

## TRLi SERIES

Compact High Energy and High Repetition Rate Q-switched Nd:YAG Lasers

2 0 2 0



# TRLi Series

Designed for flexibility and enhanced user experience

## APPLICATIONS

- OPO Pumping
- Ti:Sa Pumping
- Dye Laser Pumping
- Deflashing
- Cleaning
- Spectroscopy
- Photoacoustic Imaging
- LIBS
- LIDAR & Remote Sensing
- Flash Photolysis
- Ablation
- PLD



## Bolt and play harmonic modules

All harmonic wavelengths of Nd:YAG (532nm, 355nm, 266nm and 213nm) are available via dedicated separate easy change modules. Each harmonic module automatically adapts to a pre-set configuration.

## Intellihead™ laser function control

The Intelligent laser head uses a dedicated microprocessor to provide precision control over a host of functions including harmonic temperature stabilisation, automatic harmonic tuning, energy monitoring and attenuator controls. The system continuously monitors the Intellihead card and the PSU microcontroller, providing feedback to the user via the LUCi controller.

## Automatic harmonic tuning and auto-stabilisation

As standard, all the harmonic modules are angle tuned with high precision linear actuators for auto-tuning at start up or on demand. Continuous auto-tuning is then possible due to the fast response of the mechanical angle tuning as opposed to conventional thermal tuning. This feature maintains the set energy over long periods of continuous operation and includes a PSU control function to compensate for the lamp aging process.

## Integrated motorised beam attenuator

A high resolution motorised variable attenuator is standard for harmonic modules. This provides continuous energy adjustment of the laser output whilst keeping all other beam parameters constant. An optional motorised variable attenuator for 1064nm is available.

## Twin-rod architecture for high beam homogeneity

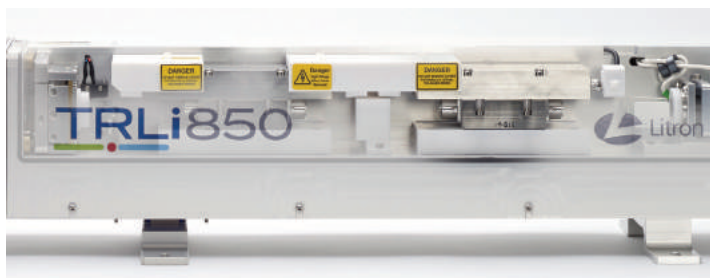
A twin-rod birefringence compensating oscillator design is standard on all TRLi series. This feature ensures the highest beam homogeneity possible. The benefits are seen in low  $M^2$  (higher focusability), better beam profiles and more efficient harmonic conversion.

## LUCi touchscreen system control interface

Full access to the control parameters and sensor feedback from the laser head and power supply are all via the intuitive LUCi touchscreen user interface or the TRLi PC software.



LUCi Touchscreen



## Fast set up and total control

The laser head and LUCi controller connect directly to the PSU and the whole laser can be assembled and running in less than 15 minutes.



**Flexible and upgradable**

The standardised mechanical mounting system for the harmonic modules ensures add-on modules will always be available for your TRLi laser. The laser system firmware and LUCi software can also be easily upgraded via USB.

**Large model range**

The TRLi series encompasses both high energy (850mj) and high repetition rate (200Hz) models. With the addition of super-Gaussian, Telescopic and Stable resonator choices, choosing a TRLi for your precise application could not be easier.

**The ultimate modular laser system**

Not only does TRLi Series provide access to all harmonic modules, it offers additional BET and OPO modules for an even wider range of applications.



**User experience**

All TRLi lasers are field rugged and sealed to IP54 against the ingress of moisture and dirt. The laser resonator is housed in a body machined from solid aluminium to ensure high mechanical and optical integrity.

A comprehensive 2 year warranty, long flashlamp lifetimes and the Litron guarantee of quality build make the TRLi series one of the easiest lasers to own and maintain.

