

- Automatic localization of workpieces
- Adaptation of the laser process to the part position and rotation
- Immediate quality inspection during and after the laser process
- Intuitive Click & Teach technology
- Marking-and-processing-On-The-Fly (MOTF) laser processing of moving workpieces

INTELLIGENT IMAGE PROCESSING FOR THE AUTOMATION AND MONITORING OF LASER PROCESSES

USER BENEFITS

RAYLASE Machine Vision Control (MVC) enhances laser processes by the valuable possibilities of modern Machine Vision. A well-adjusted system of industrial cameras, lenses, optical adapters, illuminations and intelligent image processing software simplify the development of industrial laser processes, reduces system costs and allow for the advanced control, monitoring, and in-line quality inspection.

RAYLASE MVC is capable to automatically recognize the position and rotation of a workpiece by recurring patterns or fiducials. In the design phase, these reference points can be taught with the detection software weldMARK® Vision fast and intuitively. RAYLASE MVC adapts the parameters of the laser process to the actual workpiece position even when it is continuously advancing on a conveyor belt. Right after the process, the same system verifies the success of the laser process.

Together with our world-class laser beam deflection units, our control cards and easy-to-use design software for laser processes as well as with the flexible TCP/IP interface to a master PLC, RAYLASE is offering a versatile toolbox of seamlessly interoperating modules - for the fast and easy automation and monitoring of industrial laser processes.

INNOVATION AND QUALITY

Innovation and maintaining high product quality standards are our priorities at RAYLASE. All our products are developed, built and tested in our own laboratories and production facilities. Through our world-wide support network we can offer best maintenance and rapid service for our customers.

MACHINE VISION CONTROL

FEATURES



- Automatic recognition of the position and rotation of the workpiece by using fiducials, reference marks or characteristic contours



- High-precision localization with accuracies starting from below 10 μm^1
- Intuitive Click & Teach technology based on the live camera image
 - Optimization of process position and layout with view to the workpiece
 - Creation and positioning of laser objects consisting of letters, numbers, codes, bezier- and poly lines
 - Automated object generation for weldMARK® 3 editor
 - Process simulation in the camera image and with pilot laser (if available)
 - Function Tiling for laser field scanning or scanning of parts of the field in order to generate an assembled image of the work piece



- Inherent drift compensation¹
- Recognition of different part types by Optical Character Recognition (OCR), bar codes or Data Matrix codes (ECC 200) (further on request).



- Please note that the optical character recognition (OCR) and the recognition of barcodes are only possible with the use of additional third-party software
- Automatic selection of the laser process and adjustment to the part type and position
- Automatic process monitoring and quality assurance by comparing target vs. actual results
- Support of laser beam power levels of up to 6 kW (On-Axis) or arbitrary power levels (Off-Axis)
- Modular system setup offers solutions for high-performance as well as cost-sensitive applications
- Marking-and-processing-On-The-Fly (MOTF) laser processing of moving workpieces

APPLICATIONS

- Marking and perforation of surfaces and packages, also in Marking-and-processing-On-The-Fly (MOTF) processes
- Cutting, drilling and welding with laser beam power levels of up to 6 kW (On-Axis) or any power level (Off-Axis)
- Additive manufacturing / 3D-printing
- Micro treatment; welding and drilling in the range of micrometers
- Processing of plastics, fabrics, glass, food products, carbon fiber composites, metals, diamond
- Process monitoring and optical quality inspection of workpieces

COMPONENTS

RAYLASE MVC packages comprise the following components:

