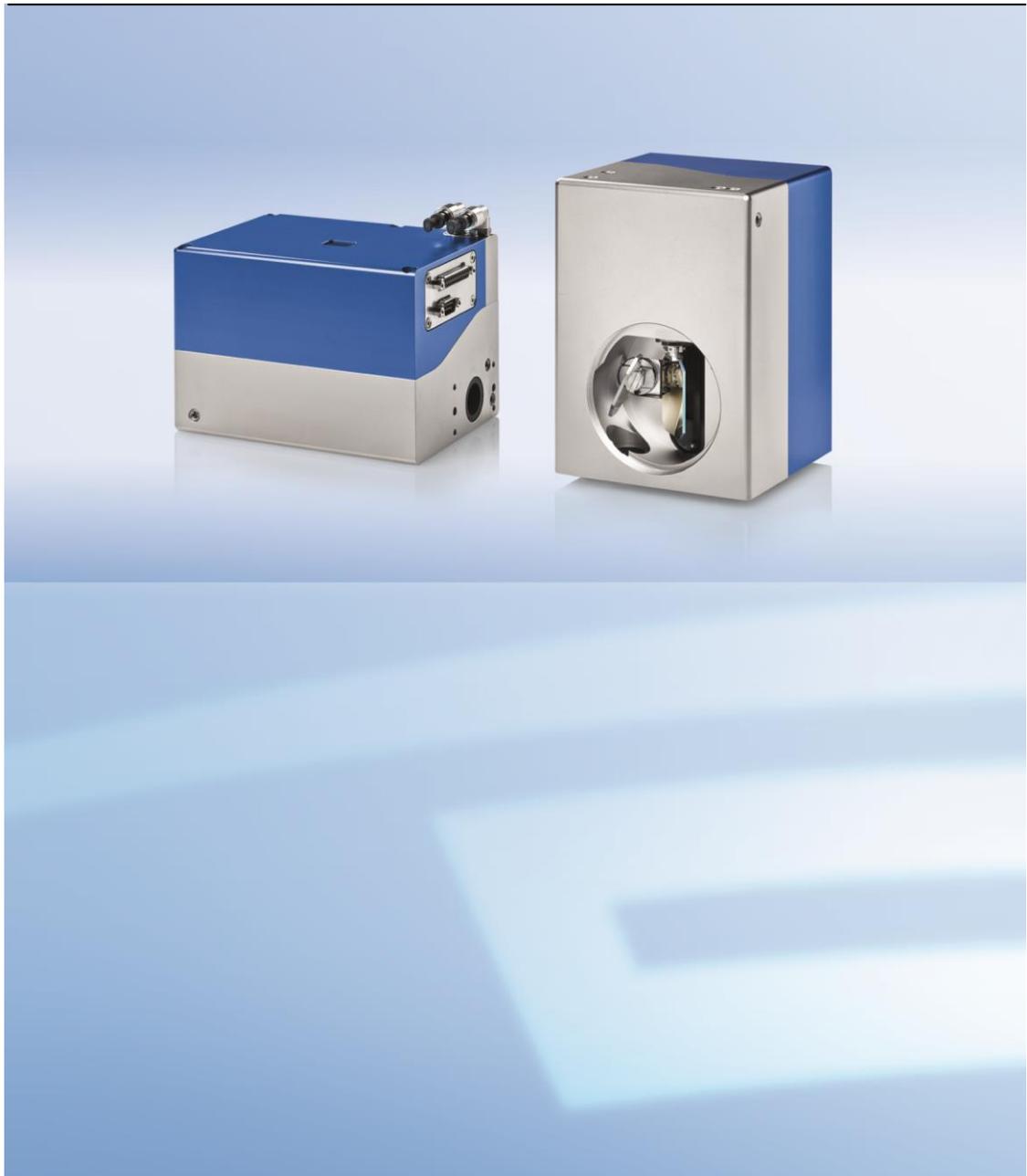


2-Axis Laser Beam Deflection Units

SUPERSCAN IIE



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CONTENTS

1	BASIC SAFETY INSTRUCTIONS	4
1.1	Laser safety.....	4
1.2	Laser shutter.....	4
1.3	Signs.....	5
1.4	Classification of laser devices	6
1.5	Laser area	7
1.6	Special hazards caused by mirrors made of beryllium	8
1.7	Special hazards caused by lenses made of zinc selenide	8
2	BASIC INFORMATION	9
2.1	Introduction.....	9
2.2	Intended use.....	9
2.3	Package contents	9
2.4	Module overview	10
2.5	Mechanical variants.....	11
2.6	Warranty	11
2.7	Manufacturer	11
2.8	Customer support.....	12
2.9	Status LEDs.....	12
3	TECHNICAL DATA	13
3.1	Rating plate code	13
3.1.1	Primary Name	13
3.1.2	Detailed Description	14
3.2	Conformity with directives	14
4	FUNCTIONAL DESCRIPTION	15
4.1	Laser beam deflection unit	15
4.2	F-Theta lens	16
4.3	Digital interface.....	17
4.4	Power supply	18
5	INSTALLATION	19
5.1	Requirements to the cooling water.....	20
5.2	Requirements to the cooling air.....	20
6	MAINTENANCE AND CLEANING	21
6.1	Cleaning the housing.....	21
6.2	Cleaning the optical system	21
6.2.1	Instructions for cleaning lenses and protective glasses.....	22
6.2.2	Instructions for cleaning mirrors	22
6.2.3	Special notes for mirrors made of beryllium and lenses made of zinc selenide	23
6.3	Replace protective glass	24
7	TROUBLESHOOTING	25
8	DISPOSAL	26

1 BASIC SAFETY INSTRUCTIONS

1.1 Laser safety

The user is responsible for safe operation and for safeguarding the surrounding area against hazards that can be caused by laser radiation. OEM customers must ensure compliance with all local and national regulations.

1.2 Laser shutter

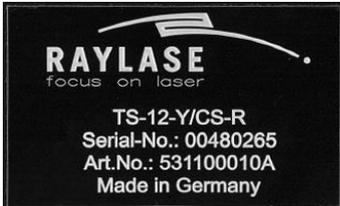
The deflection unit is designed to deflect an input laser beam and output it again.

The deflection unit cannot block or weaken the laser beam. To prevent unwanted emission of the laser beam, above a particular danger class the laser device must be fitted with a shutter (⇒ page 6, Classification of laser devices).

The laser device must be of sufficient quality that the laser beam can only be emitted at the beam output on the deflection unit.

1.3 Signs

The following signs must be attached to the subsystem. These signs may not be removed. Signs that have become illegible must be replaced.



Rating plate

The **rating plate** and the identification code printed on it allow the determination of the deflection unit type (⇒ page 13, Rating plate code). The serial number and the item number are also used to identify the deflection unit.



The **CE symbol** confirms the deflection unit's compliance with European directives. It indicates that the deflection unit is approved for free trade within the EU.



