

# Photronics Laser GmbH



**Laser Modules**  
for industrial and scientific applications

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## 1 Introduction

Photonic Laser GmbH offers diode as

- high quality OEM-systems with low prices
- with emission in the visible (395 nm – 488 nm, 635 nm – 690 nm, up to 500 mW) and
- near infrared region (780 nm – 1625 nm, up to 1 W)

with the following options:

- anamorphic corrected systems – microlens corrected systems
- line generating optics, diffractive optics
- fiber coupling with pigtail or FC/ST-connector, single-/multimode
- thermoelectric temperature control
- digital current-, temperature and power control
- external modulation (TTL) up to 20 MHz
- Low noise laser diodes, laser diode without speckles effects
- Cat Photon series, 120 mW @ 405 nm – 488 nm, modulation up to 600 MHz, fibre coupling

This brochure informs you about our laser diode modules PL (wavelengths between 635 nm and 1550 nm) and PLM (wavelength between 635 nm and 780 nm) laser diode modules.

Photonic Laser can offer modules with

- **attractive prices** and will
- **modify** them for your special application

The modules of the PL and PLM series are designed for **industrial** applications. But they also offer great advantages when used for **scientific** and **laboratory** applications.

In the modules of the PL series laser diode and power supply are integrated in the compact laser head. The modules of the PLM series have their power supply outside the laser head. Therefore the laser head has a very compact design.

We also offers the PLC series. The PLC modules are small lasers with **round beam**.

Other special laser diode modules from Sacher Lasertechnik GmbH are listed in a further catalogue. Would you like to know more about our products and services for a certain application? Please contact us:

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## 2 Laser Diode OEM-System PL

The laser diode module PL is designed for industrial applications where mechanical stability, good beam quality and long lifetime is required. The metal housing provides an excellent heat dissipation. It is possible to integrate the modules in metal holders having ground potential, because the housing is electrically isolated. The module can run in cw-mode or optionally be modulated up to 100 kHz. The focusing range is from 5 cm to infinite. In a distance of 25 m, for example, the laser produces a spot of approximately 5 mm x 12 mm. The module is offered as class 2 (DIN EN 60825-1, II, CDRH) or class 3B laser product with wavelength between 635 nm and 1550 nm. The module can be equipped with a power control potentiometer or with a digital input unit for modulation frequencies up to 100 kHz.



Our flexible production process enables us to modify the modules of the PL and PLM series to meet the special requirements of the customers. We can easily adjust the modules to fit your need concerning the dimensions, the length of wires or the optical components. We would like to discuss with you special needs to find the best solution.

### 2.1 Optics PL

For the modules PL we offer five different collimator- (option K1, K2, K3, K4, K5 and K6) and six line generation optics (option Z4, Z20, Z30, Z50, Z90 and Z100). The modular design enables to choose collimator and line generation optics independently. It is also possible to exchange the optical components. We continue in developing additional optics.

#### 2.1.1 Collimator optics (Option K1, K2 and K4 – K6)

For applications with high quality beam requirements we recommend the optics K1 to get the high quality. The central part of the laser beam is used by the optics and the efficiency is typically 55%. The optics K2 has a higher numerical aperture, which results in a higher output power of the laser module. Please request for option K2, if you choose optics K2.

The optics of option K1 is a collimator glass lens with antireflection (AR) coating. IT has a focal length of 11 mm.

The collimator lens K2 is also a glass lens with AR coating, mounted in a plastic ring. It has a focal length of 3.3 mm. The efficiency goes up to 70%. The exact value depends on the type of the diode. For example the modules PL 635-10 has an output power of 6.1 mW and PL 670-10 has an output power 5.5 mW.

