

RAYLASE IS A COMPLETE SUPPLIER OF OPTICAL SYSTEMS AND DEFLECTION UNITS FOR THE AM PROCESS.

White paper for FOR MACHINE MANUFACTURERS AND INTEGRATORS

As a sector, additive manufacturing is ready to take the next steps towards establishing itself as the production technology of the future. The crucial factors are that AM solutions are ideal for industrial use, robust, integrated and scalable. At formnext 2018 in Frankfurt/Main (Germany), RAYLASE showcases its current range of products, services and expertise in complete AM solutions in this white paper to industry experts.

STRENGTHS AND WEAKNESSES OF ADDITIVE MANUFACTURING IN "IOT"

Before looking ahead, it's worth taking a look back. Initially, additive manufacturing was mainly concerned with production of prototypes and special components that could not be manufactured using conventional methods. But it quickly established itself in small batch manufacturing, e.g. turbine blades, burners for energy technology or prosthetic hips. The technology is becoming increasingly important in the automotive industry, for example additively manufactured radiators, battery compartments and wheel mounts.

The challenge is that what works for small batches cannot simply be transferred to large batches and industrial scale production. In order to meet the demanding efficiency requirements for series production, innovative ideas are needed, both in terms of the deflection units and laser control cards, and for the entire additive manufacturing process.

"We've not yet reached a satisfactory level of industrialisation", says Wolfgang Lehmann, product manager at RAYLASE. He adds: "The parameters that make up a robust industrial-scale machine – such as an automated calibration facility, accuracy and stability – are not yet at the level that industry needs to deliver efficient production. Downtimes are also still too high. So there is still plenty of potential for improvement."

EVERYTHING STARTS WITH HIGH PERFORMANCE DEFLECTION UNITS: RAYLASE AM-MODULE NEXT GEN

The key element to overcoming these challenges are deflection units that are dynamic and, at the same time, can vary the focus of the laser beam as flexibly as possible during the manufacturing process. RAYLASE has developed just such a deflection unit especially for manufacturing of metal parts using a powder bed – the AM-MODULE NEXT GEN. The AM-MODULE NEXT GEN significantly increases productivity while simultaneously improving the quality of the components.



AM-MODULE NEXT GEN

Thanks to its highly dynamic deflection mirror, the AM-MODULE NEXT GEN is notable for small spot sizes for the very dynamic "hatching process", its integrated fibre collimator, the zoom axis system for dynamic spot size adjustment and numerous process monitoring options. These features are supplemented by versatile, configurable and automated functionalities on the SP-ICE-3 control card. This ensures constant spot sizes and power densities at every point in the process field.

We can position the tracks next to one another with very high accuracy of less than 5 µm", Lehmann adds.

The width of the tracks depends to a great extent on the grain size of the powder particles. This is normally between 15 µm and 60 µm. The spot size has to be adapted accordingly. Depending on the construction field size, it is between 40 µm and 150 µm. With the AM-MODULE NEXT GEN, RAYLASE can vary and dynamically double the spot diameter during the process.



Wolfgang Lehmann,
Product manager RAYLASE GmbH

COMPREHENSIVE SUPPORT FOR MACHINE MANUFACTURERS AND INTEGRATORS

How complicated is it to install and replace AM-MODULES NEXT GEN? "Let's start right at the beginning of the integrator's work with the mechanical installation", explains Wolfgang Lehmann. "Precision holes enable the AM-MODULE NEXT GEN to be precisely positioned on the support plate in the customer machine. It can be screwed onto the support plate from above without having to

go through the process chamber. "The advantage of this is that the modules can be quickly changed and precisely repositioned for maintenance and service work.

To connect the individual AM-MODULE NEXT GEN, one cable each for the power supply, the data from the AM-MODULE NEXT GEN (for up to 5 axes) and the process monitoring data are connected with reverse polarity protection and secured. This ensures an IP64 protection rating. The 48 V supply voltage is available in every supply cabinet.

And how does the construction job get to the laser control? "Of course, RAYLASE provides the appropriate interface and solution", Lehmann continues. "The RAYLASE AM JOB CONVERTER converts construction jobs from all standard software modules into the list structure for SP-ICE-3 control cards and allows them to be started synchronously. If the end user wants to influence the layer or an area of the layer, the production lists can be individually edited, provided they are not currently being processed."

To take into account the melt pool and its surroundings and record it, RAYLASE has integrated a high performance high-speed camera into the optional SENSOR-Module. This enables up to almost 38,000 images of a melt pool to be captured every second. The high performance CoaxPress bus sends the data to a frame grabber, where it is pre-processed before it is transferred to a computer via Gigabit Ethernet for post-processing or archiving.

