FOCUSSHIFTER RD-14

RAYLASE

3D MARKING – ENGRAVING – GLASS DRILLING & CUTTING

EFFICIENT PROCESSING OF DIFFERENT SURFACE HEIGHTS

The combination of f-theta lens and deflection unit is an **ideal solution for many marking and engraving applications.** After all, for small and medium-sized working fields, it offers **small focus diameters** and good flat field correction with **low spot variations.**

However, the workpieces are not always flat. Especially when cleaning components from paint, oxide layers or oil, cutting flexible printed circuit boards or marking, it is important to **follow the contour of the component** in order to achieve the desired processing result. It is also important to **correct the focus position during the process** when deep engraving or drilling and cutting glass.

For these applications, the FOCUSSHIFTER RD-14 is the right choice. It adds an adjustable lens system to the combination of f-theta lens and deflection unit, allowing the **z-position of the focus to be set dynamically.** As a result, **layer-by-layer processing (2.5D) as well as processing in space (3D)** are both possible. Thanks to its **extremely compact design** and **versatile mounting options,** it can be flexibly integrated into laser systems.

The FOCUSSHIFTER RD-14 therefore offers system integrators an attractive solution for extending laser systems to three-dimensional workpieces. And thanks to the f-theta lens, the FOCUSSHIFTER RD-14 performs particularly well when processing workpieces with different height levels.

Highest dynamics

Stable focus position

Versatile use

www.raylase.com

3D LASER PROCESSING WITH DYNAMIC FOCUS ADJUSTMENT

The FOCUSSHIFTER RD-14 is a **3D deflection** unit that is especially valuable at low laser powers and in small and medium-sized processing fields. It uses a **flat field correction using an f-theta lens** and also offers **highly dynamic adjustment of the z-position** of the focus. Thanks to its compact housing and multiple mounting options, the FOCUSSHIFTER RD-14 fits into almost any laser system, making it the **ideal solution for processing in 2.5D.**

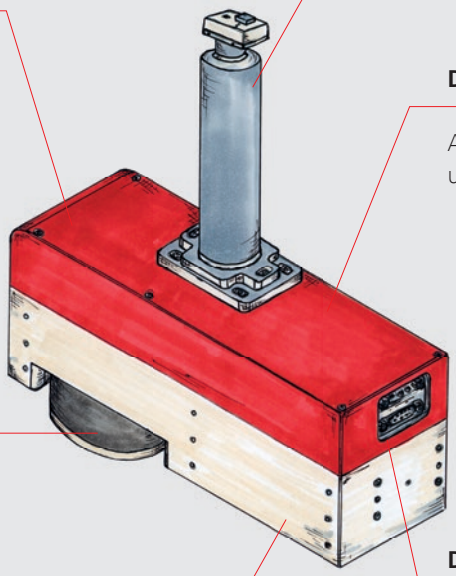
See for yourself:

OPTIONAL:
MACHINE VISION CONTROL (MVC)

Enables an "on-axis" vision solution, e.g. for automatic component alignment and process documentation

Compact housing with multiple mounting options

Enables optimum integration into almost any laser system



Dust-proof housing (IP64)

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

Suitable f-theta lenses

enable small spot variations when processing in the plane. With telecentric lenses even minimal angles of incidence are possible.

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

Highly dynamic z-focusing with RAYVOLUTION DRIVE technology

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

LASER DRILLING AND CUTTING OF GLASS

When **drilling or cutting through thicker layers of glass,** a fixed z-height often results in a defocused laser spot. The result is inaccurate drilling depths, and uneven hole walls that both compromise the accuracy and quality of the finished glass. Technical experts in glass processing therefore need **a solution that guarantees a consistent focus for every drilling or cutting process,** ensuring high precision and minimal material stress even with different glass thicknesses.

The FOCUSSHIFTER RD-14 meets these requirements with its **dynamically adjustable optical z-axis.** Thanks to RAYVOLUTION DRIVE technology, it enables **real-time focus adjustment** during the process. This ensures that the laser remains **optimally focused at the correct depth,** leading to precise, clean and consistent drilling results. The use of an f-theta lens in the FOCUSSHIFTER RD-14 also enables **minimal spot variations across the working field** and uniform, constant angles of incidence through telecentric lenses.

With the FOCUSSHIFTER RD-14, users can achieve outstanding processing accuracy and quality, which increases efficiency and reduces waste during glass processing.

Laser processing of glass. Thanks to the contact-free material ablation, even fragile materials can be processed with the laser. The adjustment of the focus position in the z-direction enables optimum focusing even with thicker glass and thus ensures a precise drilling or cutting result.

