


Electronics for Laser Line, Laser Spot and Laser Pattern Generators

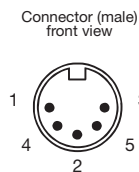
Electronics for 25CM-.../29CM-... (Electronics type S/B)

Integrated Electronics type:		S
Supply voltage		+5 V ± 0.5 V
Current consumption	max.	250 mA
Max. modulation frequency	analog TTL	100 kHz 1 MHz
Laser power output potentiometer		< 30-100 %
TTL modulation logic	TTL high	Laser ON
TTL or analog input	open or low	Laser OFF
Analog control voltage	P _{min} to P _{max}	0 ... 2.2 V
Cable type		LiY(st)CY 4x0.08mm ²

Integrated Electronics type:		B
Supply voltage	with connector w/o connector	+12 V ± 0.5 V +9 V ± 0.5 V
Current consumption	max.	250 mA
Max. modulation frequency	TTL	200 Hz
Laser power output potentiometer		< 30-100 %
TTL modulation logic	TTL high	Laser ON
TTL	open or low	Laser OFF
Cable type		LiFYCY 3x0.08mm ²


Pin-out for electronics S

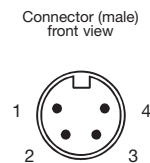
Pin-out		
Cable	Conn.	
black	1	GND
red	2	+5 V
brown	3	U _{mod} analog
orange	4	U _{mod} TTL
	5	n.c.
shield	case	



Circular connector **Lumberg SV50** (IEC-60130-9) for power supply and external modulation (pin U_{mod}). Cable shielding and casing are connected and galvanically decoupled from the laser diode and the electronics.

Pin-out for electronics B

Pin-out		
Cable	Conn.	
white	1	GND
brown	2	+12 V
green	3	U _{mod} TTL
	4	n.c.
shield	case	

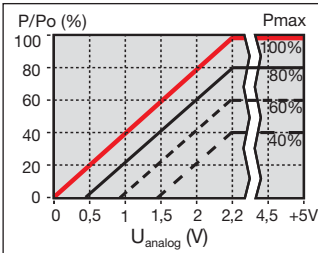


Circular connector **Lumberg SV40** (IEC-60130-9) for power supply and external modulation (pin U_{mod}). Cable shielding and casing are connected and galvanically decoupled from the laser diode and the electronics.

Modulation for electronics S

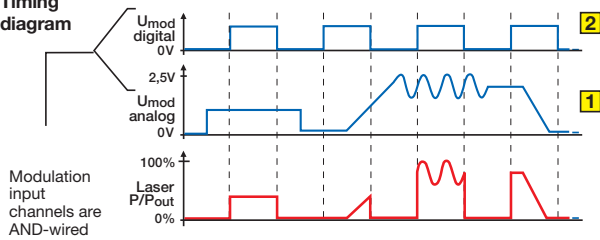
The laser has two AND-wired modulation input channels, U_{analog} **1** and U_{TTL} **2**. The laser is OFF in case of an open modulation input. If only one modulation input channel is used the other has to be set to +5 V. (see timing diagram).

The voltage U_{analog} at analog modulation input **1** linearly controls the laser output power between ≤1% and 100% of the optical power set with the potentiometer.



Connecting analog voltage (U_{analog} ranging from 0 to 2.2 V) to modulation input **1** gives linear control of the laser output power from approximately zero to the power level given by the potentiometer setting (see plot).

Timing diagram



Modulation for electronics B

Laser modules with electronics B have one modulation input channel U_{TTL} **2** and no analog modulation input. The laser is OFF in case of an open modulation input.

Electronics for Laser Line, Laser Spot and Laser Pattern Generators

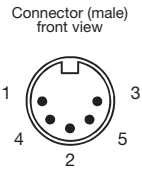
Electronics for 55CM/55CR-..., 56CM-..., 90CM/90CR-..., 91CM-...
95CM/95CR-... and 96CM-...

(Electronics type P/C/H/HP/CS/PS)

Integrated Electronics type:	C	P	H	HP	CS	PS
Supply voltage	+5 V ± 0.2 V		+5 V ± 0.2 V	+11...12 V	+5 V ± 0.2 V	+5 V ± 0.2 V
Current consumption max.	250 mA		250mA	250mA	250 mA	250mA
Max. modulation frequency	analog	100 kHz	10 Hz	100 kHz	1 Hz	1 Hz
	TTL	100 kHz	250 kHz	100 kHz	250 kHz	1 MHz
Laser power output potentiometer	< 1-100 %	< 5-100 %	< 1-100 %	< 5-100 %	< 1-100 %	< 5-100 %
TTL modulation logic	TTL high			Laser ON	Laser ON	Laser ON
TTL or analog input	open or low			Laser OFF	Laser OFF	Laser OFF
Analog control voltage P_{min} to P_{max}	0 ... 2.5 V	0 ... 2.5 V	0 ... 2.5 V	0 ... 2.5 V	0 ... 2.5 V	0 ... 2.5 V
Modulation Input Resistance [Ohm]	22k	9k	22k	9k	9k	9k
Cable type	4xAWG 26CUL 0.14 mm ²	4xAWG 26CUL 0.14 mm ²	LiY(st)CY 4x0.08mm ²	LiY(st)CY 4x0.08mm ²	6xAWG 26CUL 0.14 mm ²	6xAWG 26CUL 0.14 mm ²

Pin-out for electronics C/P/H

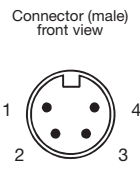
Pin-out C/P/H	Cable	Conn.	
	black	1	GND
	red	2	+5 V
	brown	3	U_{mod} analog
	orange	4	U_{mod} TTL
		5	n.c.
	shield	case	⏏



Circular connector **Lumberg SV50** (IEC-60130-9) for power supply and external modulation (pin U_{mod}).
Cable shielding and casing are connected and are galvanically decoupled from the laser diode and the electronics.

... and Pin-out for electronics HP

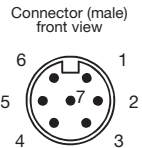
Pin-out HP	Cable	Conn.	
	black	1	GND
	red	2	+12 V
	brown	3	U_{mod} analog
	orange	4	U_{mod} TTL
	shield	case	⏏



Circular connector **Lumberg SV40** (IEC-60130-9) for power supply and external modulation (pin U_{mod}).
Cable shielding and casing are connected and are galvanically decoupled from the laser diode and the electronics.

Pin-out for electronics CS/PS

Pin-out CS/PS	Cable	Conn.	
	black	1	GND
	red	2	+5 V
	brown	3	U_{mod} analog
	orange	4	U_{mod} TTL
	yellow	5	RS232Tx
	green	6	RS232Rx
		7	n.c.
	shield	case	⏏

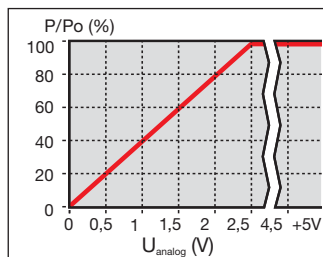


Circular connector **Lumberg SV70** (IEC-60130-9) for power supply and external modulation (pin U_{mod}) and RS232 interface. Cable shielding and casing are connected and are galvanically decoupled from the laser diode and the electronics.

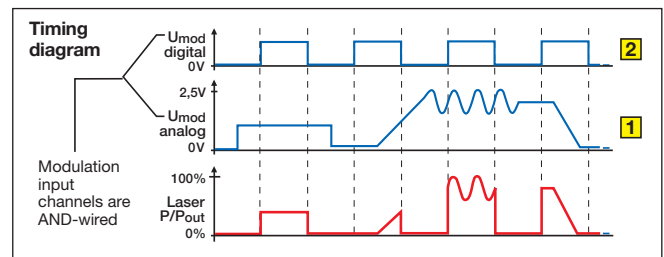
Modulation

The laser has two AND-wired modulation input channels, U_{analog} **1** and U_{TTL} **2**.
The laser is OFF in case of an open modulation input. If only one modulation input channel is used the other has to be set to +5 V. (see timing diagram).

