

# FOCUSHIFTER DIGITAL II

FOCUSSHIFTING DEFLECTION UNIT

FOR CHALLENGING INDUSTRIAL APPLICATIONS

**DIGITAL  
CONTROL**



- For easy, variable adjustment of focal height relative to the workpiece surface
- Control via SL2-100 protocol 20 bit or XY2-100 protocol
- Digitally controlled high-speed Z-axis
- Greatly reduced power loss and minimal heat development thanks to digital PWM output stages
- Modular design for deflection units with 10 mm (TY) and 15 mm apertures

## FLEXIBLE DEEP PROCESSING WITH THE SMALLEST SPOT SIZES

### YOUR BENEFITS

The FOCUSHIFTER DIGITAL II deflection unit enables small spot sizes with flexible software-controlled focusing in the Z direction, high deflection speed, long-term stability and exceptionally low drift values at 20 bit position resolution. Thanks to its modular, pre-adjusted, compact and robust design, it is perfect for easy and cost-effective integration into specialized applications. Heat development is minimized as a result of the PWM output stages used.

### CONFIGURABLE THROUGH AND THROUGH

Lenses, protective glass, mirror substrates and coatings are available for all standard laser types, wavelengths, light densities, focal lengths and processing areas. This makes it possible to process a wide range of tasks to the highest quality standards and with optimized throughput. Using telecentric F-Theta lenses enables an almost vertical processing beam over the entire field. We would be happy to provide a customized configuration for your application.

### TYPICAL APPLICATIONS

Deep cutting, deep engraving, deep material processing in general, the creation of 3D images in glass blocks, as well as marking and structuring at various heights on a workpiece.

### INTERFACES

Deflection units are compatible with both XY2-100 (16 bit) and SL2-100 (20 bit). The units are controlled digitally using a control card, such as SP-ICE-3 or SP-ICE-1 PCIe PRO.

### 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.

# FOCUSHIFTER DIGITAL II

## GENERAL SPECIFICATIONS

Power supply	Voltage	+30 V or +48 V
	Current	4 A, RMS, max. 8 A
	Ripple/Noise	Max. 200 mVpp, @ 20 MHz bandwidth
Ambient temperature	+15 °C to +35 °C	
Storage temperature	-10 °C to +60 °C	
Humidity	≤ 80 % non-condensing	
IP Code	54	

Interface signals	Digital	XY2-100-Enhanced protocol SL2-100 protocol
Resolution XY2-100-E 16-Bit		12 µrad
Resolution SL2-100 20-Bit		0.76 µrad
Tracking error LT-II-F		1.3 ms
Processing speed focus lens		880 mm/s

## TYPE DEPENDENT SPECIFICATIONS – DEFLECTION UNITS

Deflection Unit	SS-IV-10 SI [TY]	SS-IV-15 QU	SS-IV-15 SI	SS-IV-15 SC	SS-V-15 QU	SS-V-15 SC				
<b>Mechanical data:</b>										
Input aperture [mm]	10	15								
Weight [kg]	approx. 3.2									
Dimension (L x W x H) [mm]	170.0 x 125.0 x 117.5									
Beam displacement [mm]	12.5	18.1	18.1	18.0	18.33	18.27				
<b>Galvanometer scanner – specification:</b>										
Typical deflection [rad]	±0.393									
Repeatability RMS [µrad]	< 2.0				< 0.4					
Position noise (RMS) [µrad]	< 4.5				< 2.0					
Max. Gain drift [ppm/K] <sup>1</sup>	15				8					
Max. Offset drift [µrad/K] <sup>1</sup>	10				15					
Long-term drift 8 h without water tempering [µrad] <sup>1</sup>	< 60				< 50					
Long-term drift 8 h with water tempering [µrad] <sup>1,2</sup>	< 40				< 30					
<b>Dynamic data:</b>										
Tuning	VC	M	VC	W	VC	VC	W	H	M	
Processing speed [rad/s] <sup>3</sup>	50 @ 30V 80 @ 48V	30 @ 30V 30 @ 48V	45 @ 30V 50 @ 48V	- @ 30V 200 @ 48V	50 @ 30V 65 @ 48V	55 @ 30V 75 @ 48V	- @ 30V 200 @ 48V	30 @ 30V 30 @ 48V	30 @ 30V 30 @ 48V	
Positioning speed [rad/s] <sup>3</sup>	50 @ 30V 80 @ 48V	30 @ 30V 30 @ 48V	45 @ 30V 50 @ 48V	- @ 30V 200 @ 48V	50 @ 30V 65 @ 48V	55 @ 30V 75 @ 48V	- @ 30V 200 @ 48V	30 @ 30V 30 @ 48V	30 @ 30V 30 @ 48V	
Tracking error [ms]	0.12 <sup>4</sup>	0.10 <sup>9</sup>	0.19 <sup>4</sup>	0.30 <sup>5</sup>	0.16 <sup>4</sup>	0.14 <sup>4</sup>	0.20 <sup>6</sup>	0.12 <sup>4</sup>	0.18 <sup>7</sup>	0.14 <sup>4</sup>
Step response time at 1% of full scale [ms] <sup>8</sup>	0.33	0.41	0.49	0.65	0.43	0.37	0.50	0.47	0.55	0.45

<sup>1</sup> Angles optical. Drift per axis, after 30 min warm-up, at constant ambient temperature and process stress.

