AM-MODULE NEXT GEN

RAYLASE

ADDITIVE MANUFACTURING SOLUTIONS

FOR CHALLENGING INDUSTRIAL APPLICATIONS

INDUSTRIE PREIS 2018
BEST OF

- Fast beam deflection with uniform power distribution over the entire field
- High dynamic for 3D-Production of metal-parts for working fields from up to 600 mm x 600 mm
- Innovative design for effective full parallelization over the working field
- Direct fibre connection and zoom axis for highly dynamic change of spot size
- On-Axis process monitoring and control using various sensors with focus tracking

THE HIGHLY DYNAMIC SOLUTION FOR ADDITIVE MANUFACTURING

YOUR BENEFITS

The AM-MODULE NEXT GEN for fibre-coupled lasers features homogeneous power density and exceptionally low drift values. It enables ultradynamic, rapid processing with flexible spot diameters. Full digital, model-based control is ensured with absolute precision. Up to 4 modules can be operated simultaneously over one construction field. Direct connection of a photodiode or pyrometer for process control is also possible.

OPTIONS

For more effective process monitoring, the BASE-Module can be expanded with the SENSOR-Module. The 2 integrated sensors not only ensure customized quality control, they also enable archiving and process control. Focus tracking is built-in for one of the sensors. Data can be preprocessed either directly in the expanded camera electronics or on a powerful frame grabber.

TYPICAL APPLICATIONS

The AM-MODULE NEXT GEN is available in 2 variants, as a standard module or a high performance module wih fully digitally galvo-scanner. The high performance module is designed for use in the manufacture of ultra-high precision components which must satisfy particularly high safety specifications. This application is of particular interest for users in the aerospace industry, automotive manufacturing and medical engineering.

INNOVATION AND QUALITY

Innovation and quality are the highest priority at RAYLASE. We develop, manufacture and test all of our products in our in-house laboratories and production workshops. For the best possible maintenance and fast service, we offer our customers a worldwide support network.

AM-MODULE NEXT GEN

GENERAL SPECIFICATIONS

Power supply	**Voltage**	+48 V
	Current (BASE-Module)	6 A, RMS, max. 10 A
	Ripple/Noise	Max. 200 mVpp, @ 20 MHz bandwidth
Ambient temperature		+15°C to +40°C
Storage temperature		-10°C to +60°C
Humidity		≤ 80% non-condensing
IP-Code		64
Interface signals	**Digital**	RL3-100 protocol, 20 Bit

		Standard	**HPS***
Typical deflection		± 0.325 rad	± 0.325 rad
Resolution RL3-100 20 Bit		0.76 µrad	0.76 µrad
Repeatability (RMS)		< 2 µrad	< 0.4 µrad
Position noise (RMS)		< 3.2 µrad	< 2.0 µrad
Temperature drift	**Max. Gaindrift [1]**	15 ppm/K	8 ppm/K
	Max. Offsetdrift [1]	10 µrad/K	15 µrad/K
Long-term drift 8 h without water temperature control [1]		< 60 µrad	< 50 µrad
Long-term drift 8 h with water temperature control [2]		< 40 µrad	< 30 µrad

[1] Angles optical. Drift per axis, after 30 min warm-up, at constant ambient temperature and process stress.
[2] After 30 min warm-up, under varying process loads, with water temperature control set for ≥ 2 l/min and 22°C water temperature.
* High Performance System

APERTURE DEPENDENT SPECIFICATIONS – MECHANICAL DATA

Deflection unit	**SUPERSCAN IV / V -30 Kit**	
Laser fiber socket	QBH	
Weight BASE-Module [kg]	approx. 15	
Dimension BASE-Module (L x W x H) [mm] [1]	284 x 150 x 393	
Weight SENSOR-Module without sensors [kg]	approx. 14	
Dimension SENSOR-Module (L x W x H) [mm] [1]	315 x 150 x 393	
Total dimension (L x W x H) [mm] [1]	589 x 150 x 393	
	Typ. beam divergence	**max. beam divergence**
Optical sets for fiber coupling [2]	$1/e^2$ full angle	$1/e^2$ full angle
Single-mode laser, fiber core 10 µm or multi-mode laser BPP approx. 3.5 mm x mrad, fiber core 100 µm	140 mrad	150 mrad
Single-mode laser, fiber core 14 µm	100 mrad	110 mrad
Single-mode laser, fiber core 20 µm	80 mrad	90 mrad

