MULTI-LASER PLATFORM

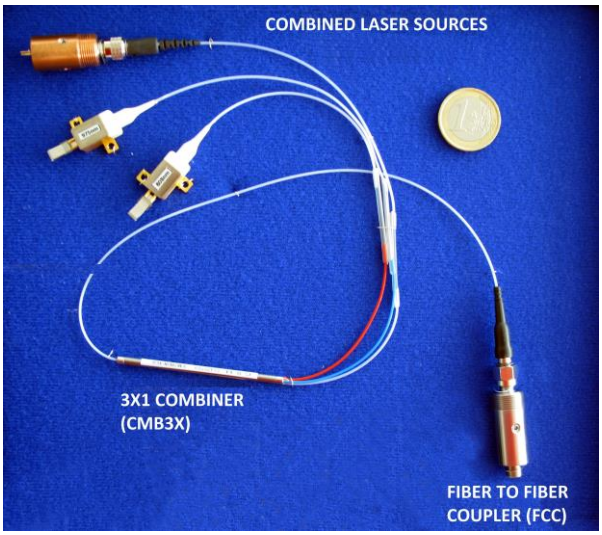
Multi-Laser Platform **(MLP)** is a modular solution based on power laser diodes to build photonic systems for OEM applications. Typical OEM applications where MLP can be used are:

- Industrial systems for laser marking of different materials, monitoring systems, dimensional control;

- Medical systems for therapy and surgery that often need the integration of laser diodes providing optimal levels of optical power at different wavelengths; laser therapy cycles on humans and animals have been proven to be more effective if specific laser wavelengths were mixed improving the light selective penetration and bio-stimulation of treated tissues; the combination of multi laser wavelengths in laser surgery may be used to increase the system power density and to improve the surgery results yielding reduced damage of tissues and accelerated post-operation healing.

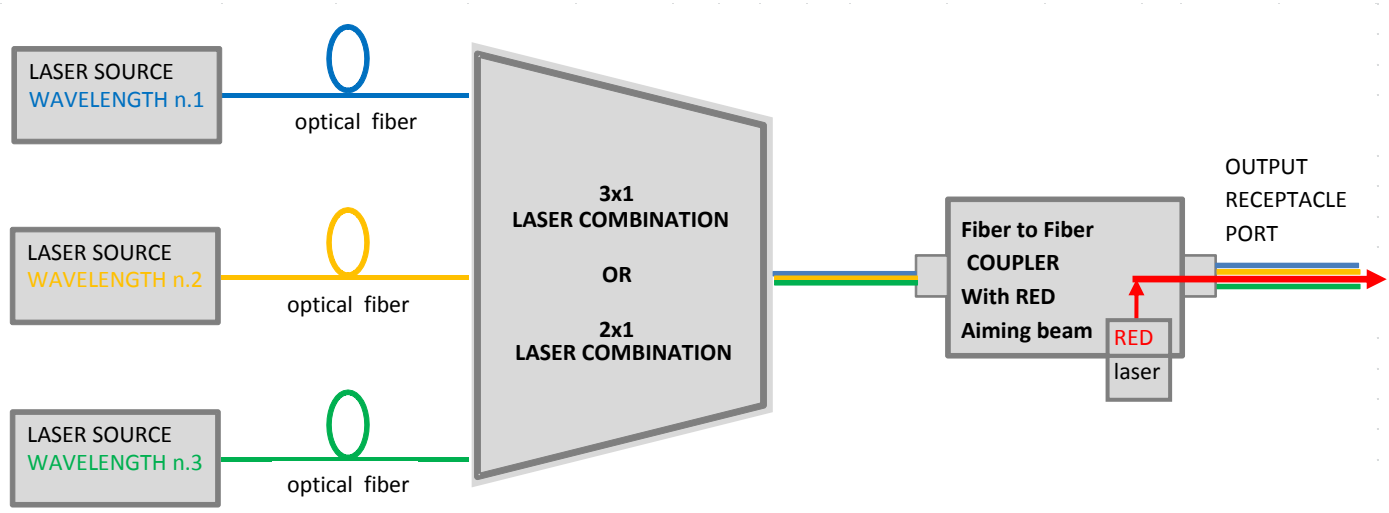
Furthermore, the coaxial integration of a visible light (generally low power red source) to the power primary beam helps the final user in highlighting the treatment zone.