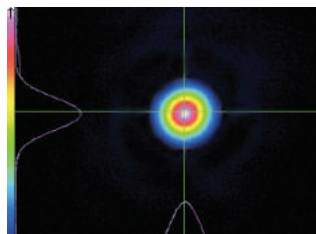
# Super-Gaussian Compact High Energy Q-switched Nd:YAG Lasers

## TRLi G RANGE SPECIFICATIONS

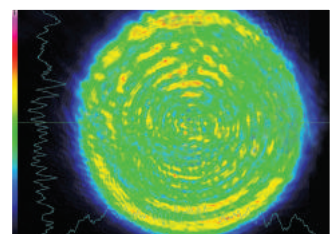
| Model  | TRLi G<br>850 -10 | TRLi G<br>650 -10 | TRLi G<br>450 -10 | TRLi G<br>400 -10 | TRLi G<br>600 -10 | TRLi G<br>550 -10 | TRLi G<br>350 -10 | TRLi G<br>320-10 |
|--|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------------------|
| <b>Repetition Rate (Hz)</b>                      | 10                | 10                | 10                | 20                | 20                | 30                | 30                | 50               |
| <b>Output Energy (mJ)</b>                        |                   |                   |                   |                   |                   |                   |                   |                  |
| 1064nm   | 850               | 650               | 450               | 400               | 600               | 550               | 350               | 320              |
| 532nm  | 435               | 325               | 220               | 200               | 300               | 275               | 175               | 160              |
| 355nm <sup>(1)</sup>                             | 230               | 150               | 130               | 120               | 100               | 90                | 70                | 60               |
| 266nm  | 100               | 70                | 60                | 50                | 60                | 60                | 40                | 30               |
| 213nm <sup>(2)</sup>                             |                   |                   |                   |                   |                   |                   |                   |                  |
| <b>Pulse Stability (±%) [RMS] <sup>(3)</sup></b> |                   |                   |                   |                   |                   |                   |                   |                  |
| 1064nm   | 2 [0.6]           | 2 [0.6]           | 2 [0.6]           | 2 [0.6]           | 2 [0.6]           | 2 [0.6]           | 2 [0.6]           | 2 [0.6]          |
| 532nm  | 3 [1.0]           | 3 [1.0]           | 3 [1.0]           | 3 [1.0]           | 3 [1.0]           | 3 [1.0]           | 3 [1.0]           | 3 [1.0]          |
| 355nm  | 4 [1.3]           | 4 [1.3]           | 4 [1.3]           | 4 [1.3]           | 4 [1.3]           | 4 [1.3]           | 4 [1.3]           | 4 [1.3]          |
| 266nm  | 6 [2.0]           | 6 [2.0]           | 6 [2.0]           | 6 [2.0]           | 6 [2.0]           | 6 [2.0]           | 6 [2.0]           | 6 [2.0]          |
| <b>Power Drift (±%) <sup>(4)</sup></b>           |                   |                   |                   |                   |                   |                   |                   |                  |
| 1064nm   | 3                 | 3                 | 3                 | 3                 | 3                 | 3                 | 3                 | 3                |
| 532nm  | 5                 | 5                 | 5                 | 5                 | 5                 | 5                 | 5                 | 5                |
| 355nm  | 5                 | 5                 | 5                 | 5                 | 5                 | 5                 | 5                 | 5                |
| 266nm  | 10                | 10                | 10                | 10                | 10                | 10                | 10                | 10               |
| <b>Pulse Duration (ns) <sup>(5)</sup></b>        |                   |                   |                   |                   |                   |                   |                   |                  |
| 1064nm   | 6-7               | 6-7               | 6-7               | 6-7               | 6-9               | 6-9               | 6-9               | 6-9              |
| 532nm  | 5-6               | 5-6               | 5-6               | 5-6               | 5-8               | 5-8               | 5-8               | 5-8              |