The voltage U_{analog} at analog modulation input **1** linearly controls the laser output power between $\leq 1\%$ and 100% of the optical power set with the potentiometer.



Connecting analog voltage (U_{analog} ranging from 0 to 2.5 V) to modulation input **1** gives linear control of the laser output power from approximately zero to the power level given by the potentiometer setting (see plot).



Software Parameters for RS232 interface (electronics CS/PS)

The RS232 interface (or the USB connection using the switchbox SBS 070701-USB) allows laser control and reating out of laser data:

- Input parameters:**
- laser power
 - laser power limit
 - mode of operation

- Output parameters**
- laser current (mA)
 - photo diode current (μ A)
 - temperature
 - laser output power (%)
 - operating voltage
 - hours of operation
 - min./max. temperature

Switchbox and Power Supply

Figure 1



A Switchbox SBN050501,
B Switchbox with integrated power supply SBP 05-C-2-1

The switch box is the interface between power supply and laser diode beam source. The integrated key switch and interlock mechanism ensure concordance with laser safety regulations. In addition, the inputs for analog and TTL modulation are made available via simple to use BNC connectors, the time-consuming wiring of a special adapter cable is avoided.

Schäfter+Kirchhoff laser diode beam sources are off if either one or both modulation inputs are open. Internal pull-up resistors used in the switch box however ensure that the beam source is instantly ready for use.

The switch box can be grounded using either a clamping screw or a 4 mm phone jack. With a

grounded switch box, the phone jack can also be used to connect an antistatic wristband or mat. The shielded metal housing also isolates the contents from electro-magnetic irradiation.

The operation of a laser source must conform to EN 60825 and this switch box also provides the following safety features:

- Interlock chain for the remote deactivation of the laser
- Laser power-up is only possible using the key switch
- LED status indicator for "Laser ON"
- Switch also provides output for external status indicator "Laser ON" (only with type SBP).

Laser Interlock:

An external laser interlock is mandatory in most countries for laser class 3B and beyond, so that a break in the laser interlock chain will cause an immediate shutdown of the laser power.

An automatic shutdown system (e.g., a door or enclosure-opening switch) has to be used for the immediate disconnection of the interlock chain in order to prevent any exposure of an unprotected person to the hazardous laser radiation.

The interlock mechanism in the **Schäfter+Kirchhoff** laser beam sources requires no external power supply and its absence is detected by an integral surge tripswitch that must be bridged by the interlock chain before the laser source can be used!

Choosing the right switchbox and power supplies for the laser diode modules depending on electronics type

Electronics type:	S	B	C and P (standard)	CS and PS (RS232 interface)	H	HP
Voltage	5V	12V (with connector)	5V	5V	5V	11...12V
Power Supply	PS051003E	PS120516E	PS051003E	PS051007E	PS051003E	PS120516E
Key features: (For details see page 70)	5V / 2.6A 5-pin KV 50 connector, female	12V / 1.25A 4-pin KV 40 connector, female	5V / 2.6A 5-pin KV 50 connector, female	5V / 2.6A 7-pin KV 70 connector, female	5V / 2.6A 5-pin KV 50 connector, female	12V / 1.25A 4-pin KV 40 connector, female
Power Cords (EU, USA/Can and GB see page 70)						
Switchbox	SBN 050501	SBN 040401	SBN 050501	SBN 070701-USB	SBN 050501	SBN 040401
Key features: (For details see below)	• Two separate modulation input connectors (BNC)	• Two separate modulation input connectors (BNC)	• Two separate modulation input connectors (BNC)	• Mini USB 2.0 connection for laser control/ read out • Two separate modulation input connectors (BNC)	• Two separate modulation input connectors (BNC)	• Two separate modulation input connectors (BNC)
Switchbox with integrated Power Supply	SBP-05-...	SBP-12-...	SBP-05-...		SBP-05-...	SBP-12-...
Key features: (For details see page 70)	• Desk or 19" version • 115 or 230 V input • Two separate modulation input connectors (BNC)	• Desk or 19" version • 115 or 230 V input • Two separate modulation input connectors (BNC)	• Desk or 19" version • 115 or 230 V input • Two separate modulation input connectors (BNC)		• Desk or 19" version • 115 or 230 V input • Two separate modulation input connectors (BNC)	• Desk or 19" version • 115 or 230 V input • Two separate modulation input connectors (BNC)

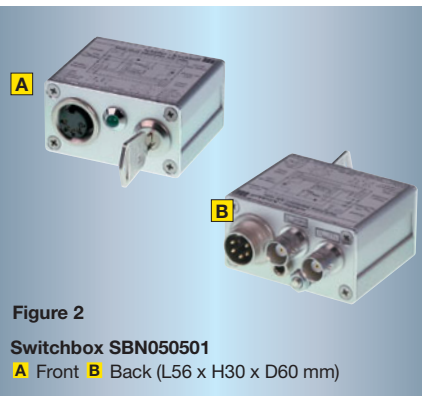


Figure 2
Switchbox SBN050501
A Front **B** Back (L56 x H30 x D60 mm)

Switchbox SBN 050501

The switchbox is the interface between the power supply and laser diode beam source. Features: Reverse voltage protection, key switch, "Laser ON" LED, grounding connector, two separate modulation input connectors (BNC), interlock and Lumberg input and output connectors according to IEC 60130-9.

Switchbox SBN050501 for laser diode beam sources with 5 V power supply, recommended power supply module **PS051003E**
Switchbox SBN040401 for laser diode beam sources with 12 V power supply, recommended power supply module **PS120516E**.

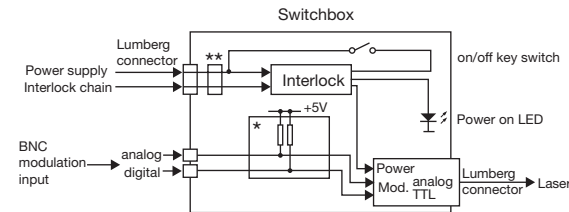


Figure 3
Switchbox SBN070701-USB
A Front **B** Back (L56 x H30 x D60 mm)

Switchbox SBS 070701-USB for laser diode modules with RS232 interface

The switchbox is the interface between the power supply and laser diode beam source. Features: Mini USB 2.0 connection for laser control and reading out of laser data, e.g. hours of operation, reverse voltage protection, key switch, "Laser ON" LED, grounding connector, two separate modulation input

connectors (BNC), interlock and Lumberg input and output connectors according to IEC 60130-9.

Switchbox SBS 070701-USB for laser diode beam sources with 5 V power supply and RS232 interface; recommended power supply module **PS051007E**

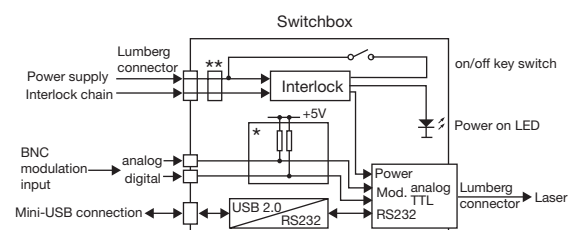


Figure 4

- C Desk switchbox**
B 106 x H 40 x D 120 mm
- D 19"-rack switchbox**
3 U x 10 HP
W 51 x H 129 x D 120 mm



Switchbox with integrated Power Supply SBP-...

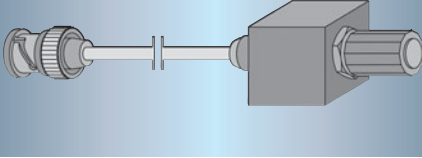
Low-noise linear power supply

IN: 115 or 230 V AC, OUT: 5 V or 12 V DC, 250 mA
Interlock, key switch, "Laser ON" LED, switch provides output for external status indicator "Laser ON", ground connector, two separate modulation input connectors (BNC), metal housing for protection against electromagnetic irradiation, Lumberg input and output connectors, according to IEC 60130-9.