[1] Length without front panel, width without brackets for fixation from above, height without pin connector.
[2] Optical sets optimized for maximum beam divergence

MIRROR VARIATIONS

Wavelengths	**Substrate**
1,060 nm – 1,090nm + AL	SC

SC = silicon carbide

TYPE DEPENDENT SPECIFICATIONS – TUNING

Tuning	**Description**
Hatching Tuning (H)	Optimized tuning for high precision beam deflection and fastest beam direction change during hatching

TYPE DEPENDENT SPECIFICATIONS – DYNAMIC DATA

	Standard	**High Performance**
Deflection unit	**SUPERSCAN IV-30 Kit**	**SUPERSCAN V-30 Kit**
Tuning	H	H
Processing speed [rad/s]	30	30
Positioning speed [rad/s] [1]	30	30
Tracking error deflection unit [ms]	0.23 [2]	0.25 [3]
Step response time at 1% of full scale [ms] [4]	0.70	0.66
Tracking error focusing unit [ms]	1.5	1.5
Speed of moving lens [mm/s]	880	880
Magnification factor spot diameter Single-Mode	1..2	1..2
Magnification factor spot diameter Multi-Mode	1..3	1..3

[1] See "Calculation of speed". [2] Calculation acceleration time approx. 1.8 x tracking error. [3] Calculation acceleration time approx. 1.7 x tracking error.
[4] Setting to 1/5,000 of full scale.

Calculation of maximum speed in field:
1 rad/s @ ± 0,325 rad deflection (± 18,6°) ≙ 0.15 m/s for 100 mm working field size.
Example: AM-MODULE NEXT GEN with working field size 400 mm x 400 mm (field factor = 4), Positioning speed 30 rad/s: => 30 x 0.15 m/s x 4 = 18 m/s
Note: Lower speeds may be produced by the linear translator module, depending on the laser job, field size and optical configuration.

Options:
The AM-MODULE NEXT GEN offer the option of water cooling (W) of the electronic components and galvanometer scanner along with air-cooling [A] for the deflection mirrors > 2 kW laser power.
This ensures constant working conditions and excellent long-term stability and guarantees reliable operation of high-power laser applications.
The AM-MODULE NEXT GEN can also be operated without water cooling. Without water cooling, drift values may increase.

AIR FLUSHING

Specifications		Flow rate	Pressure drop
Compressed air [1]	Clean air free of water and oil	**approx. 100 l/min**	1.0 bar – 1.5 bar

[1] ISO 8573-1:2010 [1:0(0.05):0(0.005)]

WATER TEMPERATURE CONTROL

Specifications		Flow rate	Pressure drop
Water [1]	Clean tap water with additives	**2 l/min**	0.4 bar
Temperature	22°C – 28°C	**4 l/min**	0.8 bar
Max. water pressure	< 3 bar	**6 l/min**	1.2 bar

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

Additive recommendations (Please consult your additive supplier for dosage information):
Standard industrial applications: Products of company NALCO, e.g. CCL105 (Premix) or TRAC105A_B (Additive)
Food & beverage, packaging applications: Polypropylene glycol of company Dow Chemical, e.g. DOWCAL N

CONFIGURATION EXAMPLES – AM-MODULE NEXT GEN

Field size [mm x mm] [1]	250 x 250	300 x 300	400 x 400	500 x 500	600 x 600
Working distance [mm] [2]	318	392	541	689	838
Spot diameter 1/e² [µm] [3]	38	44	58	72	85

[1] The processing field is pre-adjusted by RAYLASE in accordance to the customer's requirements. Small machine-specific deviations can be adjusted by software.
[2] From the bottom edge of deflection unit to the processing field. [3] Beam quality $M^2 = 1$ @ typical beam divergence 100 mrad, fiber core diameter 14 µm
Note: Lower beam divergences will cause bigger spot diameters

LENSE SPECIFICATIONS

Laser	Fiber Laser infrared 1,060 nm – 1,090 nm
Coating / Wavelength [nm]	SC 1,060– 1,090 + AL
Max. laser power, cw [W]	2,000 W single mode / 3,000 W multi mode

SC = silicon carbide

PROCESS MONITORING

Every AM-MODULE NEXT GEN is equipped with a 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.