LaserPoint invested a lot of efforts in R&D and Engineering to provide OEMs of industrial and medical machines with a cost effective, easy to integrate, reliable and modular multi-wavelength photonic platform. The Multi-Laser Platform is based on the functional optical building blocks as shown in the block diagram and description below; these building blocks can be easily selected by OEMs to match their needs for any specific applications. LaserPoint based the design of its multi-laser platform on high reliability optical components sourced from world leading manufacturers and on proprietary, robust optical solutions.



MULTI – LASER PLATFORM

1. BLOCK DIAGRAM AND FUNCTIONAL DESCRIPTION



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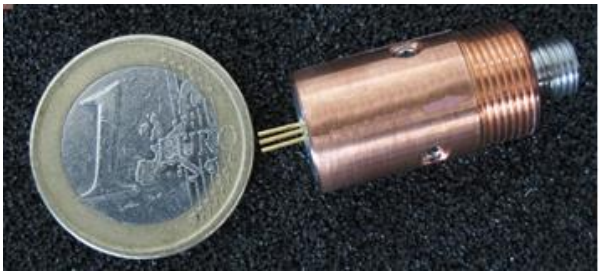
1.1. LASER DIODE SOURCES

Different laser diode sources are available in the MLP, operating at different wavelengths and power levels. Two types of laser diode sources can be provided in MLP: Fiber Coupled Laser Diode **(FCLD)** and Fiber Pigtailed Laser Diodes **(FPLD)**. In the Fiber Coupled Laser Diodes Laserpoint proprietary opto-mechanical designs are used to maximize the optical coupling efficiency (> 95%) between the laser diode source in TO package and the output fiber with core diameter down to 50μm. Laser Diode sources can be further coupled using Multi Laser combination to mix together different wavelengths or to increase to optical power at a specific wavelength.



FIBER COUPLED LASER DIODE (FCLD)

1.2. LASER DIODE MODULES

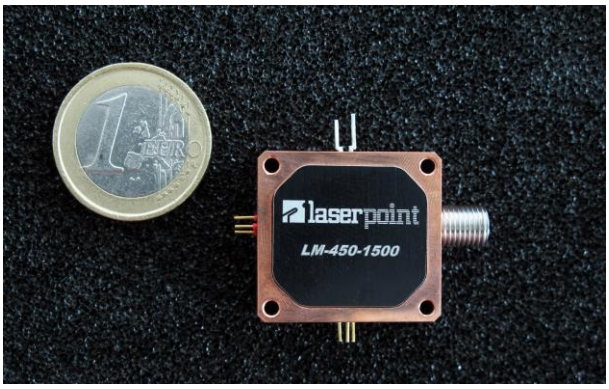
Laser Diodes Module (LM) product family is based on Laserpoint proprietary opto-mechanical designs able to:

- maximize the optical coupling efficiency (> 95%) between the laser diode source in TO package and the output fiber with core diameter down to 50 μm;
- add specific functionalities as integrated red aiming beam, photodiode for output power monitoring, temperature monitor, ect;
- mix different wavelengths from laser diode sources;
- increase output power at one wavelength combining multiple laser diode sources emitting at that specific wavelength.

LM product family may be customized according to customer requests in term of mechanical design, on board functionalities availability, different wavelengths and power level (ask to Laserpoint team for your customized Laser Diode Module Solution).

LM-450-1500-R is a Laser Diode Module operating at nominal wavelength of 450nm providing 1500mW output power in 105 μm core output fiber together with integrated red aiming beam.

LM-450-1500-R has an integrated photodiode to monitor output power.



LASER DIODE MODULE: LM-450-1500-R

1.3. MULTI LASER COMBINATION (CMB3X / CMB2X)

The core functionality of the MLP is the mixing of different laser wavelength beams, or the mixing of the same laser wavelength to scale up laser power, on a single small core output fiber using “All fiber” technologies to guarantee system long term stability and reliability. Presently this platform can integrate up to 3 different wavelength power diodes ranging from 600nm to 1000nm. The excellent optical transmission of this “All fiber“ technology, makes this platform power tolerant minimizing optical losses and allowing to efficiently deliver a total laser power up to 12 W without heat sinking the wavelength combiner and far beyond 12W if a heat sink is used. The interfacing of the main functional block with the user fiber is assured by a Fiber to Fiber coupler that allows an efficient, reliable and repeatable optical coupling of the multi-wavelength power into the end user optical fiber.

