

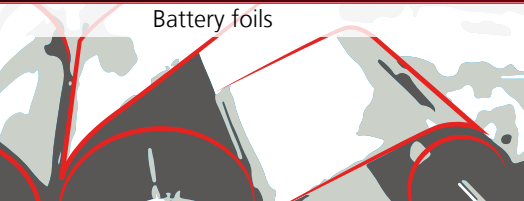
AXIALSCAN FIBER-50

Automotive industry | Commercial vehicle manufacturers | Rail vehicle construction | Shipbuilding
Aerospace engineering and technology | Fuel cell and battery manufacturing | Other e-mobility service providers

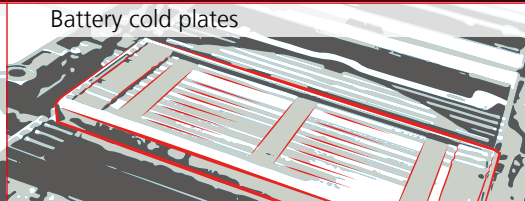
On point – the smallest spot sizes for the largest fields



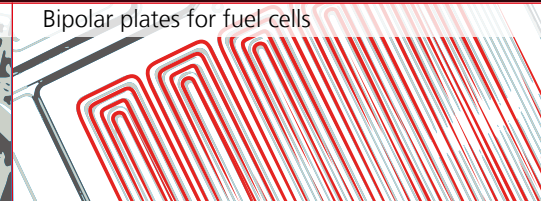
Battery foils



Battery cold plates



Bipolar plates for fuel cells



WHAT THE AXIALSCAN FIBER-50 CAN DO FOR YOU:

Many laser beam deflection units can weld and cut – but only a handful can do so **“on the fly”**. The AXIALSCAN FIBER-50 (AS F-50) ensures that the laser process is highly dynamic and precise, even when the **workpiece is passing under the deflection unit at varying speed**.

This puts the AXIALSCAN FIBER-50 in a class of its own for you as a machine manufacturer, commercial vehicle manufacturer, shipbuilder or rail vehicle manufacturer. The pre-focussing deflection unit can, among other things, separate the contours of electrical connection surfaces (**tabs**) on batteries **with precision** during the foil winding process. This benefit is possible thanks to the **pulsed laser beam – highly dynamic with position accuracy** – that is directed from the AXIALSCAN FIBER-50 deflection unit onto the workpiece.

Another ingenious feature of the AS F-50 is that it works with the smallest spot size on processing field sizes of between **300 x 300 mm** and **850 x 850 mm**. This makes the pre-focussing deflection unit the no. 1 choice for seamless laser processing – and for ensuring sharp edges without noticeable heat affected zones when separating electrode foils. Another area of application is the welding of bipolar plates for fuel cells with very thin, stainless steel plates with a thickness of less than 100 µm and a complex capillary structure. For this purpose, the AS F-50 uses a high level of position accuracy and creates fine weldseams with **stable penetration depth** to prevent damage to the bipolar plate.



The smallest spot sizes
for the largest fields



Clean-room
manufacturing



Sophisticated interface management:

The AXIALSCAN FIBER-50 can be equipped with various fibre sockets – including a **QD socket (LLK-D)** – making it compliant with the strict regulatory requirements in the automotive industry. In combination with protection rating 64, it stands for the very best in process reliability.



What you can rely on with RAYLASE:

We strive, above all, to achieve usability, quality and productivity. That's why all our products are developed, built and tested in our own laboratories and production facilities. We make our complex, pre-focussing deflection units and welding modules in our ISO Class 7 clean room to ensure an unrivalled level of optical cleanliness and strength. We guarantee fast service and expert maintenance by means of our global support network.



Flexibility that you can see:

Thanks to its structural design and compact dimensions, the AXIALSCAN FIBER-50 deflection unit with integrated collimator is easily integrated into existing machine configurations.

The horizontally arranged QBH interface – which can alternatively be implemented as QD – prevents the entry of dust particles when the laser fibre is connected. A second protective window that can be replaced in a matter of seconds minimizes maintenance. This increases productivity and process reliability.