- Industrial CCD- and CMOS-cameras with 0.5 MP to 5 MP resolution, GigE Vision compliant
- Camera lenses optimized for 640 nm or 850 nm¹
- On-Axis camera adapter with dichroic element for 355 nm to 1,070 nm laser wavelength, beam power of up to 500 W or up to 6 kW with high-power adapter
- F-Theta lens, 50 mm to 500 mm eff. focal length
- RAYLASE laser beam deflection unit
- Intuitive weldMARK® 3 control software for RAYLASE deflection units
- LED-illumination based on Bar-, flat- or ring-light modules, 640 nm or 850 nm; several lights enable a homogeneous intensity
- Illumination controller with 1, 2 or 4 channels and manual or USB control interface
- Industrial PC, compact (fan-less) or 19"-housing with TCP/IP interface to master PLC
- Control card SP-ICE-1 PCI PRO or SP-ICE-3 integrated in PC
- weldMARK® Vision image processing software
 - Differentiation of workpieces by geometric measurement and text or code reading
 - Recognition of the workpiece position and its rotation
 - Adjustment of the laser process to the type, position and rotation of the workpiece
 - Click & Teach functionality¹
 - Quality inspection
 - Interface to master PLC

¹ Only at On-Axis systems

CLICK&TEACH – LASER JOBS HAVE NEVER BEEN CREATED FASTER

CUSTOMER BENEFITS

Click&Teach offers additional workflow optimization. This new software from RAYLASE allows you to start the laser process sooner and to dispense with time-consuming, material-intensive "trial and error" iterations. In addition to being an ideal solution for accelerating the laser job setup process, the software can also be used to monitor and optimize this process. This makes it the ideal enhancement of RAYLASE's weldMARK® Vision machine vision software.

With Click&Teach, the deflection unit maps the laser job on-axis onto the workpiece that is to be processed. For this purpose, a camera scans a specific segment or the entire laser field and divides the generated image into individual sections known as tiles. The required laser process is projected onto the scanned image of the workpiece and can be adjusted and optimized as required. In addition, a previously saved laser job can easily be adjusted to the contours and position of the current workpiece. Live image mode

allows the laser job to be simulated with moving crosshairs and a pilot laser.

Thanks to on-axis monitoring, the Click&Teach function can also be executed with very short focal lengths and working distances. The high-resolution CCD or CMOS camera provided guarantees the highest-quality images. The software uses the integrated camera driver or, alternatively, can access the camera via weldMARK® Vision. The integrated lighting surface controls up to 4 RAYLASE lighting units and ensures high-contrast workpiece images with homogeneous illumination.

This new, highly efficient Click&Teach software allows laser jobs to be quickly set up, easily optimized and perfectly positioned.