| 355nm  | 5-6               | 5-6               | 5-6               | 5-6               | 5-8               | 5-8               | 5-8               | 5-8              |
| 266nm  | 5-6               | 5-6               | 5-6               | 5-6               | 5-8               | 5-8               | 5-8               | 5-8              |
| <b>Beam Parameter</b>                            |                   |                   |                   |                   |                   |                   |                   |                  |
| Beam Diameter (mm) <sup>(6)</sup>                | 9.5               | 8.0               | 6.4               | 6.4               | 8.0               | 8.0               | 6.4               | 6.4              |
| Beam Divergence (mrad) <sup>(7)</sup>            | <0.5              | <0.5              | <0.5              | <0.5              | <0.5              | <0.5              | <0.5              | <0.5             |
| M <sup>2</sup> @ 1064nm <sup>(8)</sup>           | <2                | <2                | <2                | <2                | <2                | <2                | <2                | <2               |
| Pointing Stability (µrad) <sup>(9)</sup>         | <35               | <35               | <35               | <35               | <35               | <35               | <35               | <35              |
| Timing Jitter <sup>(10)</sup>                    | <0.5              | <0.5              | <0.5              | <0.5              | <0.5              | <0.5              | <0.5              | <0.5             |
| Linewidth @1064nm (cm <sup>-1</sup> )            | <0.7              | <0.7              | <0.7              | <0.7              | <0.7              | <0.7              | <0.7              | <0.7             |
| Spatial Profile Near Field <sup>(11)</sup>       | >0.75             | >0.75             | >0.75             | >0.75             | >0.75             | >0.75             | >0.75             | >0.75            |
| Spatial Profile Far Field <sup>(12)</sup>        | >0.95             | >0.95             | >0.95             | >0.95             | >0.95             | >0.95             | >0.95             | >0.95            |
| Lamp Life (pulses)                               | 10 <sup>8</sup>   | 10 <sup>8</sup>   | 10 <sup>8</sup>   | 10 <sup>8</sup>   | 10 <sup>8</sup>   | 10 <sup>8</sup>   | 10 <sup>8</sup>   | 10 <sup>8</sup>  |
| <b>Services</b>                                  |                   |                   |                   |                   |                   |                   |                   |                  |
| Voltage  | 100-250VAC        | 100-250VAC        | 100-250VAC        | 100-250VAC        | 100-250VAC        | 100-250VAC        | 100-250VAC        | 100-250VAC       |
| Frequency  | 50/60Hz           | 50/60Hz           | 50/60Hz           | 50/60Hz           | 50/60Hz           | 50/60Hz           | 50/60Hz           | 50/60Hz          |
| Power Phase                                      | Single            | Single            | Single            | Single            | Single            | Single            | Single            | Single           |
| Cooling  | Air Cooled        | Air Cooled        | Air Cooled        | Air Cooled        | Air Cooled        | Air Cooled        | Air Cooled        | Air Cooled       |
| Ambient Temp <sup>(13)</sup>                     | 5-35°C            | 5-35°C            | 5-35°C            | 5-35°C            | 5-35°C            | 5-35°C            | 5-35°C            | 5-35°C           |
| Water Temp <sup>(14)</sup>                       |                   |                   |                   |                   | 20°C              | 20°C              | 20°C              | 20°C             |
| PSU Type   | LPU1000           | LPU1000           | LPU1000           | LPU1000           | 19" Rack          | 19" Rack          | 19" Rack          | 19" Rack         |