Specification			
Output voltage	5V DC	Input resistance	8.2 kΩ
max. output current	250 mA	Switching contact:	
Supply voltage (VAC)	100 - 130	max. voltage / current	48V / 1A
	200 - 250	Fuse	2x 0.16 AT
Line frequency (Hz)	50 - 60	Ambient temperature	5 - 40° C
Power consumption	< 7 W	Weight (kg)	0.65

Order Code SBP - 05 - B - 2 - 1				
Output voltage	Housing	Supply voltage	Version	
5V: 05	Desktop: B	230V	2	standard 1
12V: 12	19" Cassette: C	115V	1	pot.meter 2

Figure 5
SBCTRL-50



Switchbox Accessories

Order Code SBCTRL-50

Control cable for external output power adjustment for the laser beam sources of series 13 and 90. Remote precision potentiometer with BNC connector. Shielded coaxial cable with 500 mm cable length (as standard, other cable lengths on request).

Connecting scheme

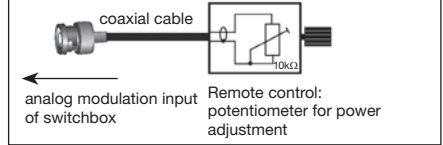
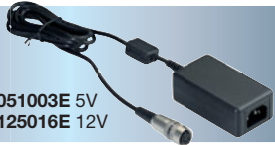


Figure 6
Power Supply

- Order Code PS051003E 5V**
- PS125016E 12V**



Power Supply

Specification:
IN: 100-240 V AC, Class 1 protective ground, IEC320-C14 chassis plug
OUT: 1.5 m shielded cable with connector (IEC 60130-9) Lumberg series KV (female)

Depiction



Power supply for lasers w/o RS232 interface and operation with or w/o switchbox SBN...	Order Code	OUTPUT
	PS051003E	5 V / 2.6 A
	PS120516E	12 V / 1.25 A

Connector (female)
5 V : 5-pin, KV 50
12 V: 4-pin, KV 40

Power supply for lasers with RS232 interface and operation with or w/o switchbox SBS...	Order Code	OUTPUT
	PS051007E	5 V / 2.6 A

Connector (female)
5 V : 7-pin, KV 70

Power cord for Power Supply PS....E IEC320 3-pin 1.5 m cable, 10 A, 250 V AC	Order Code	Country
	PC150DE	Europe
	PC150US	USA / Canada
	PC150UK	Great Britain



Figure 7

Linear power supply for mounting rail EN60715 (TH35), 230 V AC, 5 V DC, 0.3 A with 1.5 m cable and Lumberg connector type KV50 female IEC 60130-9 (H 76 x W 45 x D 100 mm)



- Order Code PS050302E** for operation with switchbox SBN... or laser without switchbox

Figure 8



Connector type Lumberg IEC 60130-9

Accessories

Order Code BC 01 09 F
Lumberg IEC 60130-9 connector type: KV 50 (female 5-pin). For connection between a customer power supply and laser (with connector SV30 and SV50) or switchbox.



Order Code BC 01 05 M
connector Lumberg IEC 60130-9 Type: SV 50 (male 5-pin). For connecting a customer laser to the switchbox.



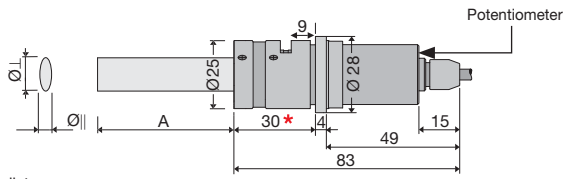
Order Code BC 01 04 F
connector Lumberg IEC 60130-9 Type: KV 40 (female 4-pin). For connection of a customer power supply to the laser or switchbox.



Dimensions

Dimensions: Laser Modules with Laser Diode Collimator 55CM and 55CR

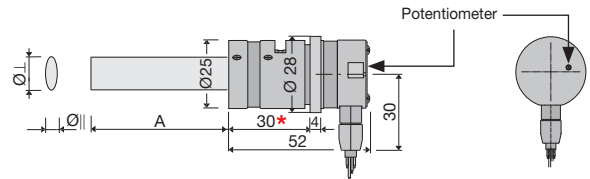
A 55CM



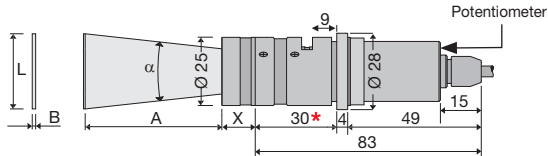
A = working distance
 Ø_\perp = beam diameter perpendicular
 Ø_\parallel = beam diameter parallel

* = Clamping region for mounting

B 55CR



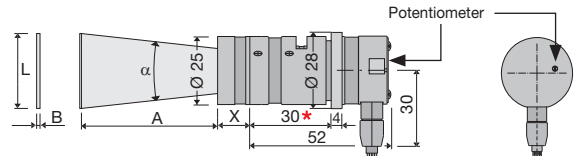
A1 13LR / 13LRM + 55CM



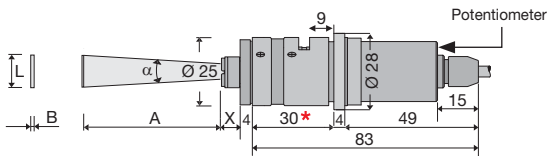
A = working distance L = line length
 B = line width α = fan angle

* = Clamping region for mounting

B1 13LR / 13LRM + 55CR



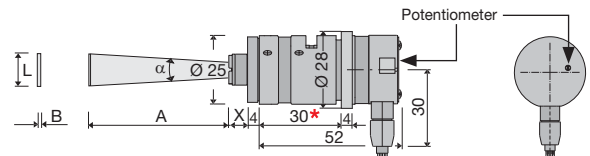
A2 5L... / 5L...M + 55CM



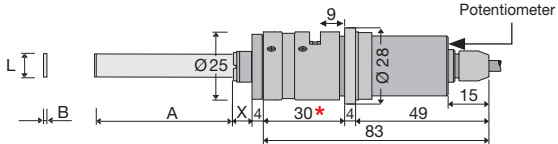
A = working distance L = line length
 B = line width α = fan angle

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B2 5L... / 5L...M + 55CR



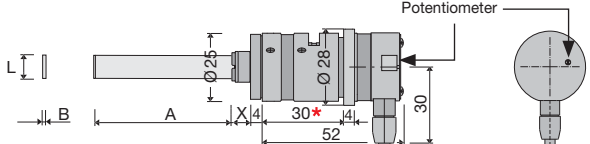
A3 5LT / 5LTM + 55CM



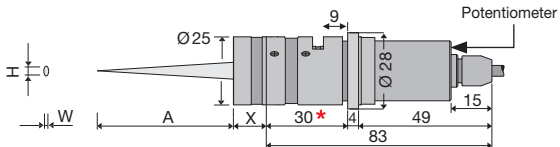
A = working distance L = line length
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B3 5LT / 5LTM + 55CR



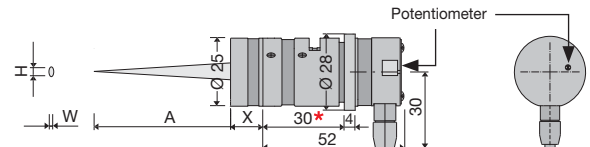
A4 13M / 13MM + 55CM



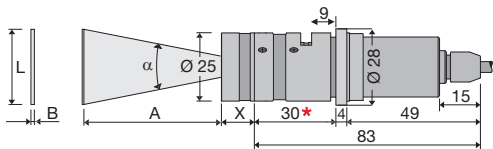
A = working distance H = focus height
 W = focus width