Focal diameters in several distances (typical values for visible index-guided laser diodes):

Typical technical data of optics K1:

Distance	Focal diameter	Distance	Focal diameter
0 cm (Aperture)	2.5 x 6 mm	2 m	350 x 750 $\mu\text{m}$
5 cm	30 x 40 $\mu\text{m}$	5 m	1 x 2 mm
10 cm	35 x 35 $\mu\text{m}$	10 m	2 x 4 mm
50 cm	100 x 200 $\mu\text{m}$	25 m	5 x 12 mm
1 m	200 x 400 $\mu\text{m}$	50 m	12 x 30 mm
<b>Focal adjustment region</b>		5 cm – infinity	
<b>Deviation beam/housing</b>		$\leq 20$ mrad (depending on the diode)	

Typical technical data of optics K2:

Distance	Focal diameter	Distance	Focal diameter
0 cm (Aperture)	0,65 x 3,2 mm <sup>2</sup>	2 m	0,68 x 3,00 mm <sup>2</sup>
5 cm	65 x 90 $\mu\text{m}^2$	5 m	1,7 x 7,0 mm <sup>2</sup>
10 cm	35 x 160 $\mu\text{m}^2$	10 m	3,5 x 18 mm <sup>2</sup>
50 cm	210 x 740 $\mu\text{m}^2$	25 m	15 x 40 mm <sup>2</sup>
1 m	0,36 x 1,52 mm <sup>2</sup>	50 m	-
<b>Focal adjustment region</b>		5 cm – infinity	
<b>Deviation beam/housing</b>		$\leq 20$ mrad (depending on the diode)	

Typical technical data of optics K4 (standard lense PLL series, acrylic):

Distance	Focal diameter	Distance	Focal diameter
0 cm (Aperture)	4,3 x 1,0 mm <sup>2</sup>	2 m	0,8 x 2,1 mm <sup>2</sup>
5 cm	38 x 85 $\mu\text{m}^2$	5 m	2 x 5 mm <sup>2</sup>
10 cm	57 x 140 $\mu\text{m}^2$	10 m	4 x 15 mm <sup>2</sup>
50 cm	215 x 580 $\mu\text{m}^2$	25 m	15 x 30 mm <sup>2</sup>
1 m	0,40 x 1,15 mm <sup>2</sup>	50 m	-
<b>Focal adjustment region</b>		5 cm – infinity	
<b>Deviation beam/housing</b>		$\leq 20$ mrad (depending on the diode)	

Typical technical data of optics K5:

Distance	Focal diameter	Distance	Focal diameter
0 cm (Aperture)	3,2 x 4,0 mm <sup>2</sup>	2 m	420 x 610 $\mu\text{m}^2$
5 cm	13 x 16 $\mu\text{m}^2$	5 m	1,0 x 1,4 mm <sup>2</sup>
10 cm	24 x 32 $\mu\text{m}^2$	10 m	6 x 6 mm <sup>2</sup>
50 cm	110 x 150 $\mu\text{m}^2$	25 m	7 x 10 mm <sup>2</sup>
1 m	210 x 300 $\mu\text{m}^2$	50 m	-
<b>Focal adjustment region</b>		5 cm – infinity	
<b>Deviation beam/housing</b>		$\leq 20$ mrad (depending on the diode)	

K5 has a small numerical aperture and efficiency of 20%. This optics is used to get a round beam shape which is important for a lot of measurements/alignment applications where you do not need much power.

Typical technical data of optics K6:

Distance	Focal diameter	Distance	Focal diameter
0 cm (Aperture)	1,6 x 5,7 mm <sup>2</sup>	2 m	-
5 cm	38 x 52 μm <sup>2</sup>	5 m	-
10 cm	40 x 83 μm <sup>2</sup>	10 m	-
50 cm	170 x 330 μm <sup>2</sup>	25 m	-
1 m	250 x 670 μm <sup>2</sup>	50 m	-
<b>Focal adjustment region</b>		5 cm – infinity	
<b>Deviation beam/housing</b>		≤ 25 mrad (depending on the diode)	

For applications that need high beam quality together with optimised power output the optics K6 should be used. The K6 is AR coated and has an efficiency about 60%.