<sup>2</sup> After 30 min warm-up, under varying process loads, with water temperature control set for ≥ 2 l/min and 22 °C water temperature.

<sup>3</sup> See "Calculation of speed".

<sup>4</sup> Calculation acceleration time approx. 1.9 x tracking error.

<sup>5</sup> Calculation acceleration time approx. 2.3 x tracking error.

<sup>6</sup> Calculation acceleration time approx. 2.4 x tracking error.

<sup>7</sup> Calculation acceleration time approx. 1.7 x tracking error.

<sup>8</sup> Setting to 1/5,000 of full scale.

<sup>9</sup> Calculation acceleration time approx. 1.8 x tracking error.

### Calculation of speed

Speed in processing field = Focal length F-Theta lens x Positioning speed:

Example: deflection unit with F-Theta lens f = 254 mm, Positioning speed 40 rad/s.  $v = 254/1,000 \times 40 = 10.1$  m/s

## TYPE-DEPENDENT SPECIFICATIONS – TUNING

Tuning	Description
Vector tuning (VC)	Optimized tuning for a wide range of applications with emphasis on processing speed
Wafer tuning (W)	Optimized tuning for long vectors at highest speeds and precise beam deflection
Hatching (H)	Optimized tuning for high precision beam deflection and fastest beam direction change during hatching
Microstructuring (M)	Optimized tuning for high precision beam deflection with sharp corners and minimized tracking error

**Mirrors and Lenses:** Scan mirrors and objectives with optimized mounts are available for all typical laser types, wavelengths, power densities, focal lengths and working fields. Customer specific configurations are also possible. Please contact the RAYLASE support team for specific information and possible combinations on +49 8153 9999 699 or support@raylase.de.

### Options:

The SUPERSCAN deflection units provide water temperature control (W) for the electronic components and galvanometer scanners. This ensures constant working conditions and excellent long-term stability, thus guaranteeing reliable operation even in high power laser applications.

The SUPERSCAN deflection units can also be operated without temperature control (N). In consequence the drift values may increase.



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**WATER TEMPERATURE CONTROL**

Specifications	
Water <sup>1</sup>	Clean tap water with additives
Temperature	22°C – 28°C
Max. water pressure	< 3 bar

Flow rate	Pressure drop
2 l/min	0.4 bar
4 l/min	0.8 bar
6 l/min	1.2 bar

<sup>1</sup> **Caution:** When using cooling water, even if it is deionized 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 (Additiv)

**Food & beverage, packaging applications:** Polypropylene glycol of company Dow Chemical, e.g. DOWCAL N

**TYPE DEPENDENT SPECIFICATIONS – LINEAR TRANSLATOR MODULE**

Lineartranslatormodul	LT-II-F2-05 [TY]	LT-II-F3-05 [DY] V4	LT-II-F3-05 [Y] V4	LT-II-F1.5-10 [C]
<b>Mechanical data:</b>				
Weight [kg]	approx. 5.3			
Dimension (L x W x H) [mm]	202.0 x 159.0 x 150.0			
Lens travel [mm]	11			
Wavelength [nm]	355	532	1,064	10,600
Input aperture [mm]	5	5	5	10
Beam expansion factor	2	3	3	1.5
<b>Configuration examples:</b>				
Field size [mm x mm] <sup>1</sup>	approx. 67 x 67	approx. 75 x 75	approx. 66 x 66	approx. 145 x 145
Working distance [mm] <sup>2</sup>	345 ± focus range	228 ± focus range	222 ± focus range	264 ± focus range
Spotdiameter 1/e <sup>2</sup> [µm] <sup>3</sup>	12	12	24	360
Focus range [mm]	±19.0	±17.0	±16.0	±9.0
Max. laser power, cw [W]	100	500	1,000	500

<sup>1</sup> F-Theta lens [TY, DY, Y]; focal length f = 160 mm; F-Theta lens [C] focal length = 250 mm.

<sup>2</sup> From the bottom edge of deflection unit to the processing field.

<sup>3</sup> Input beam quality: M<sup>2</sup> = 1.0.

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