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1.4. 'FIBER to FIBER' COUPLER WITH RED BEAM POINTER (FFC-R)

FFC-R is a Fiber to Fiber coupler ideal to efficiently couple the single or combined wavelength power laser beam(s) into the user (output) fiber. Its coupling design based on free space lens ensures a reliable and repeatable delivery of laser power into the user fiber, hence right to the working area. This device is suitable to couple laser power into larger core output fibers with output fiber/input fiber core ratio ≥ 1.5.
Additionally to the efficient coupling of the power (primary) laser beam, FFC-R integrates the wavelength combination of a bright red secondary (aiming) beam coaxially coupled into the user (output) fiber.
Class III B laser diodes with therapeutic function operating at 660nm can be efficiently coupled as an option using the same mechanical design of the coupler (FFC-660 code).
FFC-R can be provided without the red beam pointer (FFC).

IBER TO FIBER COUPLERS WITH RED BEAM POINTER : FFC-R

FIBER TO FIBER COUPLER WITH 660nm LASER DIODE: FFC-660

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2. TECHNICAL SPECIFICATIONS (specifications are subject to change without notice)

2.1. LASER DIODE SOURCES:

LASER DIODE TYPE				FIBER PIGTAILED LD				FIBER COUPLED LD	
P/N:				(**)				FCLD-660-100	FCLD-450-1200
NOMINAL WAVELENGTHS		nm		975	940	915	812	660	450
WAVELENGTH OPERATING RANGE		nm	MIN	963	928	905	804	652	440
			MAX	985	950	928	820	664	460
FIBER COUPLED OUTPUT OPTICAL POWER		W	Typ	10	10	10	4.5	0.110	1.2
			MIN	9.5	9.5	9.5	4.0	0.105	1.1
FORWARD CURRENT		A	Typ	11.8	11.7	11.4	5.3	0.175	1.2
			MAX	13.0	12.8	12.5	6.3	0.210	1.5
VOLTAGE		V	Typ	1.81	1.81	1.81	2.0	2.5	4.8
			MAX	2.0	2.0	2.0	2.1	3.0	6.0
OPERATING TEMPERATURE		°C		25	25	25	25	25	25
PACKAGE TYPE (See Par. 3)				S1	S1	S1	S1	S2	S6
MAX ABS. RATING	FORWARD CURRENT	A	MAX	14	14	14	6.5	0.22	1.6
	REVERSE VOLTAGE	V	MAX	2	2	2	2	2	20 mA (*)
OUTPUT FIBER		Fiber Core Diameter: 105 µm, NA 0.22							

(*): reverse current

(**): FPLD are only provided with Fiber to Fiber Coupler (FFC) to efficiently couple the power laser beam into the user (output) fiber together with red aiming beam (FFC-R) or with 660nm therapeutic laser beam (FFC-660). See specific P/N for FPLD with FCC option in the selection table (Par. 4).

2.2. LASER DIODE MODULES:

P/N:				LM-450-1500-R
NOMINAL WAVELENGTHS		nm		450
WAVELENGTH OPERATING RANGE		nm	MIN	440
			MAX	460
FIBER COUPLED OUTPUT OPTICAL POWER (*)		W	MAX	1.5
			MIN	1.3
RED POINTER BEAM POWER RANGE		mW	MAX	1
			MIN	0.35
FORWARD CURRENT (**)		A	Typ	1.2
			MAX	1.5
VOLTAGE		V	Typ	4.8
			MAX	6.0
OPERATING TEMPERATURE		°C		25
MECHANICAL DIMENSION		mm	Typ	26 x 24 x 9
MAX ABS. RATING	FORWARD CURRENT	A	MAX	1.6
	REVERSE CURRENT		MAX	0.02
MONITOR PHOTODIODE MAX. ABS RATING REVERSE VOLTAGE		V	MAX	20
MONITOR PHOTODIODE - PHOTOCURRENT		µA	Typ	18
OUTPUT FIBER		Fiber Core Diameter: 105 µm; N.A.: 0.22		
OUTPUT CONNECTOR		SMA 905		
PACKAGE TYPE (See Par. 3)		S5		

(*): OUTPUT FIBER WITH AR COATING

(**): MAX Forward current is specified for each module in the test sheet provided with it.

