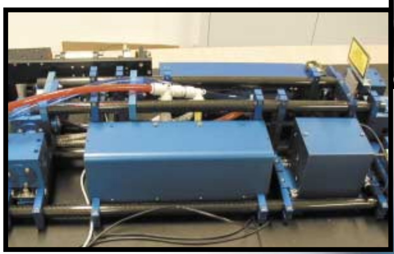
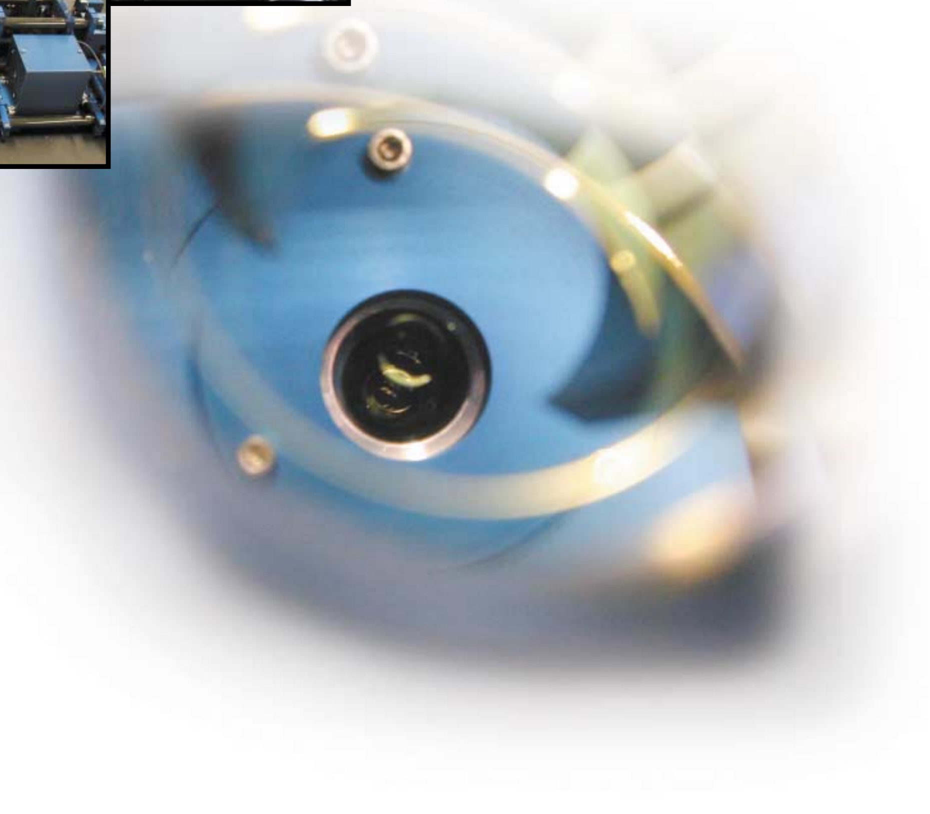
Innovative INNOLAS Lasertechnologie

# YM-R

## YAG Lasersystem

- Supergaussian Resonator
- High Peak Powers
- Excellent Beam Quality
- Low Beam Divergence
- SLM Option
- Double Pulse Option



INNOLAS LASERSYSTEM

YM-R

# The YM-R Laser

## *Technical description*

**The YM-R Series lasers features a Super Gaussian resonator providing excellent beam quality with high peak powers and low beam divergence. The fundamental output is at a wavelength of 1064 nm, and can be efficiently converted to produce harmonics at wavelength of 532, 355 or 266 nm. This laser is suitable for a wide range of applications such as Spectroscopy, Holography, PIV, Thomson scattering, LIF, and Micro-Machining to name but a few.**

The YM-R series is the next generation of the renowned YAGMaster lasers. While maintaining the optical design that provides the excellent beam characteristics all optics are mounted on the revolutionary new InnoLas carbon fibre laser head construction. This design offers extreme rigidity with a high resistance to vibration and thermal distortion. The carbon fibre construction has one half of the coefficient of thermal expansion (CFE), ten times the rigidity and one sixth of the weight of Invar, which to date has been the material of choice for this application. This provides an extraordinary level of long term stability of optical alignment of all parts of the laser, not just the laser resonator optics.

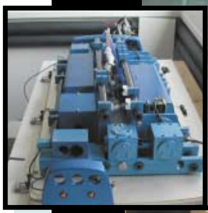
The performance of any flashlamp pumped solid state laser is critically dependent upon the efficiency and reliability of the pumping chamber that surrounds the laser rod and couples the flashlamp energy into it. The pumping chambers of YM-R lasers use a glazed ceramic design to maximise efficiency of coupling and the flow of coolant across laser rods and flashlamps. The high efficiency of this design allows the laser to operate at relatively low pumping energies, minimizing heat input and thereby reducing thermal lensing and birefringence effects on the laser rod. The benefits to the user are seen in excellent beam quality and high harmonic conversion efficiencies, even at high repetition rates. These pumping chambers do not suffer any progressive deterioration with time, unlike designs based upon coated reflective surfaces, and carry a lifetime performance guarantee.

The Q-switch on YM-R lasers is driven by a high speed FET driver circuit. The laser resonator is held closed by polarisation of the pockels cell, which provides excellent holdoff characteristics while the stored energy in the laser rod is increasing. The high speed FET driver circuit opens the Q-switch at the time of maximum inversion with a jitter of less than 250 picoseconds relative to the command signal, which may be internally or externally supplied. A double pulse option is available that provides two energy balanced laser pulses at separations from 1 microsecond to 200 microseconds.