### 2.1.2 Line generating optics (Option Z)

At deadline of this brochure six different line generating optics are available. A line of light is a form of a fan is projected by the optics of option Z. An angle of divergence between 4° and 100° can be chosen which corresponds to a length of the line between 15 cm and 2,4 m in a distance of 1 m. The line generating optics is put on the module. Therefore, the focus of the collimator lens can be adjusted independently from the line generating optics. The angles of divergence of our standard line generation optics are in the following table. Please request for other modifications. When using line generation optics class 3B lasers can often be classified to class 3A which allows to use the laser in public.



Option	Angle of divergence	Max. power for class 3A
Z 4	4°	-
Z 20	20°	2.5 mW
Z 30	30°	3.8 mW
Z 50	50°	5 mW
Z 90	90°	5 mW
Z 100	100°	5 mW

### 2.1.3 Fixed focus (Option F)

Option F enables to fix the focus with a fixing screw to a distinct distance. This ensures a good beam pointing stability even in demanding working conditions like strong vibrations.

## 2.2 Electronics PL

### 2.2.1 Input voltage

The laser modules need an input voltage of

- 5.0 – 7.0 VDC or
- 6.0 – 7.0 VDC,

depending on the operation current being lower or higher than 80 mA. For laser modules with a laser power higher than 20mW the current is higher than 80mA. The mains voltage should not exceed the allowed input voltage. Please pay attention to induced high voltage spikes, which could be caused by inductive elements being switched on or off.

<b>Operation Current</b>	30 – 250 mA	<b>Power-on delay</b>	< 5 ms
<b>Mode of operation</b>	power stabilised	<b>Polarity protection</b>	built in
<b>Low pass filter</b>	built in	<b>Noise (rms)</b>	0,25 %

### 2.2.2 Low voltage option (Option N)

For laser diodes with an operation current lower than 80 mA the low power option N is available. The modules of option N operate with an input power of

- 2.7 – 5.0 VDC, Option N

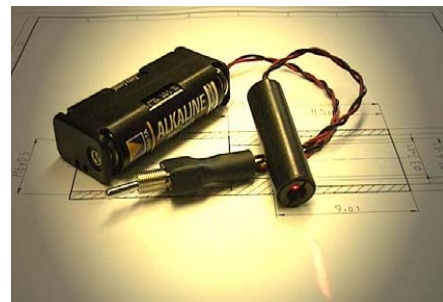
instead of 5.0 VDC – 7.0 VDC. Therefore the laser diode modules can be used with two 1.5 V batteries.

### 2.2.3 Operation with Battery (Option B)

By choosing option B you will receive a complete system working without any main voltage. The system consists of PL laser diode modules, Option N, battery clip for two mignon cells and an on/off switch.

With alkali cells a PL 670-5 module operates more than 12 hours.

As an extra equipment rechargeable accumulators “AccuCell” can be delivered. AccuCell enables to operate a PL 670-5 module without recharging over a period of about 8 hours.



## 2.2.4 Modulation option

### 2.2.4.1 Digital Modulation (Option M)

The module PL can be equipped with a digital modulation input. This implies an additional wire (green) which can be connected to a signal voltage supply. The ground potential of the power supply and the ground potential of the signal voltage supply must be connected. The laser can be switched on and off by changing the signal input voltage. Voltages of -5 to +10 V can be applied, but the recommended signal is a -5 V the laser TTL input. Above 2.5 V the laser will run at nominal output power, below 0.5 V the laser is switched off. The control circuit provides a delay between input signal and output power. The higher the frequency, the lower the modulation depth and the higher the harmonic distortion will be. For an PL 650-3-M e.g. a modulation depth of > 95 % at 2 kHz TTL-input and about 80 % at 100 kHz TTL-pulse is typical. At 150 kHz the output signal becomes sinusoidal and a phase shift occurs. When the laser is turned off by signal voltage, it can emit remaining light, typically 1 % of the nominal power. Even the modulated unit works in real peak power control mode, which makes them easier to handle than current controlled or mean power controlled devices.