The **seal label** warns against unauthorized opening of the deflection unit. If the seal is broken, all warranty claims against RAYLASE are void.



At the point where laser radiation is emitted, a **laser warning sign** must be attached. It provides information about the type of radiation, specific hazards and the degree of protection. The laser warning sign is attached by the OEM customer in accordance to the laser device's classification (⇒ page 6, Classification of laser devices).



In the high-speed versions of the subsystem the mirrors are made from beryllium. The rating plate indicates if this applies to the present deflection unit (⇒ page 14, Detailed Description). In addition, these deflection units are provided with the adjacent sign. Also note ⇒ page 8, Special hazards caused by mirrors made of beryllium.



Lenses for CO₂ laser deflection units with linear translator modules are made of zinc selenide. The rating plate indicates if this applies to the present deflection unit (⇒ page 14, Detailed Description). In addition, these deflection units are provided with the adjacent sign. Also note ⇒ page 8, Special hazards caused by lenses made of zinc selenide.

1.4 Classification of laser devices

The deflection unit can be fitted on various laser devices. Every laser device is assigned to a particular danger class, which must be specified at the point where laser radiation is emitted, e.g. using a warning sign. The following classifications are defined in DIN EN 60825-1:

Class	Description
1	The accessible laser radiation is not dangerous under reasonable foreseeable conditions.
1M	The accessible laser radiation is in the wavelength range of 302.5 to 4,000nm. The accessible laser radiation is not dangerous to the eyes, as long as the cross-section is not reduced by optical instruments (magnifying glasses, lenses, telescopes).
2	The accessible laser radiation is in the visible spectrum (400 to 700nm). Short-term exposure (up to 0.25s) is not dangerous to the eyes. Additional radiation components outside the wavelength range from 400-700 nm meet the requirements for class 1.
2M	The accessible laser radiation is in the visible spectrum from 400 to 700nm. Short-term exposure (up to 0.25s) is not dangerous to the eyes, as long as the cross-section is not reduced by optical instruments (magnifying glasses, lenses, telescopes). Additional radiation components outside the wavelength range from 400-700nm meet the requirements for class 1M.
3R	The accessible laser radiation is in a wavelength range of 302.5 to 10,600nm and is dangerous to the eyes. The power or energy is a maximum of five times the limit for permissible class 2 radiation in the wavelength range from 400 to 700nm.
3B	The accessible laser radiation is dangerous to the eyes and frequently to the skin.
4	The accessible laser radiation is extremely dangerous to the eyes and dangerous to the skin. Even diffuse scattered radiation can be dangerous. The laser radiation can cause fires or a risk of explosion.

Note: Bear in mind that the deflection unit changes the position at which the beam is emitted and the new beam output must be marked with a warning sign showing the appropriate classification.

Note: The deflection unit can change the classification of the laser device, particularly if it is fitted with a focusing lens. The laser device may require additional protective equipment as a result.

1.5 Laser area

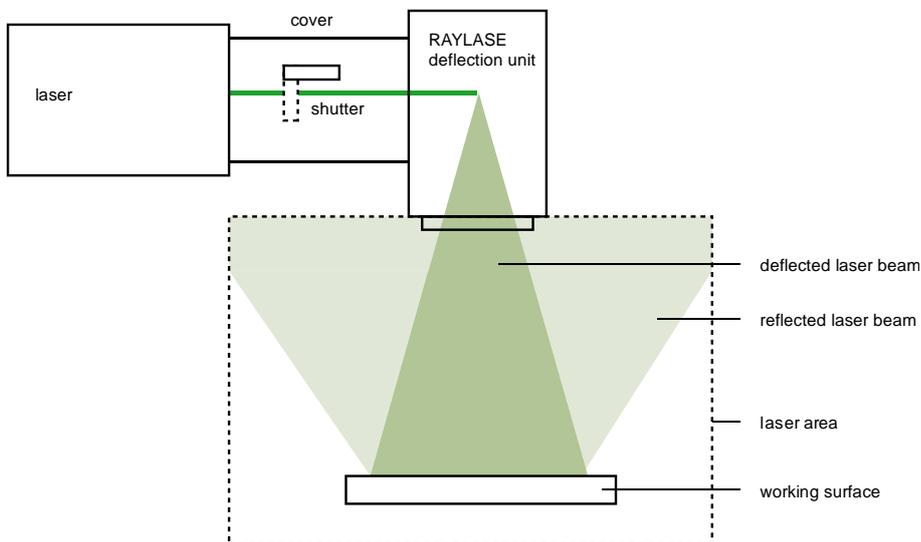
For the purposes of accident prevention, the laser area is defined as the area in which the maximum permitted radiation value can be exceeded. This is generally applicable for class 3B, 3R and 4 lasers. For class 1 to 2M laser devices, a laser area can be produced by focusing the laser beam.

A sufficient beam intensity produces a laser area that covers the entire radiation angle of the deflection unit and includes the reflection from all objects that can be exposed to the radiation as a result. Note that even apparently diffuse surfaces can reflect laser radiation and a laser beam that has been reflected several times can still be dangerous.

The laser area must be indicated by corresponding warning signs or lamps and protected by appropriate shading and interlock switches.

No flammable or explosive objects or liquids should be located in the laser area.

This operating manual interprets a selection of accident prevention regulations from the point of view of using laser deflection units in industrial plants. However, the applicable local and national standards, rules and regulations are binding.



1.6 Special hazards caused by mirrors made of beryllium

Beryllium mirrors can be destroyed by improper loading. This can lead to a release of beryllium dusts. These dusts can cause cancer, are toxic if swallowed and very toxic by inhalation.

Please observe the specified maximum applicable laser power in the data sheet.
Please note also, that soiled mirrors strengthen the absorption of laser power and thereby increase the risk of destruction of the mirror.

⇒ page 23, Special notes for mirrors made of beryllium and lenses made of zinc selenide

1.7 Special hazards caused by lenses made of zinc selenide

Zinc selenide lenses can be destroyed by improper loading. This can lead to release of dust with hydrogen selenide and selenium dioxide. These dusts can cause cancer, are toxic if swallowed and very toxic by inhalation.

Please observe the specified maximum applicable laser power in the data sheet.
Please note also, that soiled lenses strengthen the absorption of laser power and thereby increase the risk of destruction of the lens.

Therefore it is essential to ensure suitable suction in the production environment. In addition, the outer protective glass of the F-Theta lens must be checked for dirt regularly and cleaned if necessary. For non-removable deposits and after wear, which is caused by frequent cleaning, the protective glass of the F-theta lens should be replaced.

⇒ page 23, Special notes for mirrors made of beryllium and lenses made of zinc selenide

2 BASIC INFORMATION

2.1 Introduction

This operating manual describes the general handling of SUPERSCAN IIE deflection units. Refer to the rating plate to determine the present type.

This operating manual contains important information on qualified and safe handling of the deflection unit. You should therefore familiarize yourself with the content of this manual before using the deflection unit for the first time. In case of any queries, please contact RAYLASE.