To prevent a loss of focus due to mirror deflection for the camera, the image field is tracked using a highly dynamic focusing axis in the SENSOR-Module.

How can the laser power be corrected, for example if too little or too much energy gets to the powder due to the heat flow?

"The latest development from RAYLASE is the integration of a quotient pyrometer into the optional SENSOR module", says Lehmann. "The signals from the pyrometer represent the temperature in the melt pool. They are read by the SP-ICE-3 control card and displayed synchronously with the mirror positions. A configurable control loop is able to adjust the laser power depending on the temperature in the melt pool. This can be done directly, linked to a time constant, or at the next layer. The quotient pyrometer and high-speed camera can be operated in parallel in the SENSOR-Module."

To choose the most appropriate process monitoring, RAYLASE offers a comprehensive consultancy service on parameters relevant to the laser process, field settings, calibration options and software programming. RAYLASE monitors the sensor market continuously and in great detail. RAYLASE is committed to developing and integrating future sensors if they are suitable for recording process parameters and match the quality required for the AM process and the component to be manufactured.

Finally, perhaps the most important question for machine manufacturers and integrators: How can the AM-MODULE NEXT GEN from RAYLASE be commissioned quickly and effectively?

"I actually have to answer this question regularly, and that is understandable", says Wolfgang Lehmann. "We see ourselves as a supplier of comprehensive AM solutions, and of course that includes this crucial phase. At RAYLASE we have developed a method by which our customers can automatically calibrate the deflection units them-

selves and with one another. Our long-term solution will enable our customers to perform fully automated calibration during the manufacturing process. In addition, with each initial delivery a commissioning package is agreed, which facilitates efficient commissioning

and provides the machine manufacturer with all the key information through an on-site training event so that every subsequent commissioning can be performed by trained on-site personnel. Additional training sessions can be agreed."

AM-MODULE NEXT GEN – COMPREHENSIVE SOLUTION



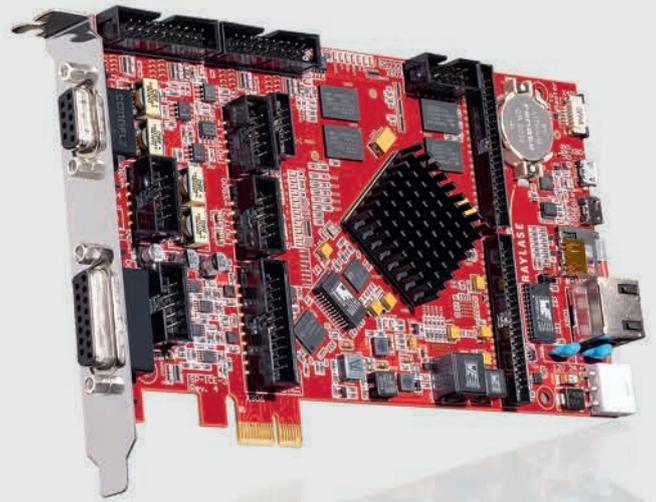
360° SOLUTIONS FOR SYSTEM INTEGRATION IN AM MACHINES

“For our customers and partners from the AM sector, we have always been more than ‘just’ a manufacturer of deflection units, control cards and software”, says Wolfgang Lehman on RAYLASE’s role in the industry. “From consultancy and commissioning to integration support for machine manufacturers and OEM through to issues such as calibration, monitoring, control and, of course, replacement and maintenance – as one of the innovation leaders in the field of laser applications we are in demand across the board – a role we are very comfortable with.”

For several years, RAYLASE has been showing off its AM innovations at formnext in Frankfurt/Main. After the successful premiere of the AM MODULE in 2016, the company exhibited the AM-MODULE NEXT GEN for the first time in 2017. An advanced digitalised version optimised based on customer feedback has been available since the first quarter of 2018. At formnext 2018, the company particularly focussed on its integrated solutions.

“Of course we want to present our technologies with the AM-MODULE NEXT GEN and the SP-ICE-3 control card, but above all we want to provide answers to the important questions posed by machine manufacturers, OEM and end users”, says Lehmann in conclusion. “What can RAYLASE do for me? What challenges can I solve as a machine manufacturer, OEM or end user? With the AM-MODULE NEXT GEN and associated services we are making advances in terms of the lack of suitability for industry production that I mentioned – namely long downtimes, frequent maintenance, lack of status communication and lack of inline quality control.

The AM solutions based on RAYLASE technology deliver increased productivity and therefore lower costs per component. In addition, machines no longer need to be individually certified for production of a component. This is how we are solving some of the problems that many machine manufacturers and end users see as their “biggest headaches” when it comes to suitability for industrial use.”



SP-ICE-3 control card

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