TYPICAL FEATURES

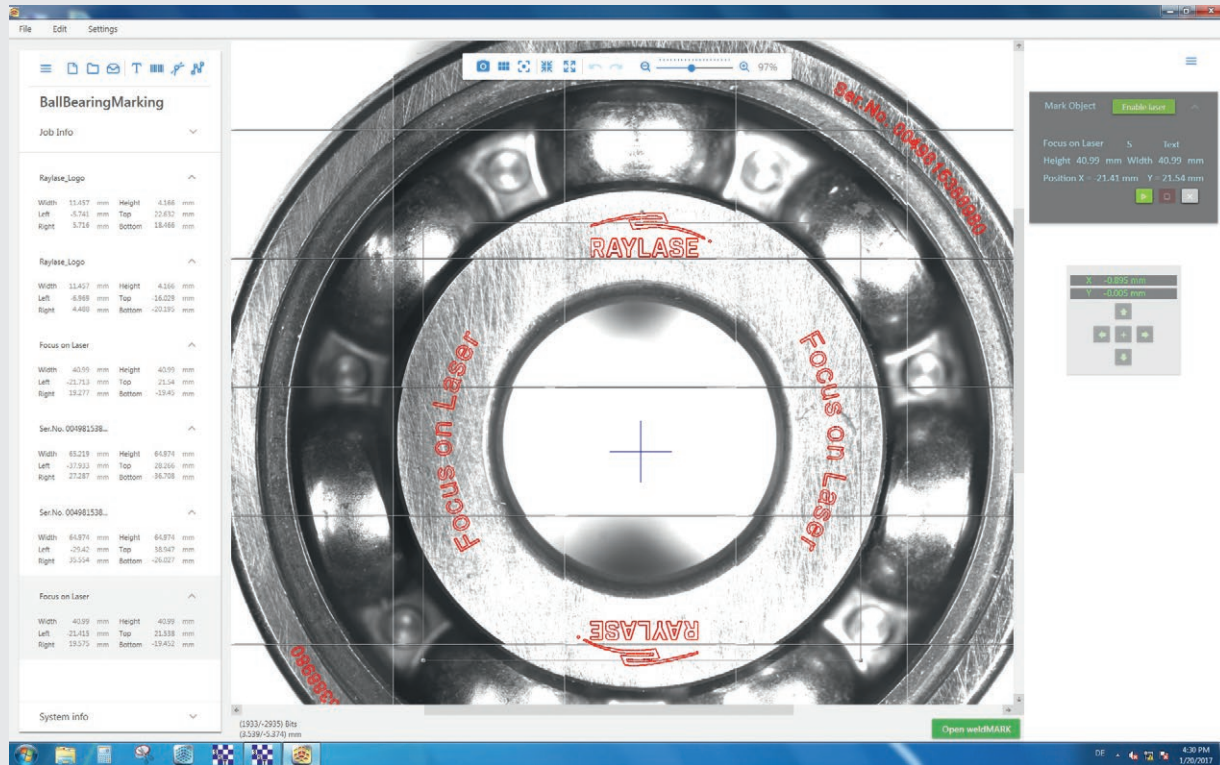
Before setting up and optimizing a laser job, the workpiece is scanned to create an image of the area to be processed or an image of the entire laser field using the "Tiling" function. Once this is done, you can

- Geometrically adjust and optimize existing laser jobs, projected onto the images of the workpieces
- Generate texts and barcodes on the tiled images of the workpieces
- Create marking, drilling, cutting and welding contours on the part's tiled image
- Simulate laser jobs in the live image of the workpieces with moving crosshairs and pilot laser (live-image mode)
- Document and archive the completed processes