The operating manual must be accessible to anyone who will be involved in developing, installing or using a laser device featuring the RAYLASE deflection unit. If the deflection unit is sold on, this operating manual or an authorized copy must be passed on with it.

2.2 Intended use

The deflection unit is developed for two-dimensional deflection and focus laser radiation in a suitable working range. If the materials to be processed generate toxic fumes, a secure suction must be ensured.

The deflection unit is designed for use in industrial environment and for use by trained professionals exclusively. It is made as a subassembly for laser devices. The deflection unit should be operated only with the specified wavelengths, laser power and beam diameters listed in the corresponding data sheet.

2.3 Package contents

Standard:

- Deflection unit

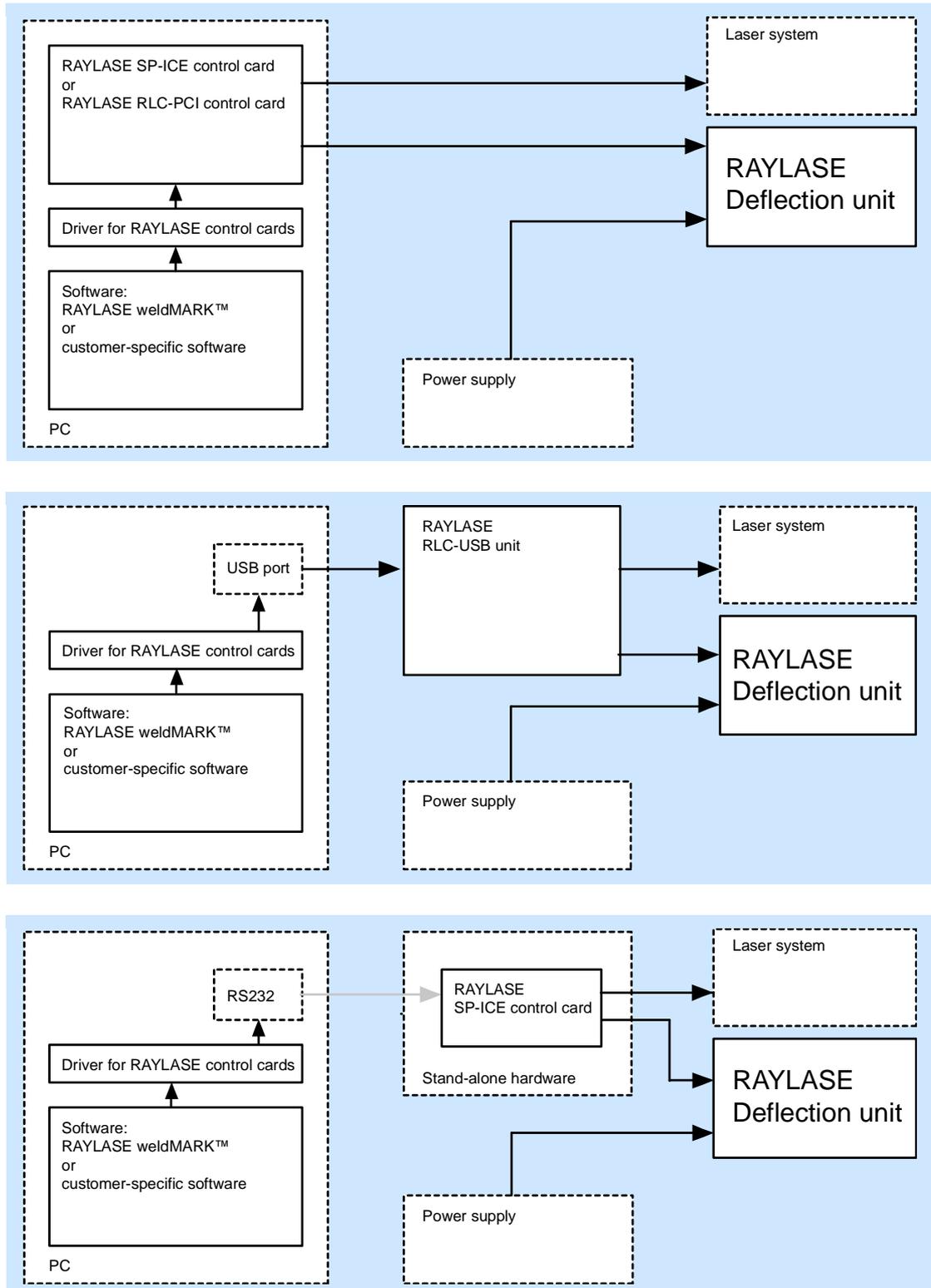
Optional:

- F-Theta lens, protective glass
- Control card
- Connecting cable between control card and deflection unit
- Software package

2.4 Module overview

The illustration below shows three typical laser devices that are realized using RAYLASE and customer-specific modules (indicated by dotted lines).

Fig. 1
Module overview



2.5 Mechanical variants

The deflection units of SUPERSCAN IIE series differ depending on the model, among other things in: the body size, the diameter of the lens thread, the nature and size of the protective glass and the size of the aperture. Therefore notice the data sheet "SUPERSCAN IIE" for every order and note the needful information about dimensions, etc., if necessary.

Additionally, the deflection units SS-IIE-20 L and SS-IIE-30 can be enhanced with a LTM to an AXIALSCAN unit.

2.6 Warranty

The rights of the customer in respect of any defects in quality or deficiencies in title are governed by the general conditions of business of RAYLASE AG. These conditions are available on our website for review.

Before returning the product, please request an authorization number from RAYLASE. Pack the product in the original packaging or in packaging that provides equivalent protection for shipping.

RAYLASE shall not be obliged to repair defects under the following circumstances:

- If persons not authorized by RAYLASE have attempted to repair the product.
- If persons not authorized by RAYLASE have modified the product.
- If the product has been used improperly.
- If the product has been connected to incompatible devices.
- If the product has been damaged because of inadmissible high laser power or focusing the laser on optical areas.
- If the product has been damaged because of unqualified cleaning of the optical areas.
- If the warranty period is expired.

Note: No implicit guarantee or warranty of suitability for specific purposes has been made. RAYLASE is not responsible for damages arising from use of the product. Individual assemblies or other assemblies manufactured by RAYLASE may be subject to separate warranty conditions. Refer to the corresponding manuals for further information.

2.7 Manufacturer

RAYLASE AG
Argelsrieder Feld 2+4
82234 Wessling
Germany
Tel.: +49 (0) 81 53 - 88 98 - 0
Fax: +49 (0) 81 53 - 88 98 - 10
<http://www.raylase.de>
E-mail: info@raylase.de

2.8 Customer support

The RAYLASE support services are available for your problems either in respect to the deflection unit or this manual. Before calling for support, please make sure you refer to any appropriate sections in the manuals on the supplied CD that may answer your questions.

If you need further assistance call RAYLASE customer service department, Monday through Friday between 8 A.M. and 5 P.M. (Middle European Time).