The beam from the oscillator is relayed to the amplifier and harmonic generation stages by means of steering mirrors. This design allows the necessary degrees of freedom to ensure that the oscillator beam is always aligned to all subsequent optical assemblies. It also provides for a compact design in which all harmonics generator and separator components can be accommodated within the laser head itself. Beam expanding telescopes provide the correct degree of matching of the oscillator beam size to the amplifier rod diameter, balancing the filling of the amplifier stage, which determines the level of energy extraction, with the effects of diffraction, which increases as the aperture of the amplifier rod becomes more highly filled. In all YM-R lasers, the selection of the filling factor is biased towards the enhancement of beam quality, rather than simple energy extraction. The result of this design philosophy may be seen in the low depth of near field modulation that appears on the output beam of these lasers and the high level of the near field fit to a Gaussian beam profile.

The power supply enclosure houses the IGBT lamp drive modules, the laser cooling system and micro-

1. The YM-R Laser Head
2. Injection Seeding
3. Carbon Fibre Resonator Structure
4. Pockels-cell Q-switch



1.

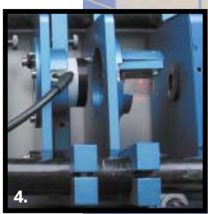
2.

3.

- **Carbon Fibre Resonator Structure**
- **Super-Gaussian VRM Resonator**
- **Double Pulse Option**
- **Single Tranverse and Longitudial Mode**

processor control module.The IGBT lamp drive modules provide flashlamp pulses with high speed rising edges, for improved efficiency and closed loop voltage control for optimum pulse to pulse stability.

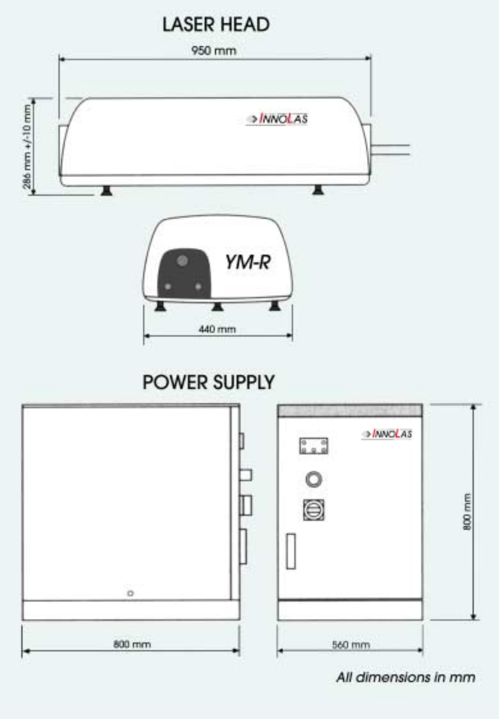
The microprocessor control module controls all laser functions and parameters. A high speed bus provides high resolution timings for control of laser pulse parameters and pockels cell timings and balance. The system is controlled via an RS232 interface that allows PC control using the InnoLas Control Panel software or via the customers or integrators custom software. The interface is specifically designed to allow easy access to system parameter and function controls as well as enhanced fault diagnostics.



4.

| YM-R Series Lasers | YM-R 1000 Specifications | | | YM-R 2000 Specifications | | |
|---|---|---|---|---|---|---|
| | 10 Hz | 20 Hz | 50 Hz | 10 Hz | 20 Hz | 50 Hz |
| **Pulse Energy (mJ)** | | | | | | |
| 1064 nm | >1100 | >1000 | >800 | >2000 | >1800 | >1600 |
| 532 nm (Type II doubling) | > 575 | > 420 | >350 | >1000 | > 900 | > 700 |
| 355 nm (Type I doubling) | > 270 | > 200 | >140 | > 450 | > 400 | > 300 |
| 266 nm | > 130 | > 90 | > 60 | > 130 | > 90 | > 60 |
| **Pulse duration[1] (nsec)** | | | | | | |
| Fundamental at 1064 nm | 10 | 10 | 10 | 10 | 10 | 10 |
| Harmonics at 532, 355, 266 nm | 9 | 9 | 9 | 9 | 9 | 9 |
| **Linewidth ($cm^{-1}$)** | | | | | | |
| standard | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| injection seeded | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| **Divergence[2] (mrad)** | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| **Pointing stability (µrad)** | <±50 | <±50 | <±50 | <±50 | <±50 | <±50 |
| **Beam diameter (nominal) (mm)** | 8 | 8 | 8 | 8 | 8 | 8 |
| **Jitter (nsec)** | | | | | | |
| standard | ±0.25 | ±0.25 | ±0.25 | ±0.25 | ±0.25 | ±0.25 |
| injection seeded | ±1.0 | ±1.0 | ±1.0 | ±1.0 | ±1.0 | ±1.0 |
| **Beam spatial profile fit to Gaussian** | | | | | | |
| near field (1 m) | >0.75 | >0.75 | >0.75 | >0.75 | >0.75 | >0.75 |
| far field (∞) | >0.95 | >0.90 | >0.90 | >0.95 | >0.90 | >0.90 |
| **Electrical** | 208-240V single phase or 208V 3 phase 50 or 60 Hz | | | | | |
| **Water** | 9 litres/min at 2 bar and <20°C | | | | | |

1. Nominal value at Full Width Half Maximum
2. Full angle to $1/e^2$




Laser Class 4

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