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2.3. COMBINED LASER SOURCES:

The following table shows laser diode sources that can be mixed together using laser combination (CMB)

COMBINED LASER SOURCE TABLE:

NUMBER FOR WAVELENGTH SELECTION				1	2	3	4	5
NOMINAL WAVELENGTHS		nm		975	940	915	812	660
WAVELENGTH OPERATING RANGE		nm	MIN	963	928	905	804	652
			MAX	985	950	928	820	664
FIBER COUPLED OUTPUT OPTICAL POWER		W	Typ	9.5	9.5	9.5	4.3	0.105
			MIN	9.0	9.0	9.0	3.8	0.100
FORWARD CURRENT		A	Typ	11.8	11.7	11.4	5.3	0.175
			MAX	13.0	12.8	12.5	6.3	0.210
VOLTAGE		V	Typ	1.81	1.81	1.81	2.0	2.5
			MAX	2.0	2.0	2.0	2.1	3.0
OPERATING TEMPERATURE		°C		25	25	25	25	25
PACKAGE TYPE (See Par. 3)				S1	S1	S1	S1	S4
MAX ABS. RATING	FORWARD CURRENT	A	MAX	14	14	14	6.5	0.22
	REVERSE VOLTAGE	V	MAX	2	2	2	2	2
OUTPUT FIBER		Fiber Core Diameter: 200 μm, NA 0.22						

2.4. 3 X 1 LASER COMBINATION (CMB3X)

It allows to mix 3 laser sources from the above Combined Laser Source table.

LASER SOURCE COMBINED	n°	MAX	3
TOTAL FIBER COUPLED OUTPUT OPTICAL POWER	W	MAX	12 (*)
OUTPUT N.A.		MAX	0.22
OPERATING CASE TEMPERATURE	°C	MAX	40
OUTPUT FIBER CORE	μm	TYP.	200/220
OUTPUT FIBER PIGTAIL	μm	TYP.	900
OUTPUT CONNECTOR			SMA 905
Dimensions (diameter x length)	mm	TYP.	3 x 65

(*): combiner without heat sinking

2.5. 2 X 1 LASER COMBINATION (CMB2X)

It allows to mix 2 laser sources from the above Combined Laser Source table.

LASER SOURCE COMBINED	n°	MAX	2
TOTAL FIBER COUPLED OUTPUT OPTICAL POWER	W	MAX	12 (*)
OUTPUT N.A.		MAX	0.22
OPERATING CASE TEMPERATURE	°C	MAX	40
OUTPUT FIBER CORE	μm	TYP.	200/220
OUTPUT FIBER PIGTAIL	μm	TYP.	900
OUTPUT CONNECTOR			SMA 905
Dimensions (diameter x length)	mm	TYP.	3 x 65

(*): combiner without heat sinking

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2.6. FIBER to FIBER COUPLER (FFC)

Fiber to Fiber COUPLER allows the optimal power coupling between the user fiber with the high power beam (primary beam) delivered at combiner output fiber or directly after the Laser Diode source.

2.6.1. FIBER to FIBER COUPLER WITH RED AIMING BEAM (FFC-R).

INPUT OPTICAL POWER	**W**	**MAX**	**10**
PRIMARY BEAM WAVELENGTH OPERATING RANGE	nm	MAX	1000
		MIN	800
MAGNIFICATION FACTOR		**TYP.**	**1:1**
OUTPUT FIBER N.A. (input fiber with N.A. = 0.22)		MIN	0.22
Fiber OUT / Fiber IN Core RATIO		**MIN**	**>1.5**
COUPLING EFFICIENCY (OUTPUT FIBER WITH AR COATING)	%	MIN	95
RED POINTER BEAM POWER RANGE	**mW**	**MAX**	**1**
		MIN	**0.35**
INPUT PORT CONNECTOR			SMA 905
OUTPUT PORT CONNECTOR			SMA 905
OPERATING TEMPERATURE	**°C**	**MIN**	**15**
		MAX	**40**
PACKAGE TYPE (see Par. 3)			S3

OPTION WITHOUT RED AIMING BEAM IS AVAILABLE (FFC)