The customer service personnel will be able to give you direct assistance and answers to your questions.

Germany (Wessling)
+49 (0) 81 53 - 88 98 – 0
E-Mail: support@raylase.de

... ask for the customer service department

2.9 Status LEDs

The status LEDs allow you to check important functions and statuses of the deflection unit. They are located on the front or on the top of the deflection unit (depends on type).

LED arrangement	Name	Color	Meaning
	D1	red	CLK error
	D2	red	Parity error X
	D3	red	Parity error Y
	D4	green	Temp. error X
	D5	green	Temp. error Y
	D6	orange	New data X
	D7	orange	New data Y
	D8	red	Error X
	D9	red	Error Y
	D10	green	+VCC
	D11	green	-VCC
			Incorrect data transmission. Malfunctioning cable.
			Temperature status exists if LEDs are on.
			New data transmitted if LED is on.
			Galvanometer scanner or driv- er faulty. Power supply is faulty, if LEDs flicker.
			The power supply is operating properly if LEDs are on.

3 TECHNICAL DATA

This section outlines the common features of all deflection units. For type-specific features, refer to the data sheets. The individual data can be assigned by the rating plate on the deflection unit and by the identification code (⇒ below, Rating plate code).

3.1 Rating plate code

With the rating plate code, the properties of the deflection units can be determined. Please check before installation whether the deflection unit is suitable for the intended use.

3.1.1 Primary Name

With the primary name on the rating plate, the product group, the type, the aperture and the intended wavelength of the deflection unit can be determined.

```

Product line
SS = SUPERSCAN

Type
II = Series
E = Enhanced
K = AutoCalibration

Aperture
07...30 [mm]

Wavelength
[AI] = 193nm
[TY] = 355nm
[405] = 405nm
[AG] = 400nm to 1064nm
[DY] = 532nm
[DY+Y] = 532nm & 1064nm
[780-980] = 780nm to 980nm
[780-980+AL] = 780nm to 980nm
[850-870+Y] = 850nm to 870nm & 1064nm
[900-1030+AL] = 900nm to 1030nm
[900-1100+AL] = 900nm to 1100nm
[915+975] = 915nm & 975nm
[975] = 975nm
[975+985+AL] = 975nm & 985nm
[Y] = 1064nm
[C*] = 9000nm to 11000nm
[AU] = CO2 wideband
[C] = 10600nm
[AL] = Aluminum coating

Version deviation
V1...V9 = e.g. different mirror deflection range

Additional information or customer shortcut
L

GG-TTTT-AA [WWWWWWWWWWW] VV/D
    
```

Note: All mirrors have, in addition to the above coatings, a deflector for the wavelength 633nm.

3.1.2 Detailed Description

With the detailed description on the rating plate, the mirror material, the type of cooling, the size of the mechanical design, the type of tuning, the type of connector can be determined. If the scan head is a customized one then the detailed description contains the individual customer number (DKdNr).

Mirror material

BE = Beryllium
 BA = Beryllium/Alu
 OG = Optical Glass
 QU = Quarz
 SI = Silicium
 SC = SiliciumCarbid

Mechanical design

Mechanical design (cooling)

[N] = no cooling
 [W] = water cooling
 [W2] = water cooling with 90° angle
 [A] = air-cooled
 [WA] = water cooling and air cooling for mirrors
 [W2A] = water cooling with 90° angle and air cooling for mirrors

Mechanical design (others)

[L] = Head with a lager input aperture for LTM
 [F] = Head combined with FOCUSSHIFTER

Tuning

LN = low Noise
 RA = short acceleration time
 ST = minimal step time
 VC = vector
 ML = multiple tuning (default: LN)
 MR = multiple tuning (default: RA)
 MS = multiple tuning (default: ST)

Connector

D1 = 25pin D-Sub-connector
 D2 = 25pin D-Sub-connector + 9pin D-Sub-connector
 A1 = 25-pin D-Sub-connector
 A2 = 25-pin D-Sub-connector+ 9-pin D-Sub-connector

Navision customer number

SS-[MMM]-TT-CC/DKdNr

3.2 Conformity with directives

The deflection unit conforms to the requirements of the following directives:

- EU Directive 2004/108/EC (EMC)
- WEEE Directive 2012/19/EC
- RoHS II 2011/65/EU
- Directive 2006/42/EC on machinery

For details of conformity with other directives, contact RAYLASE.

4 FUNCTIONAL DESCRIPTION

4.1 Laser beam deflection unit

The deflection unit can be used to deflect a laser beam in X and Y directions. This produces an area within which a laser can be directed at any position. This area is known as the "marking field" and is shown in Fig. 2. Deflection is performed by two mirrors, each of which is moved by a galvanometer scanner. The deflection unit has a beam input, into which the laser beam is fed, and a beam output, through which the laser beam is emitted from the unit after deflection. Only suitable lasers can be fed into the beam input. Refer to the corresponding data sheet for details. Depending on the version, the beam output is either open or fitted with an F-Theta lens or protection glass (⇒ page 16, F-Theta lens).

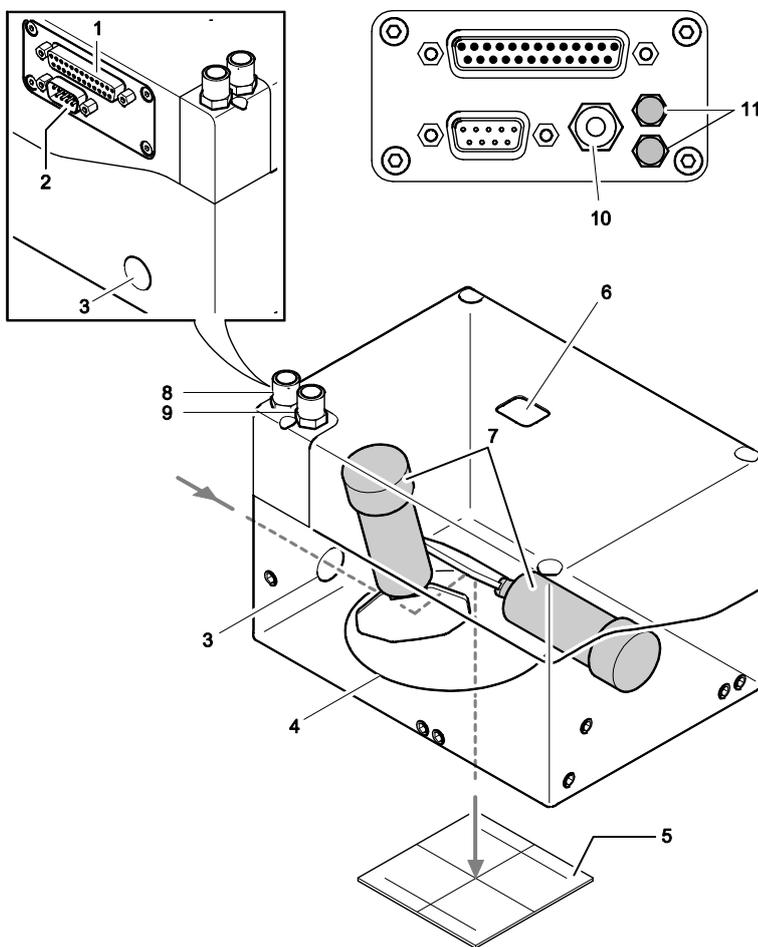


Fig. 2
Functional principle

- | | | |
|---|------------------------------------|--|
| 1 | Digital interface | |
| 2 | Power supply | |
| 3 | Beam input | |
| 4 | Beam output | |
| 5 | Marking field | |
| 6 | Status LEDs | |
| 7 | Galvanometer scanners with mirrors | |
| | | Only for deflection units with water cooling |
| | 8 | Input coolant |
| | 9 | Output coolant |
| | | Only for deflection units with "Air Flush" |
| | 10 | Air inlet |
| | 11 | Air outlet |