3D LASER MARKING AND ENGRAVING

Marking and engraving on 3D surfaces. The dynamic z-axis of the FOCUSSHIFTER RD-14 enables optimum focusing during the marking process. As a result, QR codes and markings remain clearly readable even on uneven surfaces. (Source: Laserax)

When **marking and engraving workpieces with complex geometries,** a uniform focus across different contours and surfaces is a challenge. Without an adjustable z-height, the laser can lose focus when passing over uneven or 3D surfaces. This leads to inconsistent engraving depths, blurred markings and possible damage to the workpiece. The lack of precision is particularly problematic with complicated designs or when a high level of detail is required. Therefore, engineers in this field need **a solution that maintains a constant, precise focus and adapts seamlessly to the complex geometries of the workpieces.**

The dynamically adjustable optical z-axis of the FOCUSSHIFTER RD-14 enables **rapid focus adjustment almost in real time** and ensures that the laser remains optimally **focused on every contour and angle of the workpiece.** This results in sharp, uniform engravings and markings, regardless of the complexity of the surface.

The FOCUSSHIFTER RD-14 enables you to achieve maximum efficiency and quality when engraving and marking, even with geometrically complex workpieces.

PROCESS AUTOMATION WITH MACHINE VISION CONTROL (MVC)

Part alignment is a critical step in the manufacturing process that frequently requires manual intervention and may take a lot of time. **The same applies to quality control** of the machined parts. Hence, these tasks can quickly limit the scalability of series production.

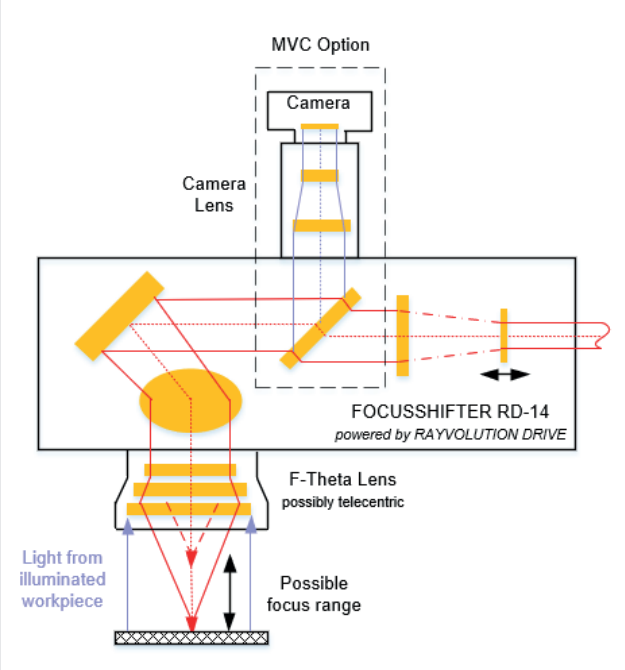
Therefore, we offer our MACHINE VISION CONTROL (MVC) as **the basis for an automated system.** The MVC are **matched vision components** that enable an optimal solution for your process optimization and process monitoring. The MVC includes the following hardware components:

- On-axis camera adapter for laser wavelengths of 355 nm, 532 nm or 1,070 nm
- Industrial CMOS cameras with 5 MP resolution, GigE Vision compliant
- Camera lenses optimized for 640 nm illumination
- LED illumination based on flat or ring light modules for 640 nm including illumination controller for control via GigE.

User-friendly vision plug-ins for our RAYGUDE laser process software complement the optical hardware. Thanks to the plug-ins RAYGUIDE CLICK&TEACH and RAYGUIDE MATCH, it is **much easier to recognize the position of the workpiece and adapt the movement of the deflection unit accordingly.** This offers a wide range of adjustments and automations:

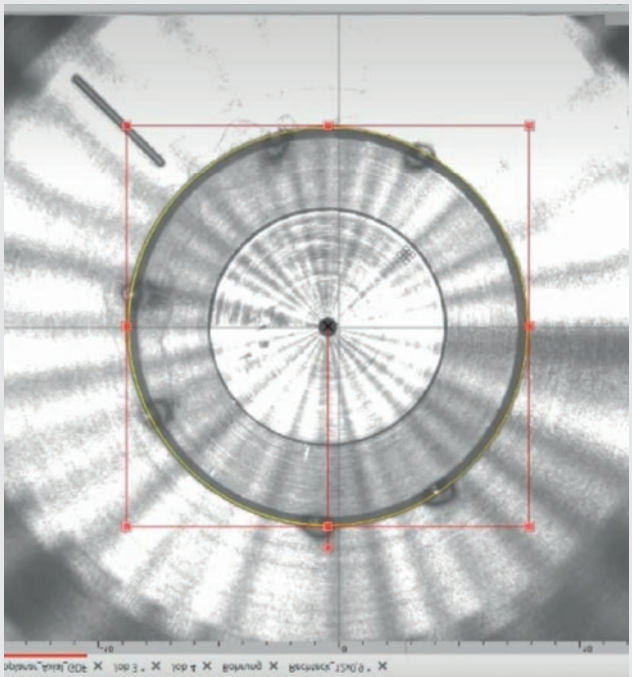
- Geometric adaptation and optimization of existing laser jobs to the workpiece
- Generate texts and barcodes on the workpiece
- Create marking, drilling, cutting and welding contours on the workpiece
- Simulate laser jobs in the live image with moving crosshairs and pilot laser
- Document and archive the executed processes
- Teaching in references and geometries for automatic and correct positioning of the laser process

ON-AXIS MACHINE VISION SETUP



The observation light from the component is collected by the f-theta lens. After the scanning mirrors, it is reflected by a dichroic element onto the camera lens and the camera.