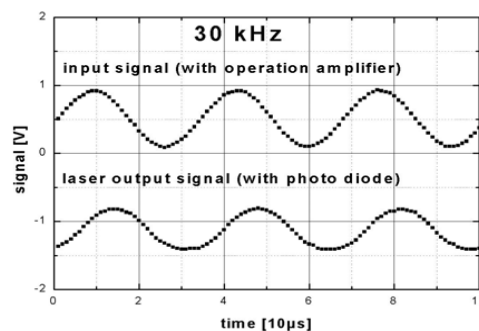
Requirements for the signal voltage source are:

<b>Output current</b>	Max. 1 mA	<b>Laser on</b>	$U < 2.5 \text{ V}$
<b>Allowed signal range</b>	-5 to 10 V	<b>Laser off</b>	$U > 0.5 \text{ V}$
<b>Absolute maximum frequency*</b>	300 kHz (no function)	<b>Recommended maxim. Frequency*</b>	10 kHz – 100 kHz

\*The modulation frequency should not be higher than the absolute maximum frequency. The recommended maximum frequency is given by a modulation depth which is at least 80 % and depends on the type of diode. The maximum modulation frequency depends on the diode and the required output power.

### 2.2.4.2. Analog Modulation (Option A)

The analog modulation - option A - allows to regulate the output power of the module by changing the feeding voltage. This voltage has to stay within a range of 0 up to 1,22 VDC. Applying 0 V results in max. optical output power. Apart from this a typical analogic signal like a sinus function (picture) can also be realised (offset plus sinus in the mentioned voltage range). Our measurement shows that at 30 kHz modulation frequency the sinus function is well reproduced.



## 2.2.5. Power Control

With the options R1 and R2 you can set the power of the laser diode modules with an internal or external potentiometer, respectively.

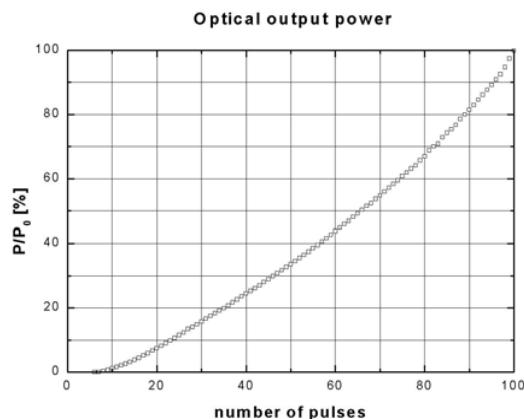
The modules with option R1 are equipped with a multiple-thread potentiometer. The power being controlled can be set infinitely variable between maximum power and 5% - 25% of the maximum power, depending on the type of the laser diode. The power control potentiometer is projected about 2 mm - 4 mm above the backside of the modules.

### 2.2.5.1. Open Resistance Wire (Option R2)

The modules with option R2 have an open resistance wire to set the laser power being controlled with an external potentiometer by the customer. The potentiometer should have a resistance between 100 kΩ and 200 kΩ, depending on the type of the laser diode.

### 2.2.5.2. Digital Potentiometer (Option R3)

The digital potentiometer - option R3 - allows the serial adjustment of the optical output power by applying TTL pulses. The input of the potentiometer consists of five input wires. Two of them are used for the power supply. One is for the selection of in- or decrementation respectively. One wire is for the TTL pulse input and one is to store the actual power value. The resolution for the power adjustment is given by 96 steps. When the whole adjustment range from 0% to 100% is not demanded we can e.g. pre-set a range from 30% to 100% which results in an increase of the adjustment resolution.



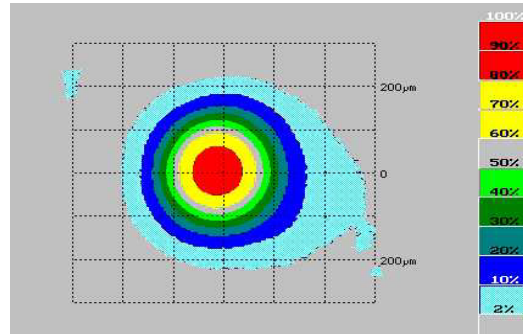
## 2.3. Mechanics PL

Housing with collimator optics: brass, black anodised,  
length: 40 mm, diameter: 12 mm, weight: < 20 g

Module with collimator and line generating optics: length: 50 mm, diameter: 14 mm.