2.6.2. FIBER to FIBER COUPLER WITH INTEGRATED 660nm Laser Diode (FFC-660).

INPUT OPTICAL POWER	**W**	**MAX**	**10**
PRIMARY BEAM WAVELENGTH OPERATING RANGE	nm	MAX	1000
		MIN	800
MAGNIFICATION FACTOR		**TYP.**	**1:1**
OUTPUT FIBER N.A. (input fiber with N.A. = 0.22)		MIN	0.22
OUTPUT FIBER CORE	**µm**	**MIN**	**400**
Fiber OUT / Fiber IN Core RATIO		MIN	>1.5
COUPLING EFFICIENCY (OUTPUT FIBER WITH AR COATING)	**%**	**MIN**	**95**
INTEGRATED LASER - WAVELENGTH RANGE	nm	MAX	652
		MIN	664
INTEGRATED LASER - OUTPUT POWER	**W**	**MIN**	**0.02**
INPUT PORT CONNECTOR			SMA 905
OUTPUT PORT CONNECTOR			SMA 905
OPERATING TEMPERATURE	**°C**	**MIN**	**15**
		MAX	**40**
PACKAGE TYPE (see Par. 3)			S4

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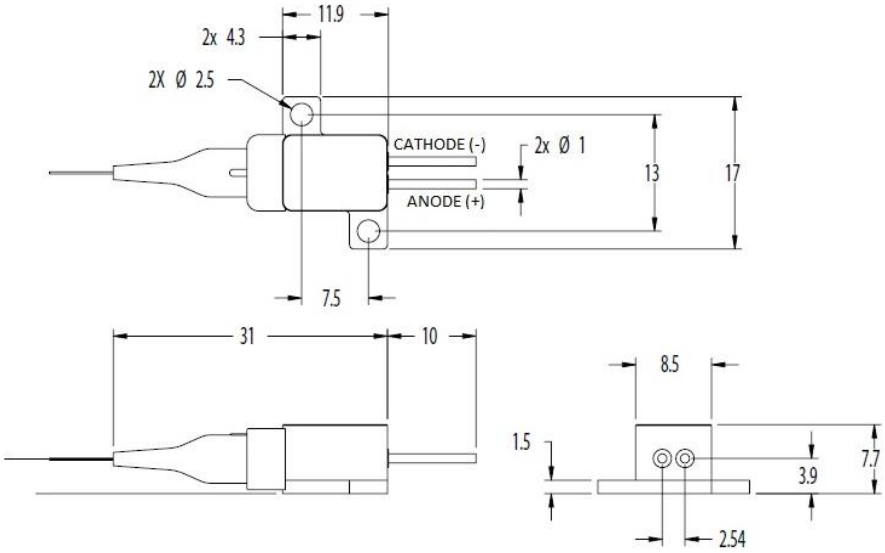
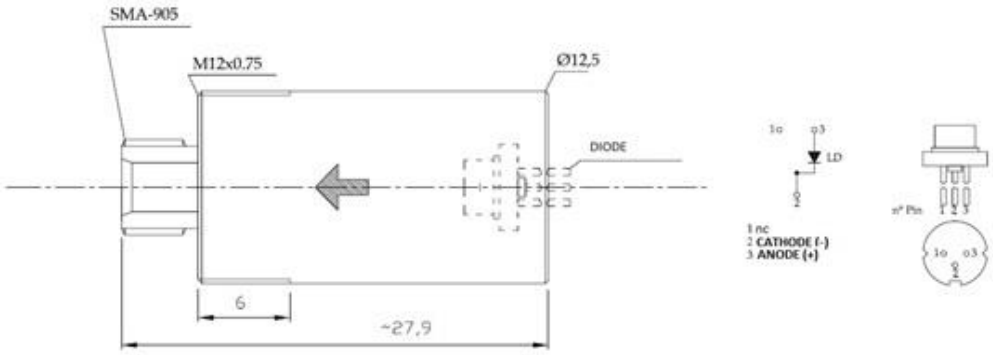
3. PACKAGE TYPE (specifications in mm)