POSITIONING WITH RAYGUDIE CLICK&TEACH



With MACHINE VISION CONTROL (MVC), the laser jobs can be adapted and positioned directly on the component. The MVC is also ideal for automated quality inspection.

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 successful 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
	Riple / Noise @ 20 MHz bandwith [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**	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 RL3-100 / SL2-100 20-Bit [µrad]		0.76
Repeatability (RMS) [µrad]		< 2.0
Positioning noise (RMS) [µrad]		< 4.5
Temperature drift	**Max. Gaindrift [ppm/K]**	15
	Max. Offsetdrift [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		**FOCUSSHIFTER RD-14**
Limiting input aperture [mm]		5.0
Beam displacement [mm]		17.0
Optimum input beam diameter	**full beam [mm]**	4.7
	1/e² [mm]	3.1
Weight (without f-theta lens) [kg] [1]		5.5
Dimensions without electrical connectors (L x W x H) [mm]		330.0 x 105.0 x 134.0

[1] MVC = Machine Vision Control / camera observation

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
Cleaning tuning (C)	Optimized tuning for long vectors and maximum speeds

TYPE DEPENDENT SPECIFICATIONS – DYNAMIC DATA

Deflection unit	FOCUSSHIFTER RD-14 SI		FOCUSSHIFTER RD-14 QU	
Tuning	MA	VC	MA	C
Writing speed [cps] with high/good writing quality [1, 2]	650 / 800	-	-	-
Processing speed [rad/s] [3]	30	50	30	100
Positioning speed [rad/s] [3]	90	50	90	100
Tracking error [ms]	0.16	0.20	0.17	0.30
Acceleration time approx. [ms]	0.30	0.46	0.30	0.60
Step response time at 1% of full scale [ms]	0.36 [4]	0.68 [5]	0.36 [4]	0.69 [5]
Tracking error focusing unit [ms]	0.9		0.9	
Speed of moving lens [mm/s]	900		900	

[1] With f-theta Lens f = 163 mm / processing field size 120 mm x 120 mm [2] Single-stroke font height 1 mm, single line. [3] See "Calculation of speed".
[4] Setting to 1/1,000 of full scale [5] Setting to 1/5,000 of full scale

Calculation of speed:

Speed in processing field = focal length f-theta lens x processing speed
Example: FOCUSSHIFTER RD-14 with f-theta lens f = 163 mm, MA-Tuning, processing speed 30 rad/s,
v = 163 / 1,000 x 30 = 4.8 m/s

Mirrors and lenses:

Deflection mirrors and f-theta lenses with optimized mounts are available for many laser types, wavelengths, power densities, focal lengths and processing fields. Customized specific configurations are also possible.
For more information on possible combinations, please contact the RAYLASE support team at +49 8153 9999-699 or support@raylase.de.

OPTICS SPECIFICATIONS

Wavelength and coatings	Mirror substrate	Maximum permissible laser power [W] [1]
355 nm	SI	100 / 20 (MVC)
532 nm	SI	200
1,064 nm	SI	300
1,070 nm	QU	1,000

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

CONFIGURATION EXAMPLES – FOCUSSHIFTER RD-14

Wavelength [nm]	355		532	
Effective focal length (EFL) [mm]	163	254	163	254
Spot diameter 1/e² [µm] [1]	8.7	13.6	13.0	20.3
Free focus range [mm]	-16.0 to +14.0	-41.0 to +32.0	-16.0 to +14.0	-41.0 to +32.0

Wavelength [nm]	1,064 / 1,070	
Effective focal length (EFL) [mm]	163	254
Spot diameter 1/e² [µm] [1]	26.1	40.7
Free focus range [mm]	-16.0 to +14.0	-41.0 to +32.0

[1] Beam quality $M^2 = 1$

OPTION MACHINE VISION CONTROL (MVC):

Using the "Machine Vision Control (MVC)" option, a camera lens and a CMOS camera can be connected to the FOCUSSHIFTER RD-14 for "on-axis" process monitoring. Using dedicated RAYGUIDE software components, image processing can be implemented for process monitoring and control.

PROCESS-MONITORING

	FOCUSSHIFTER RD-14 MVC
Illumination wavelength and bandpass filter [nm]	640
Mechanical interface (thread)	M36 x 1

EXAMPLE SPECIFICATIONS FOR CAMERA MONITORING USING MVC [1]

Focal length of the f-theta lens	Physical resolution [µm]	Image field size [mm x mm]
163 mm	10.6	13.6 x 11.3
254 mm	16.6	21.3 x 17.7

[1] Specifications apply to the RAYLASE camera lens Art. no. 03334

OTHER SUITABLE ACCESSORIES

RAYGUIDE

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 of scanner and sensor signals.

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