Only for deflection units fitted with an F-Theta lens

4.2 F-Theta lens

The F-Theta lens is designed especially for use with 2-axis deflection units. It focuses the laser beam at optimum quality to any position on the marking field. At the same time, it provides partial compensation for the barrel-shaped distortion that is unavoidable when using a two-axis deflection unit. The remaining distortion (see below) must be compensated by the deflection unit drive.

Fig. 3
Field distortion
with and without
F-Theta lens

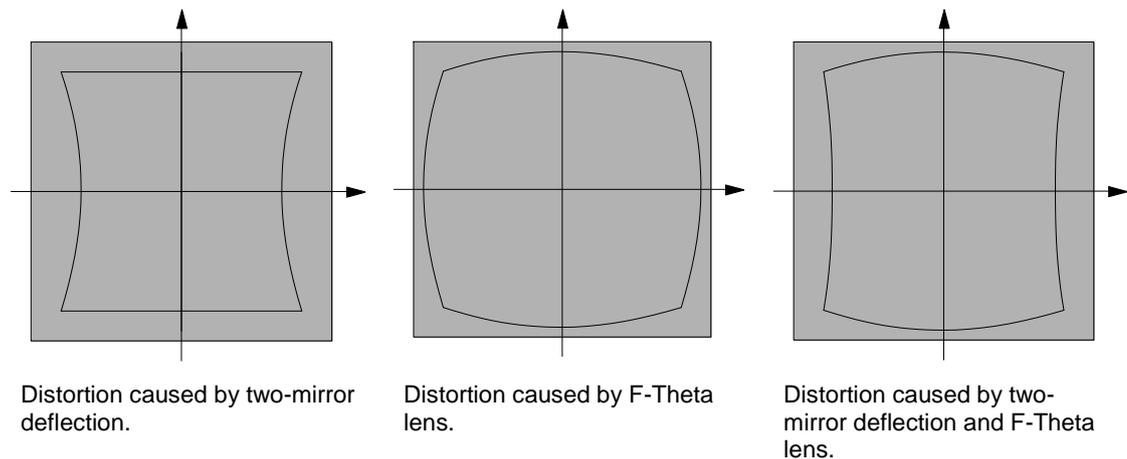
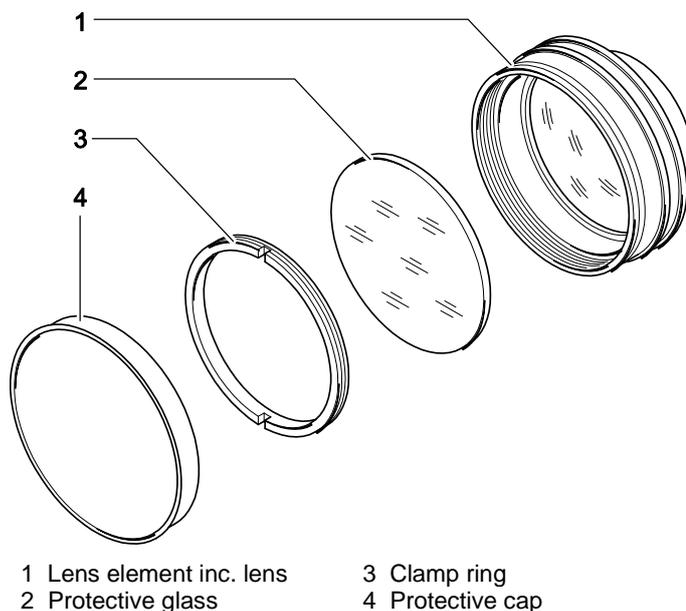


Fig. 4
Example: F-
Theta lens for
Nd:YAG



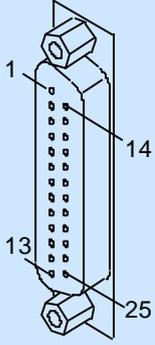
Assembly instructions

- Before installation, check the protection window for dirt, scratches or cracks.
 - If the protection window is dirty, it must be cleaned (⇒ page 22, Instructions for cleaning lenses and protective glasses).
 - If the protection window is scratched or cracked, it must be replaced.
- Brush the outer thread of the protective glass with a small amount of special grease for photo-mechanical components. Normal fats are not suitable because they release gases and thus the optical system can be destroyed.
- Screw the protection window and mount into the beam output of the deflection unit until it is positioned securely.

4.3 Digital interface

The deflection unit is connected to a RAYLASE control card using the 25-pin D-SUB connector. All signals are compatible with RAYLASE's extended function XY2-100 standard.

If the deflection unit is equipped with an 9-pin D-SUB connector, the power supply for the unit is performed on this connector. Deflection units that are not equipped with a 9-pin D-SUB connector are supplied via the digital interface. Observe the following connection table:

J1	PIN	Signal	PIN	Signal
 <p>25 PIN D-SUB</p>	1	I -SENCLOCK	14	I +SENCLOCK
	2	I -SYNC	15	I +SYNC
	3	I -X CHANNEL	16	I +X CHANNEL
	4	I -Y CHANNEL	17	I +Y CHANNEL
	5	I -Z CHANNEL	18	I +Z CHANNEL
	6	O -HEAD-STATUS	19	O +HEAD-STATUS
	7	I -P-DAC CHANNEL	20	I +P-DAC CHANNEL
	8	nc	21	nc
	9	nc ¹ +VSS ¹	22	nc ¹ +VSS ¹
	10	nc ¹ +VSS ¹	23	GND
	11	GND	24	GND
	12	nc ¹ -VSS ¹	25	nc ¹ -VSS ¹
	13	nc ¹ -VSS ¹	---	---

I = Diff. Input, nc = Not connected (not used) O = Diff. Output

1) The power supply must be provided by the OEM customers.