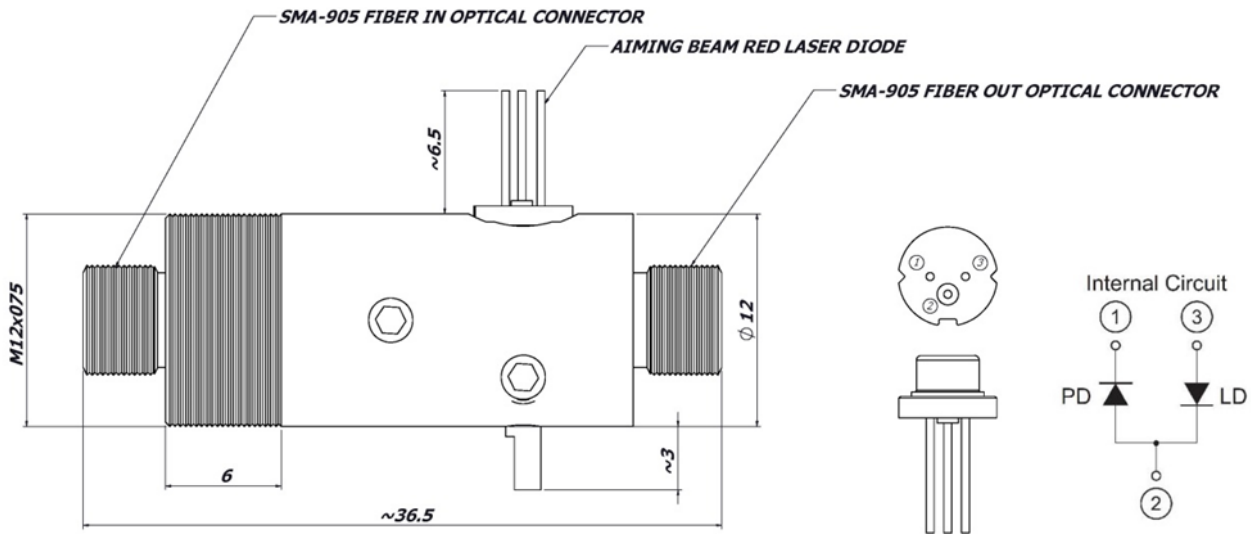
S1 PACKAGE (FPLD):



S2 PACKAGE (FCLD-660):



S3 PACKAGE (FFC-R):