### 3. Laser Diode Modules PLC

With the PLC-series we have realised an laser diode module with an almost round beam. This is realised by the use of diodes equipped with a high quality micro lens which establishes the anamorphic beam correction. Instead of the conventional beam correction done with prisms or fibre coupling this method provides you with modules with a nearly gaussian beam profile and very small size of  $\varnothing$  12 mm and length of 40 mm. The much better efficiency of the output power of the laser diode is a further advantage of the PLC-series. A loss of only 7 % has to be taken into account using the standard collimating lens K1. For standard OEM-lasers 50 % is a typical value.

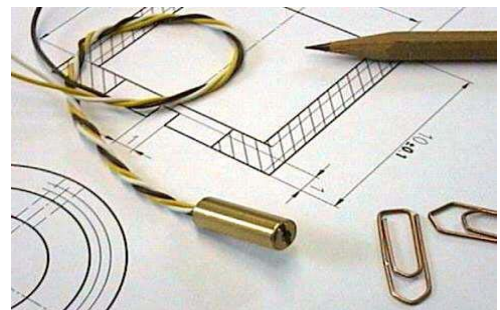


The picture shows a PLC module with 635 nm focused on a distance of 1 m, forms a nearly round beam with a  $M^2$  value of better than 1.2. Concerning the electrical and mechanical attributes the PLC modules are identically with the PL modules. This implies that the same options are available.

With the PLC series you now have an attractive substitute for your HeNe laser.

### 4. Laser Diode OEM-System PLM

The PLM miniature laser system consists of a laser head containing a collimator lens (diameter: only 7 mm, length: 22 mm) and a separate power supply. The power supply is compound-filled, the size of its housing is 25 mm x 12 mm x 8 mm. The length of the wires between laser head and power supply is 10 cm. The system can be delivered with a power of 1 mW (Class 2, DIN EN 60825-1) or 2 mW (Class 3B). The wave-lengths can be seen in the specification table.



#### 4.1. Optics PLM

The focus is adjustable between 3 cm and infinite with same properties as the PL module. The collimator lens is made of acrylic and is fixed with an adjustment screw.

#### 4.2. Electronics PLM

The electronic parameters of the PLM module are the same as those of the PL module. It is also available with low voltage option **N**, power control potentiometer **R1** and modulation option **M**.

### 4.3. Mechanics PLM

The housing of the laser head is made of brass without electrical isolation. By mounting into a system the customer has either to isolate it or alternatively use an extra power supply (galvanic separated) for the laser system.

## 5. Temperature Controlled Laser Diode Module PLT / PLTC

The Temperature Controlled laser diode module series PLT/PLTC is providing excellent stability of the optical output power of single mode diodes in a compact system. The laser diode module can be flexibly used according to many required applications.

The PLT fulfils the specifications of a HeNe-laser and is suitable for many applications including spectroscopy, reprographics, holography, medical and biotechnology. The laser meets the requirements for both commercial and research applications.

In addition the PLT can be equipped with blue emitting laser diodes (405 nm and 488 nm).

The PLT is available with internal (IPS) and external (EPS) power supply. The external power supply can be delivered with a 100 - 240 VAC option.



#### Technical Data:

<b>Power</b>	Up to 200 mW
<b>Power stability (peak to peak, 4h)</b>	> 0,5 %
<b>Noise (peak to peak, 0 Hz – 20 MHz)</b>	> 0,5 %
<b>Coherence length</b>	< 10 m
<b>Operating voltage</b>	12 VDC +/- 0,25 VDC 100 – 240 VAC (EPS option)
<b>Operating current</b>	0 A – 3 A
<b>Max. environmental temperature</b>	45°C
<b>Dimensions – IPS</b>	Ø = 40 mm, L = 256 mm
<b>Dimensions – EPS</b>	Ø = 40 mm, L = 90 mm (laser head) LxWxH 210x100x105 mm (power supply)
<b>Warm up period</b>	5 minutes
<b>Modulation capability</b>	Up to 100 MHz

### 5.1. Optics PLT / PLTC

The PLT- and the PLTC-module are equipped with a K1 – lens and therefore have the same optical specifications as the PL- and the PLC-module. The focal diameters corresponding to the distance between laser diode and focal point are listed on page 7. In the table on page seven the smaller value corresponds to the focal diameter of the round beam.