	AM-MODULE NEXT GEN
Process light output wavelengths [nm]	400 – 900 + 1,300 – 2,100

SPECIFICATIONS SENSOR-MODULE

Specifications high speed camera optical values:	
Illumination wavelength [nm]	640 / 850
Bandwidth Illumination wavelength [nm]	20
Min. Field size [mm x mm]	250 x 250
Max. Field size [mm x mm]	400 x 400
Number of pixels	1,696 pixel x 1,710 pixel (2.9 MP) configurable
Pixel size [µm]	8.0
Framerate [fps]	540 fps @ 1,696 x 1,710 Pixel to 37,700 fps @ 128 pixel x 128 pixel
Camera interface	CoaXPress
Field of view [mm x mm] [1]	8 x 6
Optical resolution [µm]	15

[1] Valid for field size 250 mm × 250 mm.

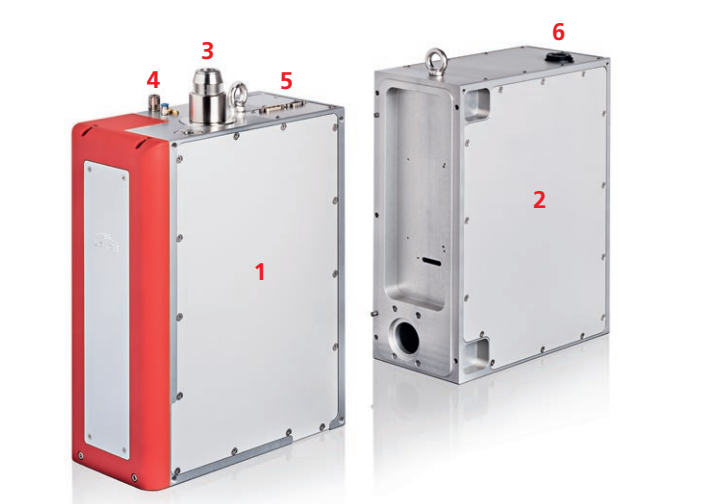
Option: Further camera- and sensortypes available on request. Objective lenses for fibers of pyrometers or measurement systems for light intensity can be integrated into the SENSOR-Module mechanically adjustable and in addition to the camera observation.

AM-MODULE NEXT GEN

ADDITIVE MANUFACTURING SOLUTIONS

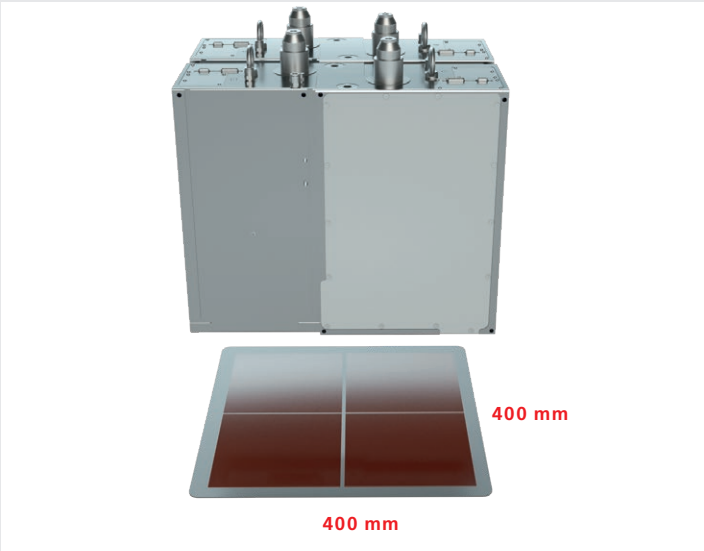
FOR CHALLENGING INDUSTRIAL APPLICATIONS

SETTING AM-MODULE



1. AM-BASE-Module
2. AM-SENSOR-Module
3. QBH fibre connector
4. Water-cooling
5. Power supply & RL3-100 data connection, reverse polarity protected to industrial standards
6. Sensor-Interfaces CoaXPress, GigE or grommet for fiber optics depending on configuration

PARALLELIZATION



3D-construction process with 4 AM-MODULES over 1 working field to increase efficiency and quality in the production.

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