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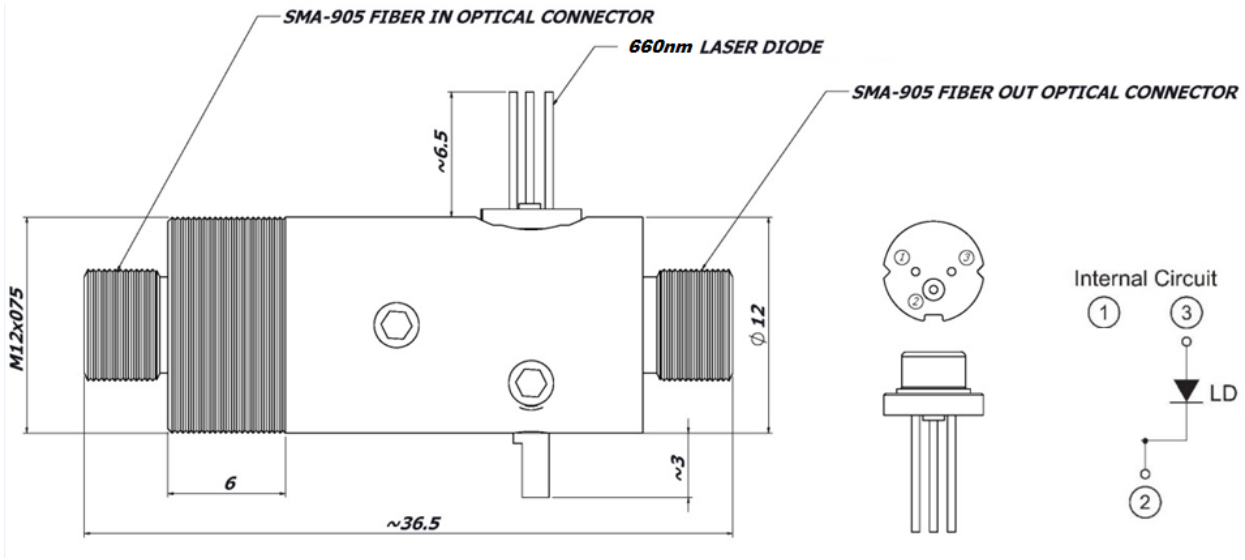
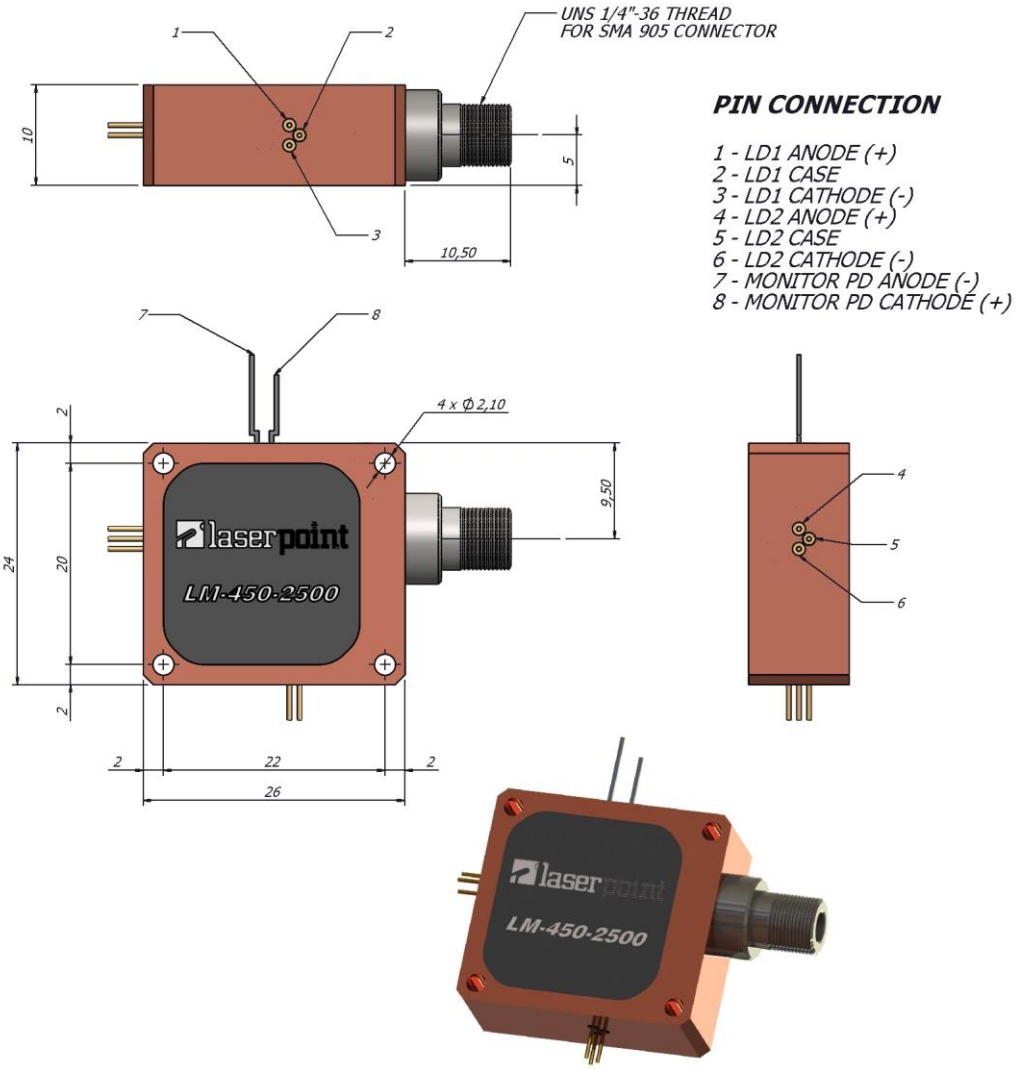
S4 PACKAGE (FFC-660)



S5 PACKAGE (LM-450)



PIN CONNECTION

1 - LD1 ANODE (+)
2 - LD1 CASE
3 - LD1 CATHODE (-)
4 - LD2 ANODE (+)
5 - LD2 CASE
6 - LD2 CATHODE (-)
7 - MONITOR PD ANODE (-)
8 - MONITOR PD CATHODE (+)