* = Clamping region for mounting

B4 13M / 13LMM + 55CR



A5 13P + 55CM

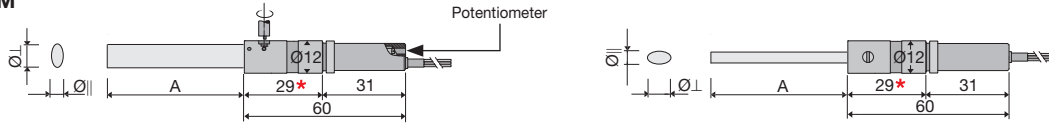


A = working distance L = line length
 B = line width α = fan angle

* = Clamping region for mounting

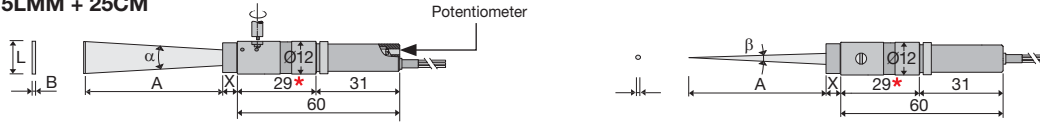
Dimensions: Laser Modules with Laser Diode Collimator 25CM and 29CM

C 25CM



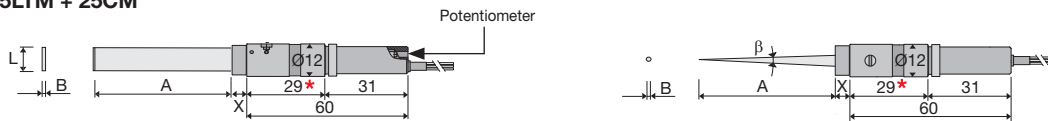
A = working distance
 Ø_\perp = beam diameter perpendicular
 Ø_\parallel = beam diameter parallel
 * = Clamping region for mounting

C1 5LM / 5LMM + 25CM



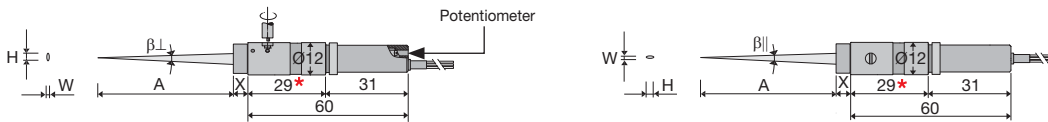
A = working distance
 B = line width
 L = line length
 α = fan angle
 β = convergence angle
 * = Clamping region for mounting

C2 5LT / 5LTM + 25CM



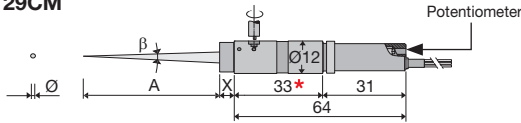
A = working distance
 B = line width
 L = line length
 β = convergence angle
 * = Clamping region for mounting

C3 5M / 5MM + 25CM



A = working distance
 W = focus width
 H = focus height
 β = convergence angle
 * = Clamping region for mounting

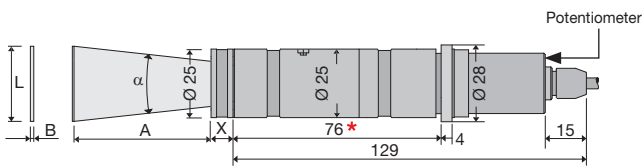
D1 5MC + 29CM



A = working distance
 Ø = spot diameter
 β = convergence angle
 * = Clamping region for mounting

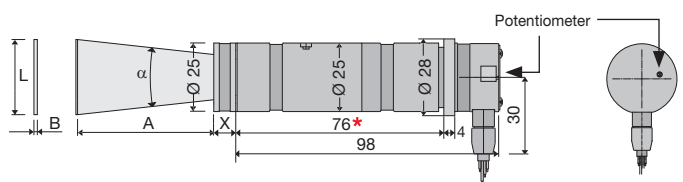
Dimensions: Laser Modules with Laser Diode Collimator 90CM/90CR and 95CM/95CR

E1 13LN / 13LNM + 90CM

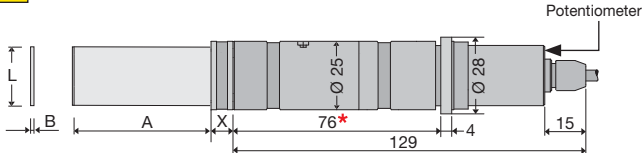


A = working distance
 B = line width
 L = line length
 α = fan angle
 * = Clamping region for mounting

F1 13LN / 13LNM + 90CR

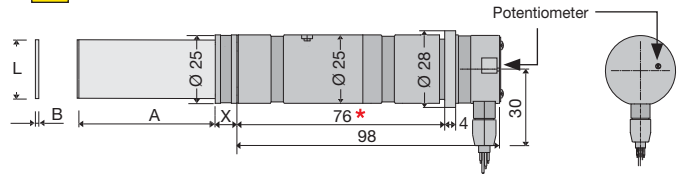


E2 13LT / 13LTM + 90CM

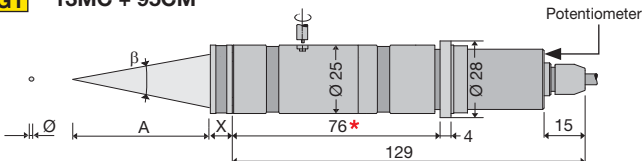


A = working distance
 B = line width
 L = line length
 * = Clamping region for mounting

F2 13LT / 13LTM + 90CR

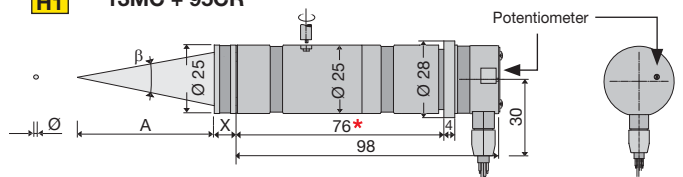


G1 13MC + 95CM



A = working distance
 Ø = spot diameter
 β = convergence angle
 * = Clamping region for mounting

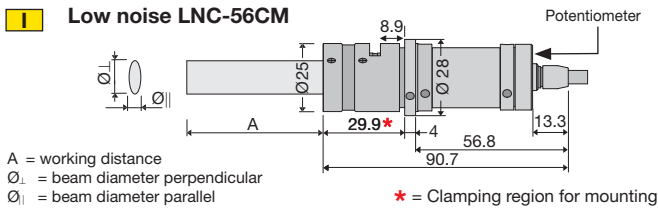
H1 13MC + 95CR



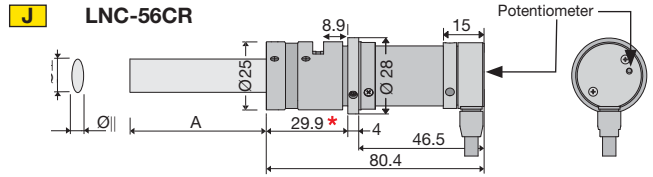
Laser Diode Modules LNC-Series

Dimensions: Laser Modules with Low noise Laser Diode Collimator LNC-56CM and LNC-56CR