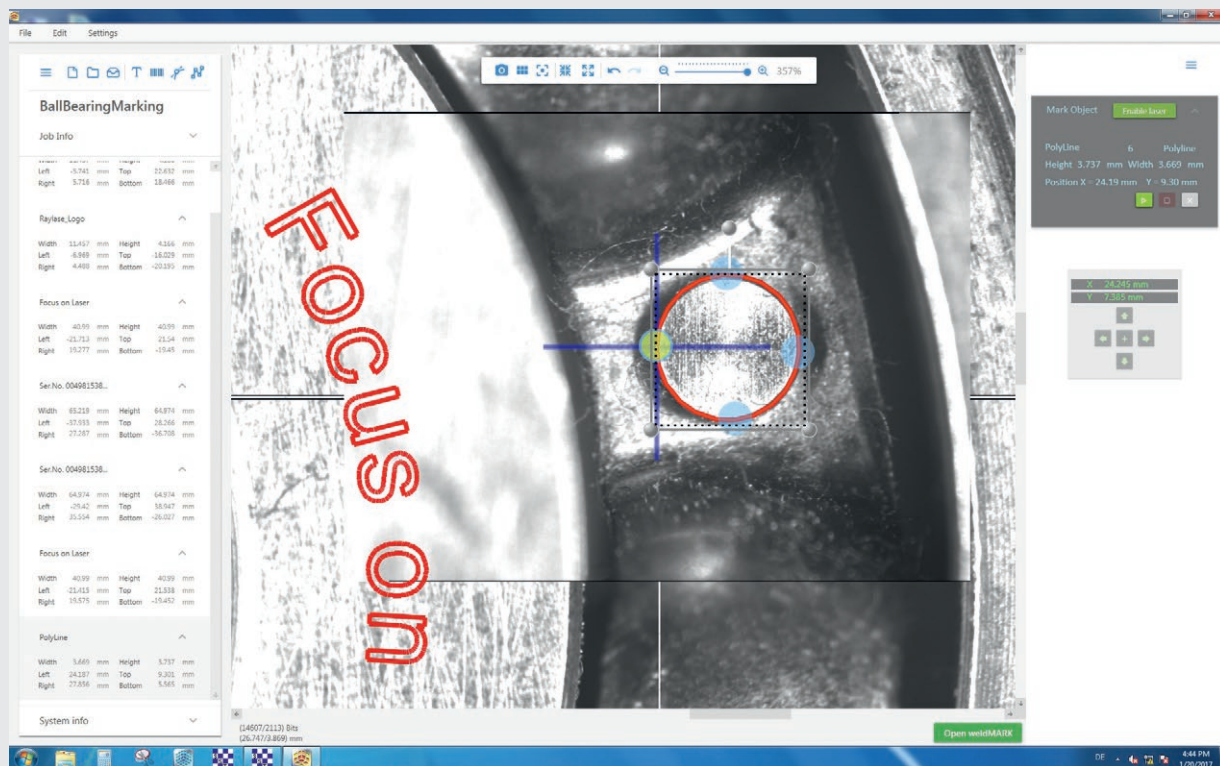
AREAS OF APPLICATION

- **Plastics welding:** Creating and modifying welding contours on new parts
- **Battery welding in the e-mobility market:** Precise positioning of welding contours on the contact surfaces that are to be joined
- **Welding, drilling and cutting:** for micrometer precision for e.g. Watch and jewelry sector
- **Job-shop:** Creating and positioning texts and markings
- **All applications** that require you to **set up a high-precision laser** job for the workpiece

IMAGE EXAMPLES CLICK&TEACH



Marker texts positioned on the ball bearing



Polyline generation, e.g. for welding tasks, in the high-resolution workpiece image