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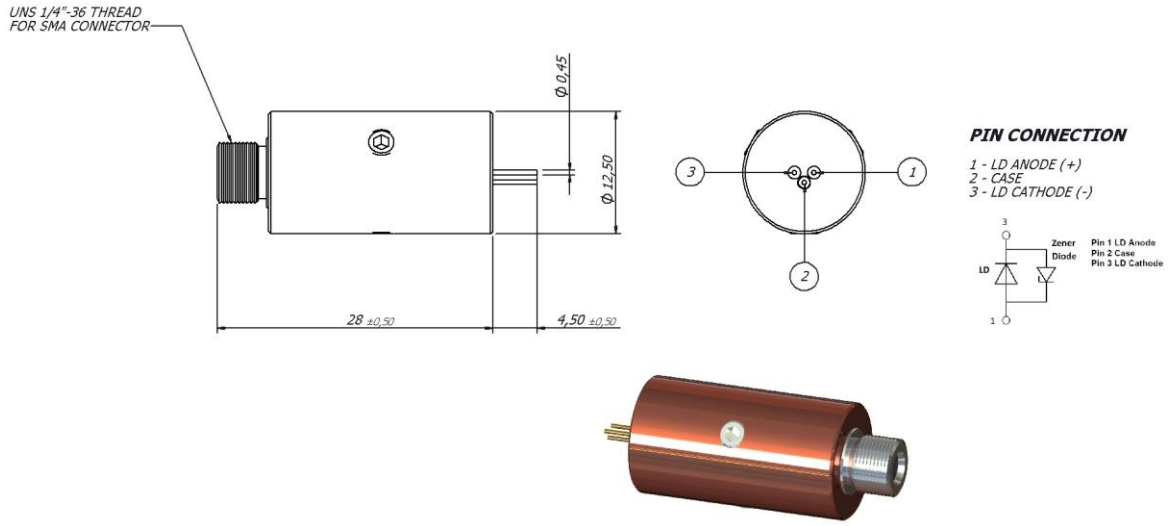
S6 PACKAGE (FCLD-450)



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4. SELECTION TABLE (ORDERING INFORMATION)

P/N DESCRIPTION	P/N
LASER DIODE MODULE operating @ 450nm; 1500mW with RED Aiming Beam	LM-450-1500-R
FIBER COUPLED LASER DIODE operating @ 660nm; 100mW	FCLD-660-100
FIBER COUPLED LASER DIODE operating @ 450nm; 1200mW	FCLD-450-1200
FIBER PIGTAILED LASER DIODE operating @ 975 nm with FFC-R	FPLD-1-FFC-R
FIBER PIGTAILED LASER DIODE operating @ 940 nm with FFC-R	FPLD-2-FFC-R
FIBER PIGTAILED LASER DIODE operating @ 915 nm with FFC-R	FPLD-3-FFC-R
FIBER PIGTAILED LASER DIODE operating @ 812 nm with FFC-R	FPLD-4-FFC-R
FIBER PIGTAILED LASER DIODE operating @ 975 nm with FFC-660	FPLD-1-FFC-660
FIBER PIGTAILED LASER DIODE operating @ 940 nm with FFC-660	FPLD-2-FFC-660
FIBER PIGTAILED LASER DIODE operating @ 915 nm with FFC-660	FPLD-3-FFC-660
FIBER PIGTAILED LASER DIODE operating @ 812 nm with FFC-660	FPLD-4-FFC-660
Laser Combination for #3 Wavelengths (see P/N creation below)	CMB3X-abc
Laser Combination for #2 Wavelengths (see P/N creation below)	CMB2X-ab
Fiber to Fiber Coupler with RED Aiming Beam	FFC-R
Fiber to Fiber Coupler (without RED Aiming Beam)	FFC
Fiber to Fiber Coupler with Integrated Laser @ 660 nm	FFC-660

P/N creation for Laser Combination is defined as shown below:

CMB**y**X **– abc**

COMBINER OPTIONS		WAVELENGTH OPTIONS (*)		
CMB**y**X		**a**	**b**	**c**
3X1 laser combination	CMB**3**X	Select wavelength number from Combined Laser Source Table	Select wavelength number from Combined Laser Source Table	Select wavelength number from Combined Laser Source Table
2X1 laser combination	CMB**2**X	Select wavelength number from Combined Laser Source Table	Select wavelength number from Combined Laser Source Table	N.A.

(*): in case 660nm laser is selected, only fiber to fiber coupler **without** the red beam pointer option (FFC) can be used.

P/N EXAMPLES for Laser Combination:

- CMB3X-134: 3x1 Combiner with laser sources emitting at 975nm, 915nm, 812nm
- CMB2X-15 : 2x1 Combiner with laser sources emitting at 975nm, 660nm.

For more info and commercial quotes, send e-mail to SALES@LASERPOINT.IT

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