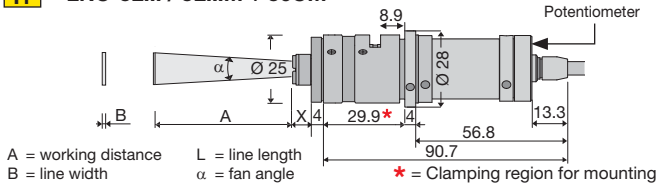
I Low noise LNC-56CM



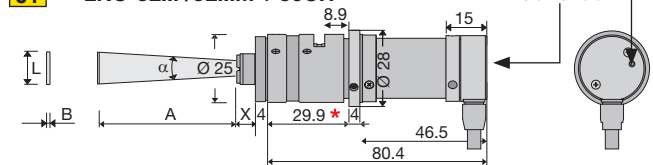
J LNC-56CR



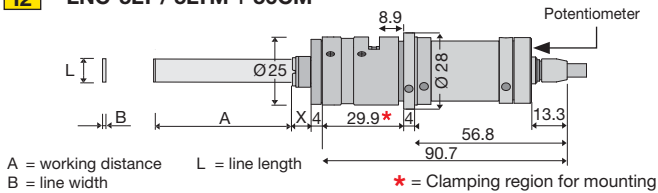
I1 LNC-5L... / 5L...M + 56CM



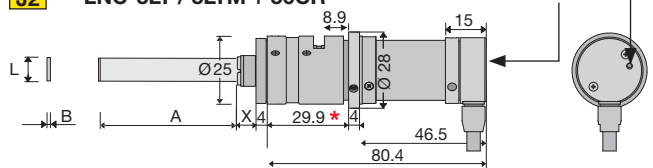
J1 LNC-5L... / 5L...M + 56CR



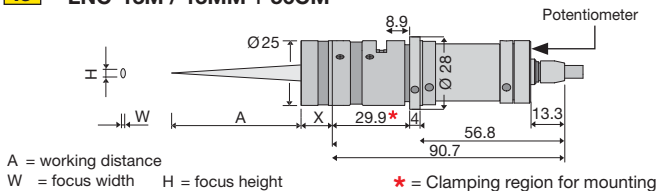
I2 LNC-5LT / 5LTM + 56CM



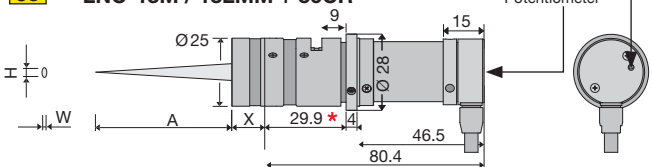
J2 LNC-5LT / 5LTM + 56CR



I3 LNC-13M / 13MM + 56CM

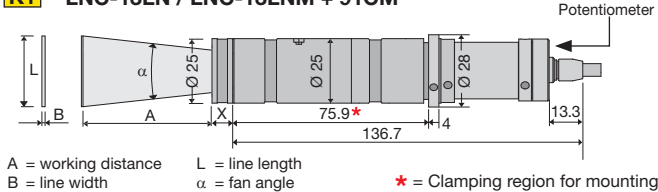


J3 LNC-13M / 13LMM + 56CR

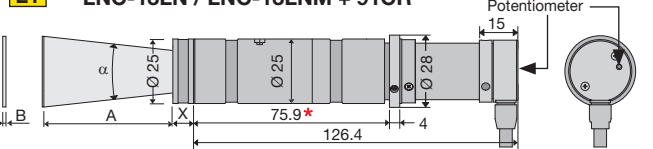


Dimensions: Laser Modules with Low noise Laser Diode Collimator LNC-91CR and LNC-96CR

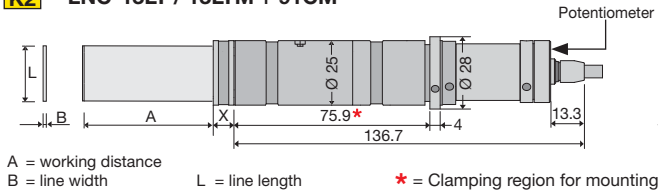
K1 LNC-13LN / LNC-13LNM + 91CM



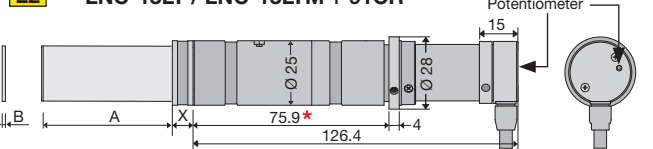
L1 LNC-13LN / LNC-13LNM + 91CR



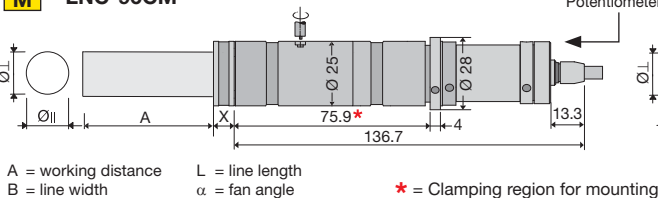
K2 LNC-13LT / 13LTM + 91CM



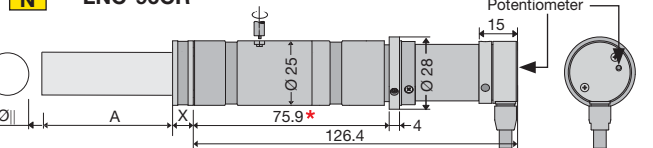
L2 LNC-13LT / LNC-13LTM + 91CR



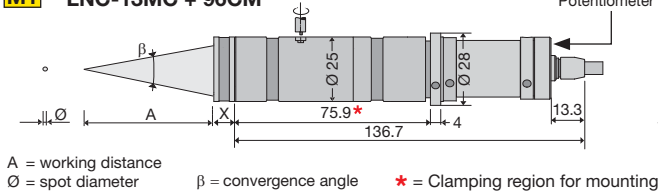
M LNC-96CM



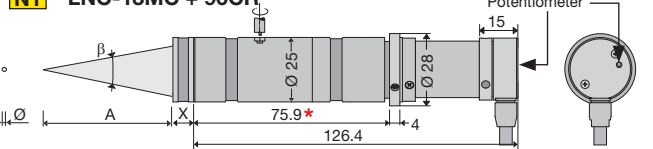
N LNC-96CR



M1 LNC-13MC + 96CM



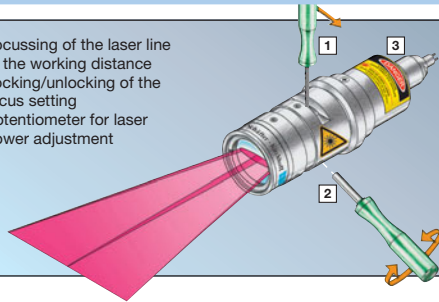
N1 LNC-13MC + 96CR



Adjustment Tools

Adjustment Tools for Laser Modules based on 55CM/55CR and 56CM/56CR

- 1 Focussing of the laser line to the working distance
- 2 Locking/unlocking of the focus setting
- 3 Potentiometer for laser power adjustment



Adjustment tools for correction 1 and locking 2 of focus setting:

1+2 Hex key WS 1.5 **Order Code** 50HD-15

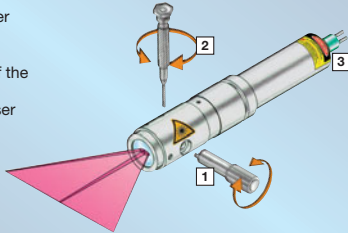
Screwdriver for the adjustment of laser power potentiometer 3

3 Screwdriver WS 1.2 **Order Code** 9D-12



Adjustment Tools for Laser Modules based on 25CM, 29CM

- 1 Focussing of the laser line to the working distance
- 2 Locking/unlocking of the focus setting
- 3 Potentiometer for laser power adjustment



Adjustment tools for correction 1 and locking 2 of focus setting:

1 Eccentric key **Order Code** 60EX-4

as an alternative:

Eccentric key with long handle **Order Code** 60EX-4-L

2 Screwdriver WS 1.2 **Order Code** 9D-12

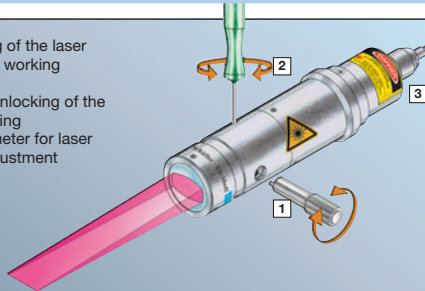
Screwdriver for the adjustment of laser power potentiometer 3