PRODUCT VARIANTS

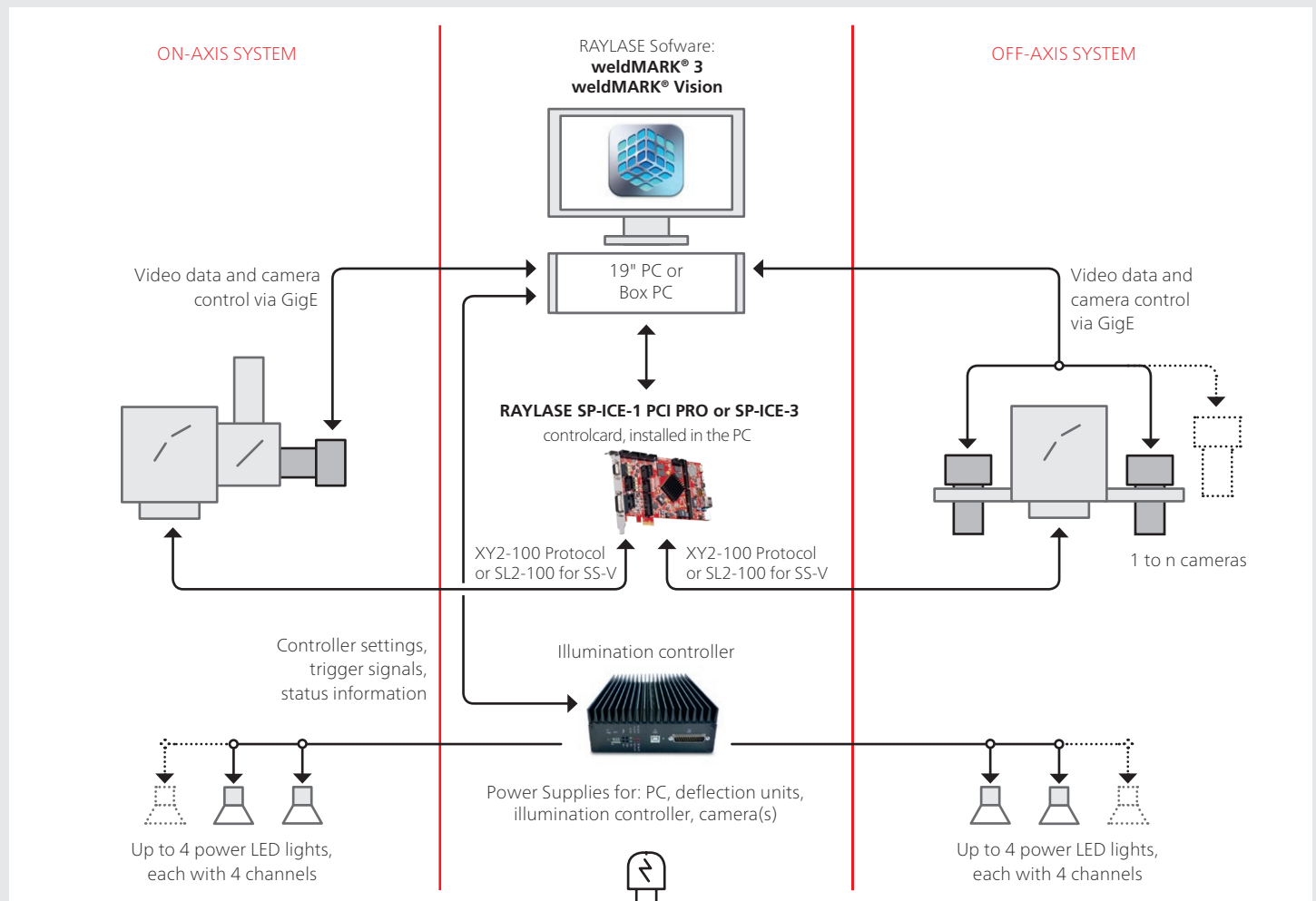
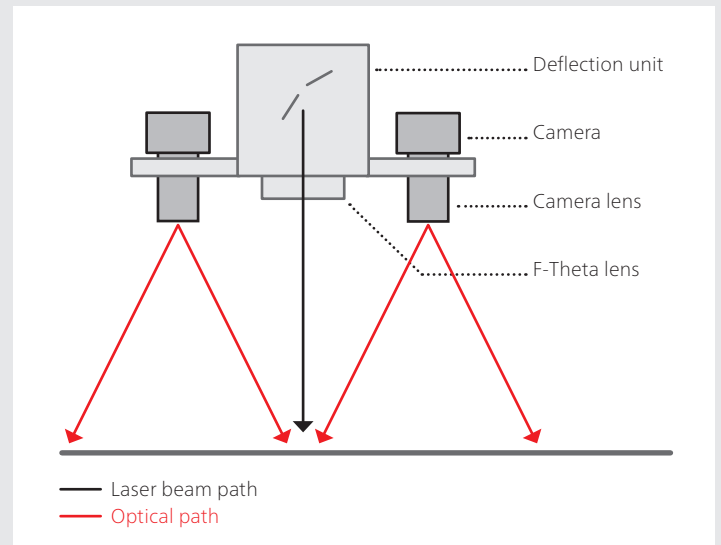
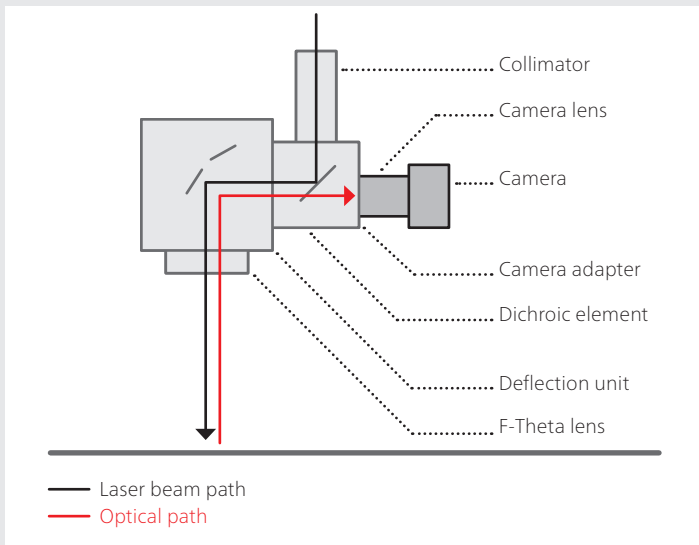
RAYLASE is one of the first providers of On-Axis and Off-Axis solutions for camera based process monitoring:

ON-AXIS SYSTEM SETUP

The camera observes the part through a dichroic element, over the mirrors of the deflection unit and through the F-Theta lens.

OFF-AXIS SYSTEM SETUP

The camera or several cameras observe the part through a standard camera lens from besides the deflection unit.



BENEFITS AND LIMITATIONS

ON-AXIS

- All working distances, also at $f\theta < 163$ mm
- High-precision ($< 10 \mu\text{m}$)
- Inherent drift compensation
- Reference marks must be in the laser field
- Laser beam power up to 6 kW
- Different refraction indices for different wavelengths of the laser and the visual light are compensated in x-y plane

OFF-AXIS

- Integrated workpiece localization and quality inspection for working distances from 150 mm, i.e. $f\theta \geq 163$ mm
- Large working field sizes feasible
- Marking-and-processing-On-The-Fly (MOTF) processing available
- Geometric calibration of cameras and laser field required
- No inherent drift compensation

MACHINE VISION CONTROL PACKAGES

RAYLASE MVC is available in the following ON-AXIS default configurations. Multiple further configurations (also OFF-AXIS) are available on request. We would be happy to provide a customized configuration for your application tailored to your requirements.

RAYLASE MVC ON-AXIS SERIES (MVC-ONA)					
	MW-50	MA-100	MP-160	MP-254	PW-500
Laser application	Micro welding	High-precision marking	Multi-purpose	Multi-purpose	High-power welding
Vision application	for small contour detection	for detection of reference marks or small contours	for detection of contours in small working fields	for detection of contours in medium working fields	for detection of contours in large working fields
Deflection unit	SUPERSCAN IIE / IV / V	MINISCAN II	SUPERSCAN IIE / IV / V	SUPERSCAN IIE / IV / V	SUPERSCAN IIE / IV
Standard wavelengths [nm]	1,064 532 355	1,064 532 355	1,064 532 355	1,064 532 355	1,020 – 1,040 1,060 – 1,090
Aperture [mm]	20	10	15	15	30
Effective focal length F-Theta objective [mm]	60	100	163	254	500
Working field [mm x mm]	7 x 7	61 x 61	86 x 86	166 x 166	205 x 205
Spot size [$M^2=1$, $1/e^2$]	8.0	19.4	21.2	32.9	63.6
Maximum laser power [W]	300	150	500	500	8,000 (75% Duty-cycle)
CMOS Camera chip size 1/1.2" monochr., 2.35 Megapixel	included	included	included	included	included
Camera field of view (FOV) [mm x mm]	approx. 6.0 x 3.8	approx. 11.0 x 6.9	approx. 17.0 x 10.7	approx. 27.0 x 17.5	approx. 55.0 x 34.5 ¹
Max. field resolution of camera FOV	5.9	5.9	8.8	14.0	28.5
LED-illumination with Controller	1 Bar Light 040	2 Bar Light 040	2 Flat Light 107 ²	4 Bar Light 200 ²	4 Bar Light 200 ²

¹ Aperture depending shadowing at corners possible. ² Also appropriate for working field illumination in case of Click&Teach applications.

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