Specifications

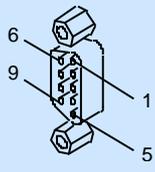
Diff. Input-, Diff. Input+		Diff. Output-, Diff. Output+	
Input voltage	0V to +5V	Output low	max. 0.6V max. 40mA
Input threshold	±200mV	Output high	min. 2V @ 50Ω max. 40mA
Hysteresis	typ. 45mV	ESD protection	±10kV
Input impedance	120Ω		
ESD protection	±15kV		

Power supply

Des.	Voltage	Current	Residual ripple	Noise
-VSS	-15V to -18V	2.5A	≤100mV	≤0,5% DC at 30MHz
+VSS	+15V to +18V	2.5A		

4.4 Power supply

The 9-pin D-SUB connector provides the deflection unit with power. The power supply must be provided by the OEM customer. Refer to the following connection and parameter table:

J1	PIN	Designation	Voltage	Current	Residual ripple	Noise
 9 PIN D-SUB	1, 2, 6	-VSS	-15V to -18V	min. 2.5A	≤100mV	≤0.5% DC at 30MHz
	4, 5, 9	+VSS	+15V to +18V	min. 2.5A		
	3, 7, 8	GND				

5 INSTALLATION



Warning:

- The laser beam can cause severe injury to the eyes and the skin. Note that even apparently matt objects can reflect laser beams. All personnel in the room must wear appropriate laser protection goggles and, if necessary, protective clothing.
- Never look directly in the laser beam, even when wearing protective goggles.
- The deflection unit may require the assignment of a different danger class (⇒ page 6, Classification of laser devices) to the laser device.
- The laser must be switched off during installation.
- We recommend that the laser area is completely protected by an appropriate working chamber. If this is not possible, appropriate protective measures for the laser class must be implemented.
- The mirrors in the deflection unit must move freely after installation of the deflection unit. No components of the laser device may protrude into the deflection unit.
- The laser device must be of sufficient quality that the laser beam can only be emitted at the beam output on the deflection unit.
- The "Laser radiation" national accident prevention regulations must be observed.
- Connecting cables may not be subjected to mechanical strain.
- The deflection unit must be protected against moisture, dust and corrosive vapors.
- The optical components may only be touched when wearing suitable cotton gloves.
- The deflection unit must be protected against static discharge and strong electromagnetic fields.
- The power density of the input laser radiation may not exceed the maximum permissible power density of the optical components of the deflection unit.
- The beam path and the function of the deflection unit must be tested after installation.

We recommend performing all tests with a danger class 1 or 2 laser to minimize the risk of injury. If this is not possible, the laser used must be set to the lowest possible power. This setting must be secured against accidental adjustment.

Procedure

- Carefully remove the protective cover over the beam input with a small screwdriver.
- To install the deflection unit, insert locating pins into the corresponding holes and attach the deflection unit to the prepared installation surface using screws.
Note: The deflection unit may only be installed using the pins and screws specified by RAYLASE. Follow the installation drawing supplied.
- For details about the connection, the deflection unit to a RAYLASE control card, refer to the corresponding manual.

Only for water cooled deflection units

5.1 Requirements to the cooling water

To avoid destruction of the aluminum housing by pitting, the cooling water must meet the requirements listed in the following table.

Note: Damage caused by pitting is excluded from the warranty.

Cooling water alternatives	Clean tap water
	Deionized water mixed with 50% clean tap water
	Deionized water with additives
Recommended additives*	Industrial application: CCL105 (NALCO)
	Food industry: Dowcal N (Dow Chemicals)
Recommended cooling temperature	22°C – 28°C Avoid condensation
Temperature stability	+/- 1°C
Water pressure at the deflection unit	2 to 3 bar
Water flow	2-6 l/min (depending on the type of deflection unit)
Water hardness	< 10 ppm
Recommended pH	7-8,6
Bacterial content	< 1000 cfu/ml

* Follow the dosage and application instructions of the manufacturer.

Only for deflection units with option "Air Flush"

5.2 Requirements to the cooling air

To avoid contamination of the mirror and the resulting destruction by the laser beam, the cooling air must meet the following requirements:

Pore filter	Pore filter $\leq 0,05$ mm
Required air pressure on the deflection unit	1-1,5 bar
Air flow	ca 50 l/min
Max. oil shares	$\leq 0,005$ mg/m ³
Max. water shares	$\leq 0,05$ g/m ³

6 MAINTENANCE AND CLEANING

The subsystem doesn't contain any components that require regular maintenance.

Repairs may only be carried out by RAYLASE or RAYLASE certified service centers because special know-how and comprehensive testing methods are required.

RAYLASE offers worldwide certified service and repair centers.

For a service and repair center in your area, see www.raylase.com.

6.1 Cleaning the housing



Warning:

The laser beam can cause severe injury to the eyes and the skin. Before cleaning, make sure that the laser device is switched off and secured against accidentally being switched on.

The deflection unit housing is dust proof. It can be cleaned with a duster. If it is very dirty, the duster can be moistened with a light and non-aggressive cleaning solution (e.g. soap solution).

6.2 Cleaning the optical system



Warning:

The laser beam can cause severe injury to the eyes and the skin. Before cleaning, make sure that the laser device is switched off and secured against accidentally being switched on.

Dirty optical surfaces result in increased absorption of the laser radiation. This can cause the dirt to heat up sufficiently, so that it burns into the optical surfaces and damage them permanently.

The following circumstances can cause increased accumulation of dirt:

- The ambient atmosphere is contaminated with dirt, grease or other particles.
- Vapors and particles are produced while working.
- Talking, coughing or sneezing close to optical surfaces.

In general, all contamination of the optical system should be avoided wherever possible. However, as contamination cannot be avoided completely, the optical system must be cleaned at appropriate intervals. Regular checking and cleaning of the optical surfaces can prevent permanent damage.

Note: RAYLASE accepts no liability for damaged optical components!

Note: Damage caused during the laser process, e.g. when processing metals, is irreversible and cannot be resolved by cleaning.

For deflection units with lens and protective glasses only

6.2.1 Instructions for cleaning lenses and protective glasses



Warning:

The laser beam can cause severe injury to the eyes and the skin. Before cleaning, make sure that the laser device is switched off and secured against accidentally being switched on.

Fingerprints contain aggressive substances that can damage the optical surfaces. Optical surfaces should therefore only be touched when wearing suitable gloves or with a lens cleaning cloth.

- Only touch the optical elements when wearing suitable cotton gloves and only touch the edges.
- Blow loose particles from the surface with clean and oil-free compressed air. Note that the compressed air in workshops can contain oil particles and is therefore unsuitable for cleaning the optical system.
- Moisten a suitable lens cleaning cloth with ethanol suitable for cleaning optical components.
- Place one end of the moistened cloth on the optical system and slowly move it over the optical components. Do not exert any pressure and do not rub the optical components.
- Remove any remaining ethanol residue with a dry optical cloth.
- Repeat the procedure until the surface is completely clean. Use a new cleaning cloth for each repetition.

6.2.2 Instructions for cleaning mirrors



Warning:

The laser beam can cause severe injury to the eyes and the skin. Before cleaning, make sure that the laser device is switched off and secured against accidentally being switched on.