## 5.2 Model overview PLT/PLTC

Model	Max. output power with optics K1	Laser class with optics K1
PLT 405-5	1,0 mW/2,5 mW*	2 / OEM (3B)
PLT 635-5	1,0 mW/2,5 mW*	2 / OEM (3B)
PLT 635-10	2,5 mW*	OEM (3B)
PLT 635-15	8 mW*	OEM (3B)
PLT 650-5	1,0 mW/2,5 mW*	2 / OEM (3B)
PLT 658-35	17 mW*	OEM (3B)
PLT 670-5	1,0 mW/2,5 mW*	2 / OEM (3B)
PLT 670-10	5 mW*	OEM (3B)
PLTC 635-3	1,0 mW/2,5 mW	2 / OEM (3B)
PLTC 635-5	4,3 mW	OEM (3B)
PLTC 635-10	8,4 mW	OEM (3B)
PLTC 635-15	13 mW	OEM (3B)
PLTC 655-5	4,3 mW	OEM (3B)
PLTC 658-35	30 mW	OEM (3B)
PLTC 670-5	1,0 mW/4,3 mW	2 / OEM (3B)
PLTC 670-10	8,4 mW	OEM (3B)
PLTC 685-35	30 mW	OEM (3B)
PLTC 785-40	34 mW	OEM (3B)
PLTC 785-50	42 mW	OEM (3B)

\* To classify the laser modules as class 2 lasers the maximal output power can be limited to < 1.0 mW

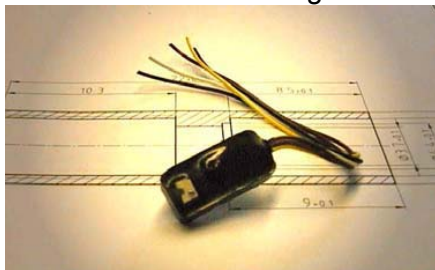
## 6. Accessories

**PL-ACPS:** 230 VAC power supply, Output voltage 4.5 VDC or 6 VDC, max. current 650 mA, very stable, without spikes, optimal for laser diode modules or diode pumped YAG-lasers. Size: app. 70x100x50 mm<sup>3</sup> plus connector.



**PL-Steck:** Connector plugs are adapted to the input power wires. With this option and the power supply PL-ACPS the laser diode module is ready to operate. Generally modules with option M can be as well offered with different connectors. For compatibility reasons the customer has to determine the type of connectors.

**PL AC B 1000:** Rechargeable Alkali-Manganese Battery Mignon 1000 mAh (AccuCell)



**PL AC L 62:** Charging Station for AccuCell Battery PL AC B 1000

**Power Supply PL:** The Power Supply PL is part of modules PLM. Therefore, we can offer these drivers for an attractive price. It can be used for n-, m- and p-type laser diodes or laser diode modules, also for laser modules from other suppliers. It has a protecting plastic

housing. The dimensions are 25x12x8 mm<sup>3</sup>. Please tell us when you need it for p-type laser diodes.