How we define (inline) quality assurance:

The AXIALSCAN FIBER-50 deflection unit makes chromatic aberrations a thing of the past! The elimination of the need for F-Theta lenses guarantees the best possible light quality, which in turn opens up **a wide range of options for coaxial inline process control**. The unaltered spectrum of the process light ensures precise capture of a huge amount of reliable data, which you can use to **evaluate** and **reproduce** the quality of your components at any time using suitable sensors and analysis software.

The structural design of the AXIALSCAN FIBER-50 also offers extensive monitoring of a wide range of manufacturing parameters. Which means that process monitoring can be customized to meet any individual requirements. For you as machine and plant manufacturer with a focus on automotive manufacturing, a commercial vehicle manufacturer or a rail vehicle manufacturer, this adds up to complete control over the quality of the bipolar plates for your fuel cells – to name just one classic component in your production line.

At any time and at any point. You benefit from **valid information about component quality** and about the manufacturing process itself. This makes the pre-focussing AXIALSCAN FIBER-50 the technology that enables quality assessment during the manufacturing process itself thanks to powerful sensors. As a result, both incorrect measurements due to excessively refracted light and costly software adjustments for camera monitoring are no longer a concern.

GENERAL SPECIFICATIONS

Power Supply	Voltage [V]	+ 48
	Current (RMS) [A]	4
	Current (max.) [A]	8
	Ripple / Noise @ 20 MHz bandwidth [mV pp]	Max. 200
Ambient temperature [°C]		+15 to +35
Storage temperature [°C]		-10 to +60
Humidity non condensing [%]		≤ 80
IP Code		64
Interface signals	Digital	RL3-100 protocol 20 Bit SL2-100 protocol 20 Bit
Typical deflection (optical) [rad]		± 0.393
Resolution RL3-100 / SL2-100 20-Bit [μrad]		0.76
Repeatability (RMS) [μrad]		< 2.0
Positioning noise (RMS) [μrad]		< 3.2
Temperature drift	Max. Gaindrift [ppm/K]	15
	Max. Offsetdrift [μrad/K] ¹	10
Long-term drift 8 h without water temperature control [μrad] ¹		< 60
Long-term drift 8 h with water temperature control ^{1, 2}		< 40

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

² After 60 min. warm-up, under varying process loads, with water temperature control set for ≥ 2 l/min and 22°C water temperature.

APERTURE DEPENDING SPECIFICATIONS – MECHANICAL DATA

Deflection Unit	AXIALSCAN FIBER-50	
Laser fiber socket	QBH / QD	
Position of fiber socket	in front	
Special version free collimated beam	on top	
Weight [kg] approx.	25	
Dimensions excluding fiber socket and electrical plug connections (L x W x H) [mm]	380.0 x 200.0 x 494.0	
	Typ. beam divergence	Max. beam divergence
Optical sets for fiber coupling ¹	1/e ² full angle	1/e ² full angle
Single-mode Laser, fiber core d = 10 μm [mrad]	140	150
Multi-mode Laser BPP 3.5 – 4.0 mm mrad fiber core d = 100 μm [mrad]	140	150
Single-mode laser, fiber core d = 14 μm [mrad]	100	110
Single-mode laser, fiber core d = 30 μm [mrad]	50	64

¹ Optical sets optimized for maximum beam divergence. Further combinations with other lasers on request.

For each combination with a fiber laser, the appropriate collimation focal length must be calculated and specified by RAYLASE.

TYPE DEPENDENT SPECIFICATIONS – TUNINGS

Tuning	Description
Vector-Tuning (VC)	Optimized tuning with a wide range of applications with emphasis on processing speed.
Microstructuring Tuning (M)	Optimized tuning for high precision beam deflection and fastest beam direction change during hatching.



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TYPE DEPENDENT SPECIFICATIONS – DYNAMIC DATA

Deflection unit	AXIALSCAN FIBER-50 SC	
Tuning	VC	M
Processing speed [rad/s] ¹	30	10
Positioning speed [rad/s] ¹	30	10
Tracking error [ms] ²	0.58	0.38
Step response time at 1% of full scale [ms] ³	1.5	1.4
Tracking error focusing unit [ms]	0.9	0.9
Speed of moving lens [mm/s]	900	900

¹ See "Calculation of speed".