The mirror surfaces are extremely sensitive and may only be cleaned by experienced personnel. We strongly recommend sending the deflection unit in to RAYLASE for the mirror cleaning, as opening of the deflection unit by unauthorized personnel voids the warranty.

However, if you want to clean the mirrors by yourself, follow the same procedure as for cleaning the lens but with even more care (⇒ above, Instructions for cleaning lenses and protective glasses).

6.2.3 Special notes for mirrors made of beryllium and lenses made of zinc selenide

**Warning:**

If the deflection unit is provided with one of the adjacent signs, there is a health hazard coming from the material of the optical components.

Behaviour if mirrors or lenses may be or are actually destroyed

- Turn the laser device off immediately!
- Leave the room for at least 30 minutes!
- Under no circumstances remove the protective glass or the F-Theta lens of the deflection unit, to check a possible destruction.
- In the deflection unit, toxic dust or fragments may be created.
- If the deflection unit has nevertheless been opened and fragments have been fallen out, the fragments must be collected wearing appropriate protective clothing and respirators and disposed of as a hazardous substance according to the local regulations.
- Label the defective deflection unit with a clear warning and send the unit airtight and well packaged to RAYLASE.
- The persons commissioned with the dismantling of the deflection unit must wear suitable protective clothing and respirators.
- The room in which the beryllium mirror or the zinc selenide lens has been destroyed, must be cleaned, decontaminated and ventilated sufficiently.
- Wear gloves and a surgical mask for the following steps!
- Gather all the broken pieces carefully and pack them in a sealed plastic container.
- Clean all contaminated components and surfaces with a damp cloth and pack the cloth in a sealed plastic container.
- Send the container to your supplier. He is responsible for the proper disposal of the material.

Hazardous properties of beryllium

With the destruction of a beryllium mirror by laser radiation beryllium dusts may be generated. These dusts can cause cancer, are toxic if swallowed and very toxic by inhalation.

Hazardous properties of zinc selenide

With the destruction of the lenses made of zinc selenide, toxic dusts may be generated with hydrogen selenide and selenium dioxide. These dusts can cause cancer, are toxic if swallowed and very toxic by inhalation.

In order to improve the optical properties of the material, zinc selenide is often provided with an anti-reflective coating, which can contain thorium fluoride. Thorium is an α -emitter and weakly radioactive. It is potentially hazardous to health if inhaled or swallowed. Since the thorium-containing coating is embedded between layers of non-radioactive layers, there is no risk for the user under normal circumstances.

For deflection units with protective glasses only

6.3 Replace protective glass

The following figure shows how the protective glass can be replaced. This, for example, is necessary in case of deposits on the protective glass. Depending on the design of the deflection unit, one of the two variants of the Output Plates illustrated may be used:

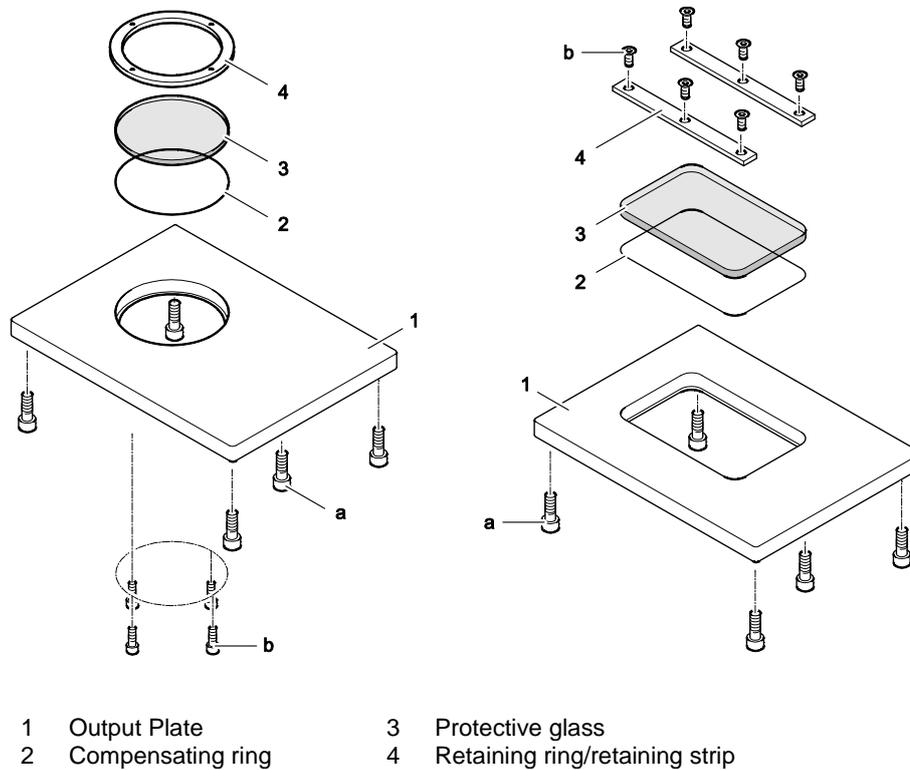


Fig. 5
Replace protective glass



Warning:

The laser beam can cause severe injury to the eyes and the skin. Before cleaning, make sure that the laser device is switched off and secured against accidentally being switched on.

The opening of the deflection unit must be done in a dust-protected environment. If dust deposits on the deflecting mirrors, it burns in during operation by the laser radiation so that the mirror will be destroyed.

Procedure

- Remove the five screws (a) holding the Output Plate (1).
- Lift the Output Plate careful from the deflection unit.
- Remove the retaining screws (b) of the protective glass (3).
- Remove the protective glass.

- Mount the new protective glass in reverse order. Be careful not to touch the optically relevant surfaces of the protective glass and remove dust particles on the optical surfaces.

7 TROUBLESHOOTING



Warning:

The laser beam can cause severe injury to the eyes and the skin.

- Never look directly or indirectly into the laser beam during troubleshooting.
- Do not disable any safety precautions for the protection against laser radiation.
- Wear protective clothing and/or goggles appropriate to the relevant laser class.

In case of malfunctions, check whether the symptom and a possible remedy are included in the following checklist.

Problem	Possible cause and remedy	
Poor marking quality	Defective power supply	
	Incorrect marking parameters	
Marking quality has deteriorated	Lens dirty	⇒ page 22, Instructions for cleaning lenses and protective glasses
	Mirror dirty	⇒ page 22, Instructions for cleaning mirrors
	Laser power decreasing	The RAYLASE weldMARK™ software can compensate a loss of laser power. Menu: System > Global adjustments
	Marking parameters changed	
	Divergence optics changed	
Laser spot changed	Dirty lens	⇒ page 22, Instructions for cleaning lenses and protective glasses
	Dirty or damaged mirrors	⇒ page 22, Instructions for cleaning mirrors
		Send deflection unit in for repair
	Laser system adjusted	
No laser beam, although process started from PC.	Beam path blocked.	Remove protective cover from beam input and/or output
	Laser driver fault	
	Fault in laser system	
The deflection unit only deflects the laser beam in one direction or not at all.	Data cable defective	⇒ page 12, Status LEDs
X and Y axis reversed	Incorrect cabling	

If the fault cannot be resolved, contact RAYLASE Customer Service for further assistance.