Model	PL PS 3/100	PL PS 5/500	PL PS 5/1500	PL PS 3/1500M	PL PS 5/500M	PL PS 5/1500M
Operation conditions	CW	CW	CW	Modulated	Modulated	Modulated
Modulation signal	-	-	-	external TTL	external TTL	external TTL
Max. frequency	-	-	-	100 kHz	100 kHz	100 kHz
Input voltage	2.7 – 5V	5 – 7 V	5 – 7 V	2.7 – 5 V	5 – 7 V	5 – 7 V
Max. laser-diode current	100 mA	200 mA	200 mA	100 mA	200 mA	200 mA
Cable length	10 cm	10 cm	10 cm	10 cm	10 cm	10 cm
n/m-type	ok	ok	ok	ok	ok	ok
p-type	ok	ok	ok	ok	ok	ok
Min. monitor-diode current	0.04 mA	0.015 mA	0.04 mA	0.04 mA	0.015mA	0.04 mA
Max. monitor-diode current	1.5 mA	0.5 mA	1.5 mA	1.5 mA	0.5 mA	1.5mA

## 7. Model Overview

Model	Maximum output power with Optics K1	laser class with Optics K1	laser class with line generating optic
PL 635-5	1.0 / 2.5 mW*	2 / OEM (3B)	2 / 3A / OEM (3B)
PL 635-10	5.0 mW	OEM (3B)	3A / OEM (3B)
PL 635-15**	8.0 mW	OEM (3B)	OEM (3B)
PL 650-5	1.0 / 2.5 mW*	2 / OEM (3B)	2 / 3A / OEM (3B)
PL 650-5(70) (70°C)	1.0 / 2.5 mW*	2 / OEM (3B)	2 / 3A / OEM (3B)
PL 658-35	17 mW	OEM (3B)	3A / OEM (3B)
PL 670-5	1.0 / 2.5 mW*	2 / OEM (3B)	2 / 3A / OEM (3B)
PL 670-10	5.0 mW	OEM (3B)	3A / OEM (3B)
PL 690-50	25 mW	OEM (3B)	OEM (3B)
PL 780-5	2.5 mW	OEM (3B)	OEM (3B)
PL 780-10	5.0 mW	OEM (3B)	OEM (3B)
PL 780-35	20 mW	OEM (3B)	OEM (3B)
PL 780-40	24 mW	OEM (3B)	OEM (3B)
PL 820-20	12 mW	OEM (3B)	OEM (3B)
PL 820-40**	24 mW	OEM (3B)	OEM (3B)
PL 980-5	2.7 mW	OEM (3B)	OEM (3B)
PL 1300-10	5.5 mW	OEM (3B)	OEM (3B)
PL 1550-5	2.7 mW	OEM (3B)	OEM (3B)
PL 1550-10	5.5 mW	OEM (3B)	OEM (3B)
PLC 635-5	4.3 mW	OEM (3B)	-

<b>PLC 635-10</b>	8.4 mW	OEM (3B)	-
<b>PLC 635-15</b>	13 mW	OEM (3B)	-
<b>PLC 635-35</b>	30 mW	OEM (3B)	-
<b>PLC 670-5</b>	1.0 / 4.3 mW	2 / OEM (3B)	-
<b>PLC 670-10</b>	8.4 mW	OEM (3B)	-
<b>PLC 685-35</b>	30 mW	OEM (3B)	-
<b>PLC 785-50</b>	40 mW	OEM (3B)	-

<b>PLM 635-5</b>	1.0 / 2 mW*	2 / OEM (3B)	-
<b>PLM 650-5</b>	1.0 / 2 mW*	2 / OEM (3B)	-
<b>PLM 670-5</b>	1.0 / 2 mW*	2 / OEM (3B)	-
<b>PLM 780-5</b>	2 mW*	OEM (3B)	-

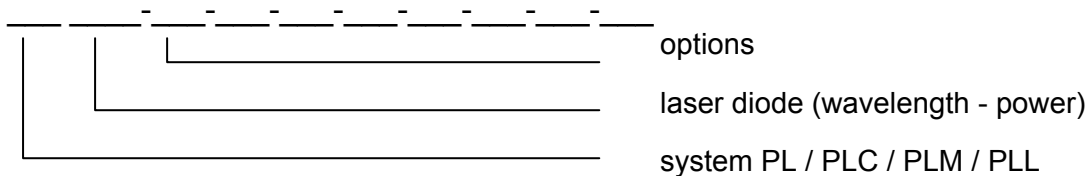
\*)To classify the laser modules as class 2 lasers (Class 2, according to DIN EN 60825-1, Class II CDRH) we can limit the maximum power to 1.0 mW.