² Calculation acceleration time approx. 2,2 x tracking error.

³ Settling to 1/5,000 of full scale.

Calculation of speed:

1 rad/s @ ± 0.393 rad deflection (45°) 0.12 m/s for 100 mm working field size.

Example: Processing field 400 x 400 mm² corresponds to field factor 4, processing speed 30 rad/s, processing speed [m/s] = 30 x 0.12 m/s = 14.4m/s

Options:

The AXIALSCAN FIBER-50 deflection units offer the possibility of air cooling for the deflection mirrors.

Note: From 4 kW laser power air cooling is required to protect the mirror system from damage.

This ensures constant working conditions as well as excellent long-term stability and guarantee reliable operation of high-power applications.

WATER TEMPERATURE CONTROL

Specifications	
Cooling water ¹	Clean tap water with additives
Water hardness [ppm]	< 10
ph value	7 – 8.6
Bacterial content [cfu/ml]	< 1,000
Recommended cooling temperature [°C]	22 – 28
Temperature stability [K]	± 1
Max. water pressure at deflection unity [bar]	< 3
Min. water flow [l/min] and pressure drop [bar]	2 / 0.4
Tube outer diameter [mm]	8

¹ **Caution:** When using cooling water including deionised water, suitable additives must be used to prevent the growth of algae and protect the aluminium and copper components of the cooling circuit against corrosion.

Additive recommendations (Please consult your additive supplier for dosage information):

Standard industrial applications: Products of company NALCO, e.g. CCL 105 (Premix) oder TRAC 105A_B (Additive)

Food & beverage, packaging applications: Polypropylene glykol of company Dow Chemicals, e.g. DOWCAL N

Note: Water cooling is strongly recommended for the AXIALSCAN FIBER-50, as the collimator can heat up considerably at high powers and high beam divergences.

In addition, the water cooling ensures a uniform temperature control of the system and thus guarantees excellent long-term stability and reliable operation of high power applications.

AIR FLUSHING

Specification compressed air ¹	
Max. water shares [g/m ³]	≤ 0.05
Max. oil shares [mg/m ³]	≤ 0.005
Pore filter [µm]	≤ 5
Recommended air flow [l/min] approx.	30
Tube outer diameter [mm]	6

¹ ISO 8573-1 Compressed air Part 1: Impurities and purity classes

OPTICS SPECIFICATIONS

Wavelength and coatings	Mirror substrate	Maximum permissible laser power [W] ¹
1,060 nm – 1,090 nm + AL	SC	6,000

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

PROCESS-MONITORING

AXIALSCAN FIBER-50	
Process light broadband output wavelength [nm]	400 – 900 + 1,300 – 2,100

Every AXIALSCAN FIBER is equipped with a dust-proof optical output for process light radiation. Both very short wavelengths below the laser wavelength and long-wave thermal radiation are transferred externally. This means that various sensors can be connected, e.g. cameras for position detection, weld quality monitoring and pyrometers.

CONFIGURATION EXAMPLES – AXIALSCAN FIBER-50

Processing field size [mm x mm]	300 x 300	400 x 400	500 x 500	600 x 600
Working distance [mm] ¹	291	415	539	663
Spot diameter 1/e ² [µm] ²	23	30	36	43
Free Focus range [mm]	2	24	60	110

¹ From the bottom edge of deflection unit to the processing field.

² Beam quality M² = 1 with typical beam divergence 100 mrad, fiber core diameter 14 µm.

Note: Lower beam divergences will cause bigger spot diameters.

The perfect companion:

SIMPLE PROCESS SOFTWARE

Guarantees fast and easy interactions for customised programming. User-friendly set-up and calibration of the deflection unit and effortless automation.

CONTROL CARD WITH FEEDBACK

Can be used universally as well as specifically for individual requirements. The laser system can thus be optimally controlled, optimised during development and monitored during operation.

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