3 Screwdriver WS 1.2 **Order Code** 9D-12



Adjustment Tools for Laser Modules based on 90CM/90CR, 91CM/91CR, 95CM/95CR and 96CM/96CR

- 1 Focussing of the laser line to the working distance
- 2 Locking/unlocking of the focus setting
- 3 Potentiometer for laser power adjustment



Adjustment tools for correction 1 and locking 2 of focus setting:

1 Eccentric key **Order Code** 55EX-5

as an alternative:

Eccentric key with long handle

Order Code 55EX-5-L

2 Hex key WS 1.5 **Order Code** 50HD-15

Screwdriver for the adjustment of laser power potentiometer 3

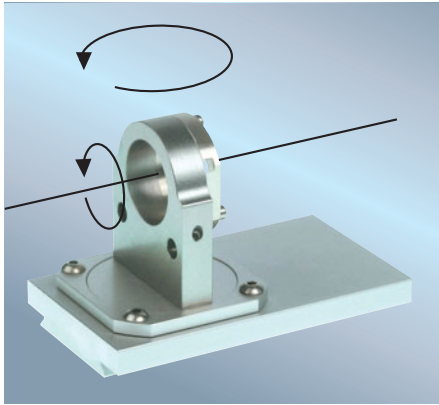
3 Screwdriver WS 1.2 **Order Code** 9D-12



Choosing the Adequate Adjustment Tools

Row No.	Beam-shaping optics	Laser Diode Module	System used in	50HD-15	60EX-4/ 60EX-4-L	55EX-5/ 55EX-5-L	9D-12	Page
1	13LR... or 13LRM...	55CM	13LR+55CM or 13LRM+55CM	x			x	22/23
2	5L... or 5LM...	25CM	5L+25CM or 5LM+25CM		x		x	24/25
3	5L... or 5LM...	55CM	5L+55CM or 5LM+55CM	x			x	26/27
		56CM	LNC-5L+56CM or LNC-5LM+56CM	x			x	50/51
4	13LN... or 13LNM...	90CM	13LN+ 90CM or 13LNM+ 90CM				x	28/29
		91CM	LNC-13LN+ 91CM or LNC-13LNM+ 91CM				x	52/53
5	13LT... or 13LTM	90CM	13LT+ 90CM or 13LTM+ 90CM				x	30/31
		91CM	LNC-13LT+ 91CM or LNC-13LTM+ 91CM				x	54/55
6	5LT... or 5LTM...	25CM	5LT+25CM or 5LTM+25CM				x	32/33
7	5LT... or 5LTM...	55CM	5LT+ 55CM or 5LTM+ 55CM				x	34/35
		56CM	LNC-5LT+ 56CM or LNC-5LTM+ 56CM				x	56/57
8	13MC... or 13MMC...	95CM	13MC+95CM or 13MMC+95CM			x		36/37
		96CM	LNC-13MC+96CM or LNC-13MMC+96CM			x		58/59
9	5MC...	29CM	5MC+29CM		x		x	38
10	13M... or 13MM...	55CM	13M+55CM or 13MM+55CM	x			x	40/41
		56CM	LNC-13M+56CM or LNC-13MM+56CM	x			x	60/61
11	5M...	25CM	5M+25CM or 5MM+25CM		x		x	42/43
12	-	25CM	25CM		x		x	45
13	-	55CM	55CM	x			x	46
		56CM	LNC-56CM	x			x	62/63
14	-	90CM	90CM				x	47
		91CM	LNC-91CM				x	66
15	-	96CM	LNC-96CM				x	64

Mounting Consoles for Laser Diode Beam Sources Series 55CM... (Housing Ø 25/28 mm)



The mounting consoles 13MK-25-36-10 ... from Schäfter+Kirchhoff allow a precise and mechanically rugged alignment of the laser beam sources 13...

The lasers are held by indirect clamping and the focussing and focus locking mechanisms remain accessible in the clamped state.

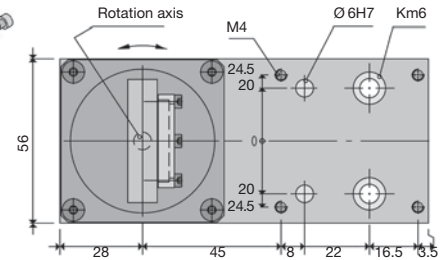
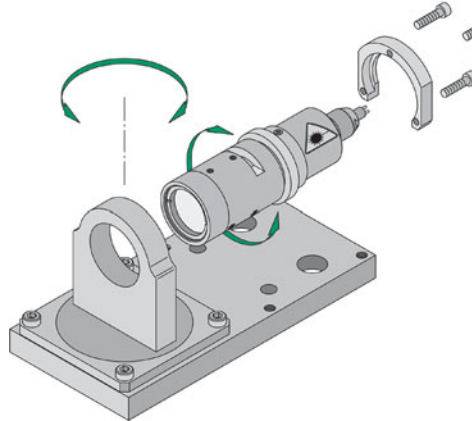
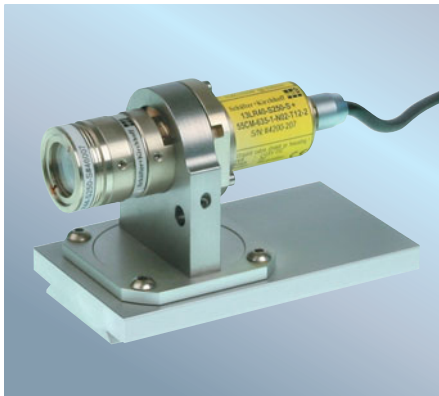
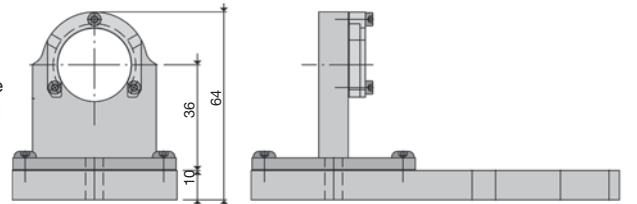
The mounting consoles 13ML-25-36-.. supports two degrees of freedom:

1. Rotation 0–360° around the optical axis (roll angle ρ)
2. In-plane rotation 0–360° (azimuth angle Φ)

Versions:

Order Code 13MK-25-36-10-F
Mounting console, flat base plate

Order Code 13MK-25-36-10-M
Mounting console,
base plate with Montech profile
AP-46-50
www.montech.com



Mounting Tools:

- Hex key WS 2 **Order Code 50HD-20**
Hex key WS 2.5 **Order Code 50HD-25**

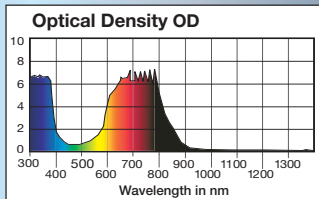
Safety at Work



Full Protection Goggles
DIN EN 207
Order Code F18.P1H03.1001



VLT = 10%



Usable Range

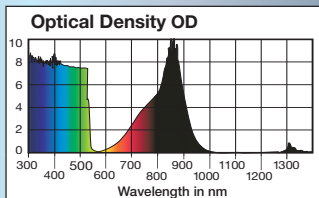
Pro-tection	Wavelength [nm]	Pro-tection Level	max. Trans-mission (EN 207)	max. Power Density (EN 207)	max. Power (EN 208)
Full	610 - 630	LB3	10 ⁻³	10 ⁴ W/m ²	-
Full	630 - 660	LB4	10 ⁻⁴	10 ⁵ W/m ²	-
Full	660 - 710	LB5	10 ⁻⁵	10 ⁶ W/m ²	-
Full	710 - 730	LB4	10 ⁻⁴	10 ⁵ W/m ²	-
Full	730 - 790	LB5	10 ⁻⁵	10 ⁶ W/m ²	-