\*\*)As one exception of PL Series the electronics of modules PL 635-15 is outside the laser head.  
Laser diodes with other wavelengths and output powers could be delivered if requested.

**Please, term the output power for your needs in your order.**

The laser diode modules are OEM systems. They have no light indicator lamp and mechanical shutter as requested for independent laser systems. The customer must consider the safety instructions according to DIN EN 60825-1 or CDRH.

## 8. Example for ordering and compatibility



**options:**

- |                               |                                  |                                    |
|-------------------------------|----------------------------------|------------------------------------|
| Z: line generation optics     | K: collimator optics for PL      | R: power control option (optional) |
| Z4: divergence angle = 4°     | K1: high beam quality (standard) | R1: power control potentiometer    |
| Z20: divergence angle = 20°   | K2: high laser power             | R2: open resistance wire           |
| Z30: divergence angle = 30°   | K3: round beam, 20% eff.         | R3: digital potentiometer          |
| Z50: divergence angle = 50°   | F: fixed focus                   | M: modulation option               |
| Z90: divergence angle = 90°   |                                  | A: analogue modulation             |
| Z100: divergence angle = 100° | N: low voltage option            |                                    |
|                               | B: operation with battery        |                                    |

**example:** PL 635-3 - K2 - Z30 -F - M

You can combine all options for all PL modules. There are only some exceptions. The modules PL 690-30, PL 780-35, PL 780-40, PL 820-20, PL 820-40 could not be supplied with option N. Option M and N are incompatible.

## 11. Warranty

The laser diodes of PL Series with wavelengths equal or higher than 650 nm have a warranty of one year after day of delivery. Laser modules of 635 nm have a warranty of 6 month. If you speak with us about your applications, we can advise you how to have a longer life time for your laser diode modules. This warranty does not apply to equipment and components that are defective or unworkable, because of abuse, mishandling, misuse alteration, negligence, improper installation, damage in transit, or other causes beyond the control of our factory.

## 12. Safety Precautions

The output power can be limited to 1 mW (class 2 after DIN EN60825-1, II CDRH) or 5 mW (class 3B). Models with line generating optics are classified in dependence of the optics as Class 2, 3A or 3B lasers. All models with higher power or emission in the Infrared are OEM-components and not complete laser systems.

The system should be classified to a higher laser class if the optics are removed or exchanged.

You must take attention to the safety requirements with lasers to protect your eyes. Laser emit sufficient optical power to constitute a possible hazard to the human eye. For example safety requirements are described in the DIN EN60825-1.

- Avoid direct exposure to the beam. Do not look into the laser beam, nor directly neither with optical instruments.
- • Installation of an area with limited access. Access to this area should only be possible and allowed for personnel familiar with laser safety precautions and their use.
- • Warning labels must be installed in clearly visible positions at all accesses to the laser operating area.
- • Wherever possible the beam should be guided totally encapsulated in order not to allow direct access to the laser beam.
- • Uncontrolled escape of the laser beam from the working area is to be avoided by use of appropriate means (e.g. additional protection shields or walls). After the beam has crossed the experimental or working area, it must be blocked and safely absorbed by a suitable target.
- • The laser beam should be guided above or below, but not at eye level.
- • Wear laser safety goggles at all time, if the set-up is working with access to free laser beam. Do not look directly into the laser beam or reflections from mirror or any polished surface. The selection of appropriate laser safety goggles depends on output power, energy and wavelength of the laser beam and also on the operating conditions. Laser safety goggles can be supplied by Photonics-Laser.



### **Safety requirements**

**Please notice, our laser modules are designed to be incorporated into the customers endproducts. Therefore, they do not comply with safety requirements of EN60825 and FDA21CFR. The customer is responsible that his system complies with that requirements. Of course we consult our customers about those requirements and will develop for him end-user version on request.**