8 DISPOSAL

For the disposal of the deflection unit, note local policies, regulations and laws. If the mirrors are made of beryllium, the local Hazardous Substance Regulations must be considered. The rating plate shows which deflection units are concerned (⇒ page 14, Detailed Description)

INDEX

B		P	
Beryllium	8, 23	Package contents.....	9
C		Power supply.....	18
CE symbol.....	5	R	
Cleaning.....	21	Rating plate	5
Conformity with directives	14	Replace protective glass	24
Customer Service.....	12	Requirements to the cooling air.....	20
Customer Support.....	12	Requirements to the cooling water	20
D		S	
Digital interface	17	Safety instructions.....	4
F		Seal label	5
Functional description	15	Shutter.....	4
I		Signs	5
Installation.....	19	Status LEDs	12
Intended use	9	T	
L		Technical data.....	13
Laser area.....	7	Troubleshooting	25
Laser beam deflection unit	15	W	
Laser safety	4	Warranty.....	11
M		X	
Manufacturer.....	11	XY2-100 Standard.....	18
Mechanical variants	11	Z	
		Zinc selenide	8, 23

SUPERSCAN-IIIE

General Specifications

Power Supply	Voltage	±15 to ±18 V	Typical Deflection (optical)	±0.393 rad
	Current	3 A, RMS, max. 10 A	Resolution optically	12 µrad
			Repeatability (RMS)	2 µrad
			Max. Gaindrift ¹⁾	< 15 ppm/K
Ripple / Noise	Max. 200 mVpp, @ 20 MHz bandwidth	Max. Offsetdrift ¹⁾	< 10 µrad/K	
Ambient Temperature	+15 to +35 °C	Long-term Drift ^{1), 2)}	< 150 µrad	
Storage Temperature	-10 to +60 °C	Long-term Drift with water tempering [W] [W2] ^{1), 2)}	< 100 µrad	
Humidity	≤ 80 % non-condensing	Position noise (RMS)	< 10 µrad	
Interface Signals	Digital XY2-100 Protocol			

1) Drift per axis, 2) after warming-up, variations of ambient temperature < 1K, variations of cooling water < 1K

Aperture Dependent Specifications – Mechanical Data

	SS IIE-07	SS IIE-10	SS IIE-12	SS IIE-15	SS IIE-20	SS IIE-20 L	SS IIE-30
Input Aperture [mm]	7.0	10.0	12.0	15,0	20.0	20.0	30.0
Beam Displacement [mm]	9.0	12.4	14.0	18.55/18.05 ¹⁾	26.28/25.63 ¹⁾	26.28/25.63 ¹⁾	35.98/35.38 ¹⁾
Weight, without objective [kg]	approx. 1.6	approx. 3.3	approx. 3.3	approx. 3.3	approx. 3.3	approx. 5.9	approx. 5.9
Dimension (mm) (L x W x H)	135 x 97 x 102	170 x 125 x 117.5	170 x 125 x 117.5	170 x 125 x 117.5	170 x 125 x 117.5	203 x 159 x 150/160.5 ²⁾	203 x 159 x 150/160.5 ²⁾
Water Tempering Option		√	√	√	√	√	√
Air Flushing Option						√	√

1) Specification for fused Silica mirrors, 2) AXIALSCAN variation only, additional output plate for protection window

Aperture Dependent Specifications - Mirror Variations

Deflection Units	SS IIE-07	SS IIE-10	SS IIE-12	SS IIE-15	SS IIE-20	SS IIE-30
355 nm	SI	SI	SI	QU, SI	QU,	
532 nm	SI	SI	SI	QU, SI, BE	QU, SI, BE	QU
780 - 980 nm + AL				QU	QU	QU
1064 nm	SI	SI	SI	QU, SI, BE	QU, SI, BE	QU, SI, SC, BE
900 - 1100 nm + AL						SC
1060 – 1080 nm						QU, SC
10600 nm	SI	SI	SI	SI, BE, SC	SI, BE	SI, SC, BE

Standard: QU = Quarz (Fused Silica), SI = Silicium - High Speed; SC = Silicium Carbide, BE = Beryllium

Type Dependent Specifications – Dynamic Data

Deflection Unit	SS IIE-07	SS IIE-10	SS IIE-12	SS IIE-15		
Mirror Type	SI	SI	SI	QU	SI	BE/SC
Acceleration Time [ms]	≤ 0.16	≤ 0.19	≤ 0.25	≤ 0.36	≤ 0.30	≤ 0.24
Writing Speed [cps] ^{1), 2)}	1000	800	650	435	500	615
Positioning Speed [m/s] ¹⁾	15.0	10.0	9.0	6.0	7.0	9.0

	SS IIE-20 / SS IIE-20 L			SS IIE-30			
Mirror Type	QU	SI	BE	QU	SI	SC	BE
Acceleration Time [ms]	≤ 0.58	≤ 0.61	≤ 0.40	≤ 0.90	≤ 0.84	≤ 0.52	≤ 0.50
Writing Speed [cps] ^{1), 2)}	350	350	450	-	-	-	-
Positioning Speed [m/s] ¹⁾	6.0	6.0	7.0	4.0	5.0	6.0	6.0

1) With F-Theta Lens f=160 / field size 110 mm x 110 mm, 2) Single-stroke font with 1 mm height.

Mirrors & Objectives

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 +49-8153-8898-0 or email support@raylase.de

Options

The SUPERSCAN IIE scan heads provide two types of water-tempering connections for the electronics and galvanometer scanners, Straight [W] connectors and 90° [W2] connectors along with air-cooling [A] of the deflection mirrors. This ensures constant working conditions and excellent long-term stability, thus guaranteeing reliable operation even in high-laser-power applications.

BE and SC mirrors allow for higher speed performance due to the lightweight mirror substrates and optimized mirror mounts.

Air flushing Specifications

Specifications		Flow rate	Air Pressure
Air	Clean air free of water & oil	100 l / min	1.0 - 1.5 bar

Water Tempering Specifications

Specifications		Flow rate	Pressure loss
Water ¹⁾	Clean tap water with additives	2 l / min	0.3 bar
Temperature	22-28°C	4 l / min	0.4 bar
Pressure	2-3 bar	6 l / min	0.7 bar

(1) Caution: When using cooling water including deionized water, suitable additives must be used to prevent the growth of algae and protect the aluminium parts against corrosion.

Additive recommendations: Standard industrial applications e.g. CCL105 (NALCO)

Food & beverage, packaging applications: e.g. polypropylene glycol e.g. DOWCAL N. (Dow Chemical).

Please consult your additive supplier for dosage information