Full protection goggles for cw lasers in the 600 - 800 nm wavelength range

Full Protection Goggles
DIN EN 207
Order Code F18.P1L02.1001



VLT = 30%



Usable Range

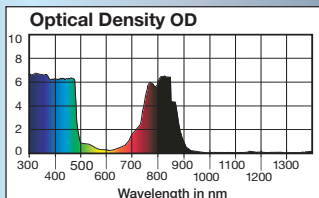
Pro-tection	Wavelength [nm]	Pro-tection Level	max. Trans-mission (EN 207)	max. Power Density (EN 207)	max. Power (EN 208)
Full	>315 - 532	LB6	10 ⁻⁶	10 ⁷ W/m ²	-

Full protection goggles for cw lasers in the 315 - 532 nm wavelength range

Full and Alignment Protection Goggles
DIN EN 207 / DIN EN 207
Order Code F18.P1H02.1001



VLT = 42%



Usable Range

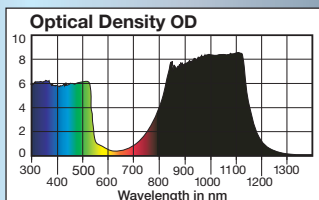
Pro-tection	Wavelength [nm]	Pro-tection Level	max. Trans-mission (EN 207)	max. Power Density (EN 207)	max. Power (EN 208)
Alignment	660 - 675	RB2	-	-	100 mW
Full	700 - 820	LB5	10 ⁻⁵	10 ⁶ W/m ²	-

Alignment protection goggles are for lasers in the 660-675 nm wavelength range
Full protection goggles for the 700-820 nm wavelength range

Full and Alignment Protection Goggles
DIN EN 208/DIN EN 207
Order Code F18.P1H01.1001



VLT = 35%



Usable Range

Pro-tection	Wavelength [nm]	Pro-tection Level	max. Trans-mission (EN 207)	max. Power Density (EN 207)	max. Power (EN 208)
Full	770 - 800	LB4	10 ⁻⁴	10 ⁵ W/m ²	-
Full	800 - 1100	LB5	10 ⁻⁵	10 ⁶ W/m ²	-

Full protection goggles for lasers in the 770 - 1100 nm wavelength range

Laser safety and laser adjustment goggles

The use of laser safety goggles is recommended when working with lower power lasers from laser protection class 3R and beyond, such as all visible lasers from Schäfter+Kirchhoff with up to 5 mW of output power.

Laser safety goggles are mandatory for protection class 3B and beyond, such as all invisible infrared lasers and all visible lasers from Schäfter+Kirchhoff with more than 5 mW of output power.

The correct handling and use of the laser safety goggles protects you and your colleagues against eye injuries from hazardous laser radiation. A selection of CE and GS certified laser safety goggles (manufactured by LaserVision, www.lvg.com) are provided for the lasers manufactured by Schäfter+ Kirchhoff.

The type of frame is dependent upon whether glass or plastic filters are fitted. Laser safety goggles with glass filters (Order Code **RX7**) have a heavier frame with a facility for attaching personal spectacles, according to individual requirements. Laser safety goggles with plastic filters are lighter and can be worn over normal spectacles.

The two distinct protective functions of either **full protection goggles** or **alignment protection goggles** need emphasizing (see box below).

Laser Safety Goggles - Function and Characteristics

Protective function. Full protection goggles and alignment goggles provide different levels of safety and laser protection.

Full protection goggles, conforming to European standard EN 207, provide personal protection against laser radiation. The laser radiation is blocked and is no longer visible.

The **protection levels** (such as protection level LB..) differ in the maximum spectral transmission of the filter glasses. The EN 207 standard specifies a maximum incident laser power density (power per unit area, in W/m²) for the laser power that is allowed to irradiate the filter glass.

Alignment protection goggles, conforming to European standard EN 208, reduce the visible laser radiation (400 - 700 nm wavelengths) to that of the power of laser class 2 (EN 60825-1). The laser radiation remains visible so as to allow the alignment protection glasses to be used for adjustment tasks while offering significant laser protection safety.

The **protection levels** (protection level RB..) describe the maximum power (watts) of a collimated laser beam that is allowed to irradiate the goggles.

Maximum power (EN 208): the maximum power of a laser beam in a specified wavelength range that is sufficiently attenuated by the alignment protection goggles (in accordance with EN 208).

Maximum transmission (EN 207): maximum transmission (minimum attenuation) in a specified wavelength range (according to EN 208).

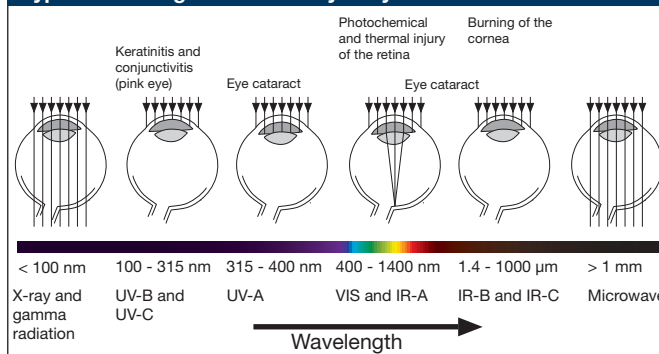
Maximum power density (EN 207): maximum power density that the filter glasses can withstand over a longer period (according to EN 207).

VLT: (visible light transmission): in addition to the specified wavelengths, laser protection goggles also attenuate the ambient light. The VLT is the percentage of daylight transmitted.


OD (optical density): logarithmic scale for the attenuation of radiation at a specified wavelength. The OD at wavelength λ is defined as:

$$OD(\lambda) = -\log_{10} \tau(\lambda)$$

Types of Damage Caused to Eyes by Radiation



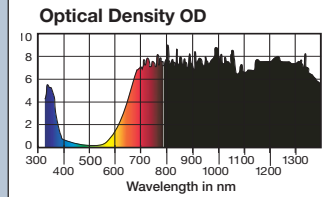
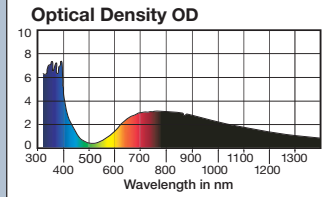
Insert for Spectacles



As an accessory for the laser protection goggles of type R01.T1A01 and R01.T1Q01, the insert RX7 for personal spectacles is available.
Order Code RX7

Please Note Typical density curves for the respective filters are shown for information only and are not guaranteed values. Only the protection levels (RB.. or LB..) are guaranteed by Schäfter+Kirchhoff.

Laser Alignment Goggles



Usable Range					
Protection	Wavelength [nm]	Pro-tection Level	max. Trans-mission (EN 207)	max. Power Density (EN 207)	max. Power (EN 208)
Alignment	630 - 690	RB2	-	-	100mW

Alignment protection goggles for cw lasers in the 630 - 690 nm wavelength range

Usable Range					
Pro-tection	Wavelength [nm]	Pro-tection Level	max. Trans-mission (EN 207)	max. Power Density (EN 207)	max. Power (EN 208)
Full	690 - 1320	LB5	10 ⁻⁵	10 ⁶ W/m ²	-
Full	1320 - 1550	LB2	10 ⁻²	10 ³ W/m ²	-

Allround goggles as full protection for cw lasers in the 690 - 1500 nm wavelength range

Laser Safety

According to DIN IEC 60825-1:2007, every laser system must be labelled with a **warning triangle**. Additionally, all lasers must be labelled with additional **warning information** specific to the laser class:

If the laser is enclosed but the housing can be opened then the housing must also be labelled with a warning triangle and the requisite information about the laser class, as listed below:

- Class 1:**
" CLASS 1 LASER PRODUCT "
- Class 1M:**
" LASER RADIATION, DO NOT VIEW DIRECTLY WITH OPTICAL INSTRUMENTS, CLASS 1M LASER PRODUCT "
- Class 2:**
" LASER RADIATION, DO NOT STARE INTO BEAM, CLASS 2 LASER PRODUCT "
- Class 2M:**
" LASER RADIATION, DO NOT STARE INTO BEAM OR VIEW DIRECTLY WITH OPTICAL INSTRUMENTS, CLASS 2M LASER PRODUCT "
- Class 3R:**
" LASER RADIATION, AVOID DIRECT EYE EXPOSURE, CLASS 3R LASER PRODUCT "
- Class 3B:**
" LASER RADIATION, AVOID EXPOSURE TO THE BEAM, CLASS 3B LASER PRODUCT "
- Class 4:**
" LASER RADIATION, AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION, CLASS 4 LASER PRODUCT "

- Class 1:** The laser is safe for any form of measurement task and the maximum permitted exposure (MPE) cannot be exceeded. Enclosed high power laser systems, with an integrated automatic shutdown system on opening of the enclosure, are also included in this laser class.
- Class 1M:** As for class 1, except when magnifying optics such as microscopes and telescopes are used: safety limits may be exceeded and class 3 dangers may be possible.
- Class 2:** Visible laser light (400 - 700 nm) with <1 mW continuous wave (CW) and/or <0.25s exposure time (with an energy limit according to the standard) is considered to be safe. Radiation either side of the 400 - 700 nm range is considered to be class 1.
- Class 2M:** As for class 2, except when magnifying optics such as microscopes and telescopes are used.
- Class 3R:** If handled carefully, the laser is considered safe because only a low risk of injury exists. Visible CW lasers in Class 3R are limited to 5 mW. For other wavelengths and for pulsed lasers, other limits apply.
- Class 3B:** Direct exposure is hazardous for the eye, but diffuse reflections such as from paper are not harmful. The limits apply to wavelengths and to operation mode (as for CW and pulsed lasers). Laser safety goggles are absolutely required when a direct view of the laser beam is at all possible. Class-3B lasers must be equipped with a isolating key switch and a safety interlock.
- Class 4:** Every type of laser beyond class 3B.

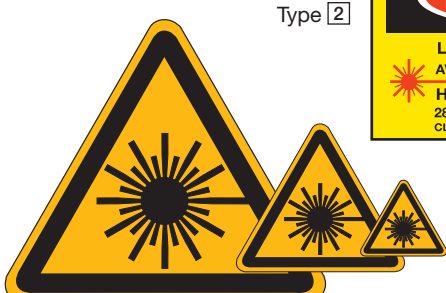
Furthermore, all lasers of class 2 to 4 must have a warning that lists the laser specifications, including the laser source, the wavelength and the laser power or pulse energy.

Laserstrahlung
nicht dem Strahl aussetzen
Laser Klasse 3B
Klassifiziert nach DIN EN 60825-1/05.2008

Type 1


Laser radiation
Avoid direct exposure to beam
Laser class 3B

$P_0 = \text{_____} \text{ W}$
 $\lambda = \text{_____} \text{ nm}$



Type 2

DANGER

LASER RADIATION
AVOID DIRECT EYE EXPOSURE

HeNe LASER
28mW MAX OUTPUT AT 633 nm
CLASS 3B LASER PRODUCT

Order Code	Size
SK-LB-T1	Triangle 10 mm
SK-LB-T2	Triangle 46 mm
SK-LB-T3	Triangle 92 mm
SK-LB-T4	Triangle 185 mm

SK-LB - 3B - 633 - 25 - HeNe - 100x50 - BI - E Order Code

Laser classification
1, 1M, 2, 2M, 3R, 3B
(see list above)

Wavelength [nm]

Laser power [W] or pulse energy [J]

Laser Type:
HeNe
Diode
Nd:Yag
others

Language:
E = English
D = German

Option:
E = Sign for removable enclosure
B = Basic information sign without specifications
I = Laser specification sign
BI = both B and I

Label size
105 x 52 mm type 1. .105x52
148 x 74 mm type 1. .148x74
64 x 34 mm type 2. . .64x34

Laser Diodes for Modular Laser Diode Collimating Systems (page 77ff)

Table 1 Technical Data and Appropriate Collimator Types (Please note that laser diodes are not sold separately)

Row	λ [nm]	P [mW]	LD Order Code	Single-/Multi-mode	θ_{\parallel} FWHM [°]	θ_{\perp} FWHM [°]	Casing	Pin-Out	25CM	55CM	90CM	29CM	95CM	40...-PO	40...-NO	48TE	48-0	20C, 20P	21C, 21P	22P	24PX	50BM	55BC
1 Fabry Perot																							
2	405	120	X15	S	9	19.5	5.6	F4	X	X	X					X		X	X	X	X		X
3	405	20	Y07	S	8.5	19	5.6	1	X	X	X							X	X	X	X	X	X
4	515	100	X17	S	8.5	21.5	5.6	F4	X	X	X							X	X	X	X	X	X
5	635	15	H10	S	8	28	9	3	X	X	X							X	X	X	X	X	X
6	639	30	H18	S	8	31	5.6	3		X	X											X	X
7	640	45	H22	S	9	21	5.6	3	X	X	X							X	X	X	X	X	X
8	659	120	M25	S	10.2	16.5	5.6	6		X	X					X							X
9	660	35	M01	S	9	22	5.6	2	X	X	X							X	X	X	X	X	X
10	660	60	M26	S	8.5	20.5	5.6	2	X	X	X							X	X	X	X	X	X
11	685	35	M21	S	10.5	19	5.6	2	X									X	X	X	X		
12	685	50	H13	S	8.5	21	5.6	2	X	X	X							X	X	X	X	X	X
13	785	8	M10	S	11	29	5.6	3	X									X	X	X	X		
14	785	120	Q06	S	9	16	5.6	3		X	X											X	X
15	825	200	M35	S	8	16	5.6	1						X									
16	830	50	H19	S	9	22	5.6	2	X									X	X	X	X		
17	830	150	N23	S	8	16	5.6	2		X	X												X
18																							
19																							
20																							
21 CircuLaser™ Diodes																							
22	635	5	B08	S	8	8	9	3				X	X					X	X	X	X	X	X
23	635	15	B07	S	8	8	9	3				X	X					X	X	X	X	X	X
24	639	35	B21	S	7.7	8	5.6	3				X	X					X	X	X	X	X	X
25	658	35	B09	S	8	8	5.6	2				X	X					X	X	X	X	X	X
26	658	120	B28	S	10	10	5.6	2				X	X										X
27	690	35	B12	S	8.5	8	5.6	2				X	X					X	X	X	X	X	X
28	785	90	B32	S	9	9	5.6	3				X	X					X	X	X	X	X	X
29	828	150	B30	S	7	7	9	2				X	X										X
30																							
31 DFB / DBR (S* narrow emission bandwidth because of integrated grating)																							
32	1065	120	sold by manufacturer	S*	11.5	30	9	1							X		X						
33	1305	6	sold by manufacturer	S*	25	30	5.6	4							X	X							
34	1550	6	sold by manufacturer	S*	25	30	5.6	4							X	X							
35	1850	5	sold by manufacturer **	S*	30	50	TO5	4							X		X						
36	1900	5	sold by manufacturer **	S*	30	50	TO5	4							X		X						
37	2334	3	sold by manufacturer **	S*	20	40	TO5	4							X		X						
38																							
39																							
40																							
41																							
42																							
43 Superluminescent Diodes																							
44	679 ± 4	10	sold by manufacturer ***				9	2							X		X						
45	860 ± 60	15	sold by manufacturer ****				TOW2								X		X						
46	650 ± 3	0.5	sold by manufacturer ****				TOW2								X		X						
47 VCSEL																							
48	760	0.3	sold by manufacturer *****	S	17 ± 7		TO46	3							X	X							
49	780	2.5	sold by manufacturer *****	S			TO46	2							X	X							
50	850	8	sold by manufacturer *****	S	29	29	TO46	6							X	X							

** sold directly by nanoplus *** sold directly by Qphotonics **** sold directly by Superlum ***** sold directly by U-L-M Photonics **Other diodes are available on request.**

Connection Types and Pin-Out

