher costs per implant.

Here, the AXIALSCAN RD-14 represents an interesting technological option. With its highly dynamic RAYVOLUTION DRIVE z-axis, a **fast and precise flat field correction** becomes possible without an F-Theta objective. This allows the AXIALSCAN RD-14 to utilize the full scanning angle and thus **cover a larger working field** without compromising the dynamics of the system. The larger working field results in more implants per production run, which leads to a shorter production time per implant and therefore a reduction in costs.

Furthermore, with its compact dimensions and versatile mounting options, the AXIALSCAN RD-14 can be **easily integrated into existing machine designs**. As a result, the AXIALSCAN RD-14 with its RAYVOLUTION DRIVE offers an attractive solution for optimizing productivity and costs in additive manufacturing and paves the way for scalable and more economical production processes for customer-specific dental implants.



Patient-specific dental implants are often manufactured using additive manufacturing. Here and in other additive manufacturing processes, high dynamics and a favorable machine price play an important role. For many such applications, the AXIALSCAN RD-14 offers an optimum compromise between spot size, dynamics, compact design and price.

OTHER SUITABLE ACCESSORIES



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 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 successfully integrate it into the machine, everyone involved benefits in the end – our customers, us and also the end users.

GENERAL SPECIFICATIONS

Power Supply	Voltage [V]	+ 48
	Current (RMS) [A]	4
	Current (max.) [A]	8
	Ripple / Noise @ 20 MHz bandwidth [mV pp]	Max. 300
Ambient temperature [°C]		+15 to +35
Storage temperature [°C]		-10 to +60
Humidity non condensing [%]		≤ 80
IP Code		64
Interface signals	Digital	XY2-100 Enhanced protocol 16 Bit SL2-100 protocol 20 Bit
Typical deflection (optical) [rad]		± 0.393
Resolution XY2-100 16 Bit [μrad]		12
Resolution SL2-100 20-Bit [μrad]		0.76
Repeatability (RMS) [μrad]		< 2.0
Positioning noise (RMS) [μrad]		< 4.5
Temperature drift	Max. Gain drift [ppm/K]	15
	Max. Offset drift [μrad/K] ¹	10
Long-term drift 8 h [μrad] ¹		< 60

¹ Angles optical. Drift per Axis, after 30 min. warm-up, at constant ambient temperature and process stress.

APERTURE DEPENDENT SPECIFICATIONS – MECHANICAL DATA

Deflection Unit		AXIALSCAN RD-14
Limiting input aperture [mm]		5.0
Beam displacement [mm]		17.0
Optimum input	full beam [mm]	4.7
beam diameter	1/e ² [mm]	3.1
Weight [kg]		5.5
Dimensions without electrical connectors (L x W x H) [mm]		330.0 x 105.0 x 134.0

TYPE DEPENDENT SPECIFICATIONS – TUNINGS

Tuning	Description
Marking-Tuning (MA)	Optimized tuning for marking applications
Vector-Tuning (VC)	Optimized tuning with a wide range of applications with emphasis on processing speed

TYPE DEPENDENT SPECIFICATIONS – DYNAMIC DATA

Deflection unit		AXIALSCAN RD-14 SI	
Tuning		MA	VC
Processing speed [rad/s] ¹		30	50
Positioning speed [rad/s] ¹		90	50
Tracking error [ms]		0.16	0.20
Acceleration time approx. [ms]		0.30	0.46
Step response time at 1% of full scale [ms]		0.36 ²	0.68 ³
Tracking error focusing unit [ms]		0.9	
Speed of moving lens [mm/s]		900	

¹ See "Calculation of speed" ² Setting at 1/1,000 of full scale ³ Setting to 1/5,000 of full scale

Calculation of speed:

With a deflection angle of ± 0.393 rad (45°) for a process field of $100 \times 100 \text{ mm}^2$, an angular speed of 1 rad/s corresponds to a speed in the field of 0.12 m/s.

Example: An AXIALSCAN RD-14 with a process field of $400 \times 400 \text{ mm}^2$ (field factor 4) and Marking Tuning (MA) with an angular speed of 30 rad/s achieves a processing speed in the field of: $30 \text{ rad/s} \times 0.12 \text{ m/s} \times 4 = 14.4 \text{ m/s}$

Note: Depending on the control card used, processing task, process field size and optical configuration, the Z-axis may lower the processing speed.

CONFIGURATION EXAMPLES – AXIALSCAN RD-14

Field size [mm x mm]	200 x 200	300 x 300	400 x 400	500 x 500	600 x 600
Working distance [mm]	200	324	448	571	695
Spot diameter $\lambda = 355 \text{ nm}$, $1/e^2$ ca. [μm]	16	24	32	40	48
Spot diameter $\lambda = 1064 \text{ nm}$, $1/e^2$ ca. [μm]	45	68	91	113	136
Working volume [mm]	36	143	355	747	1000

Note: Spot data valid for beam diameter FBD = 4.7 mm

Working distance and working volume valid with one external protective cover glass. The values may change slightly when using the second external quick-change protective cover glass. Details on request.

OPTICS SPECIFICATIONS

Wavelength and coatings	Mirror substrate	Maximum permissible laser power [W] ¹
355 nm	SI	100
1,064 nm	SI	300

¹ Valid for single-mode and multi-mode continuous wave (CW) lasers

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