- High energy 355nm as standard with standard 2HG module.
- Contact Litron for more information.
- Peak-to-Peak Energy - 100% of pulses.
- 8 Hours continuous running without adjustment.
- FWHM - Fast photodiode and >1GHz oscilloscope.
- Beam diameter is rod diameter - FWHM diameter will be smaller.
- Full angle for 90% of the output energy.
- Measured using ISO 11146-1:2005.
- Half angle.
- Jitter is measured with respect to the Q-switch trigger input.
- Least squared fit to Gaussian at ~ 0.4m from the laser output.
- Least squared fit to Gaussian at the focus of a 1m lens.
- 5 to 80% relative humidity (non condensing).
- >8 lpm at <5 bar.

\* LPU1000 - 110VAC option requires autotransformer to be specified on order.



Far Field at 1064nm >95% Gaussian fit.



Near Field at 1064nm

## Stable Telescopic Compact High Energy Q-switched Nd:YAG Lasers

### TRLi ST RANGE SPECIFICATIONS

| Model  | TRLi HR<br>320-50 | TRLi HR<br>100-100 | TRLi HR<br>250-100 | TRLi HR<br>80-200 | TRLi HR<br>120-200 |
|--|-------------------|--------------------|--------------------|-------------------|--------------------|
| <b>Repetition Rate (Hz)</b>                      | 50                | 100                | 100                | 200               | 200                |
| <b>Output Energy (mJ)</b>                        |                   |                    |                    |                   |                    |
| 1064nm   | 320               | 100                | 250                | 80                | 120                |
| 532nm  | 160               | 60                 | 130                | 45                | 65                 |
| 355nm  | 60                | 20                 | 45                 | 15                | 20                 |
| 266nm  | 30                | 10                 | 20                 | 7                 | 9                  |
| 213nm <sup>(1)</sup>                             |                   |                    |                    |                   |                    |
| <b>Pulse Stability (±%) [RMS] <sup>(2)</sup></b> |                   |                    |                    |                   |                    |
| 1064nm   | 2 [0.6]           | 2 [0.6]            | 2 [0.6]            | 2 [0.6]           | 2 [0.6]            |
| 532nm  | 3 [1.0]           | 3 [1.0]            | 3 [1.0]            | 3 [1.0]           | 3 [1.0]            |
| 355nm  | 4 [1.3]           | 4 [1.3]            | 4 [1.3]            | 4 [1.3]           | 4 [1.3]            |
| 266nm  | 6 [2.0]           | 6 [2.0]            | 6 [2.0]            | 6 [2.0]           | 6 [2.0]            |
| <b>Pulse Duration <sup>(3)</sup></b>             |                   |                    |                    |                   |                    |
| 1064nm   | 8-11              | 8-11               | 8-11               | 8-11              | 8-11               |
| 532nm  | 8-10              | 8-10               | 8-10               | 8-10              | 8-10               |
| 355nm  | 7-9               | 7-9                | 7-9                | 7-9               | 7-9                |
| 266nm  | 7-8               | 7-8                | 7-8                | 7-8               | 7-8                |
| <b>Beam Parameter</b>                            |                   |                    |                    |                   |                    |
| Beam Diameter (mm) <sup>(4)</sup>                | 6.4               | 6.4                | 6.4                | 6.4               | 6.4                |
| Beam Divergence (mrad) <sup>(5)</sup>            | <8                | <8                 | <8                 | <8                | <8                 |
| Pointing Stability (µrad) <sup>(6)</sup>         | <50               | <50                | <50                | <50               | <50                |
| Timing Jitter <sup>(7)</sup>                     | <0.5              | <0.5               | <0.5               | <0.5              | <0.5               |
| Linewidth @ 1064nm (cm <sup>-1</sup> )           | <0.7              | <0.7               | <0.7               | <0.7              | <0.7               |
| Lamp Life (pulses)                               | 10 <sup>8</sup>   | 10 <sup>8</sup>    | 10 <sup>8</sup>    | 10 <sup>8</sup>   | 10 <sup>8</sup>    |
| <b>Services</b>                                  |                   |                    |                    |                   |                    |
| Voltage  | 100-250VAC        | 100-250VAC         | 100-250VAC         | 100-250VAC        | 100-250VAC         |
| Frequency <sup>(8)</sup>                         | 50/60Hz           | 50/60Hz            | 50/60Hz            | 50/60Hz           | 50/60Hz            |
| Power Phase                                      | Single            | Single             | Single             | Single            | Single             |
| Cooling  | Water Cooled      | Air Cooled         | Water Cooled       | Water Cooled      | Water Cooled       |
| Ambient Temp <sup>(9)</sup>                      | 5-35°C            | 5-35°C             | 5-35°C             | 5-35°C            | 5-35°C             |
| Water Temp <sup>(10)</sup>                       | 20°C              |                    | 20°C               | 20°C              | 20°C               |
| PSU Type   | 19" Rack          | LPU1000            | 19" Rack           | 19" Rack          | 19" Rack           |

1. Contact Litron for more information.

2. Pulse-to-pulse energy.

3. FWHM - Fast photodiode and >1GHz oscilloscope.

4. Beam diameter is rod diameter - FWHM diameter will be smaller.

5. Full angle for 90% of the output energy.

6. Half angle.

7. RMS jitter. Measured with respect to the Q-switch trigger input.

8. 5% to 80% relative humidity (non condensing).

\* LPU1000 - 110VAC option requires autotransformer to be specified on order.

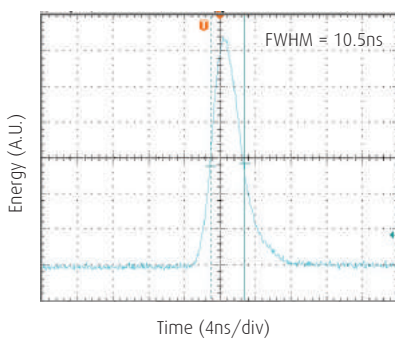


# TRLi HR RANGE SPECIFICATIONS

## High Repetition Rate Compact High Energy Q-switched Nd:YAG Lasers

| Model  | TRLi ST 850-10  | TRLi ST 650-10  | TRLi ST 450-10  | TRLi ST 400-20  |
|--|-----------------|-----------------|-----------------|-----------------|
| <b>Repetition Rate (Hz)</b>                      | 10              | 10              | 10              | 20              |
| <b>Output Energy (mJ)</b>                        |                 |                 |                 |                 |
| 1064nm   | 850             | 650             | 450             | 400             |
| 532nm  | 425             | 325             | 225             | 200             |
| 355nm  | 130             | 100             | 80              | 65              |
| 266nm  | 95              | 70              | 55              | 50              |
| 213nm <sup>(1)</sup>                             |                 |                 |                 |                 |
| <b>Pulse Stability (±%) [RMS] <sup>(2)</sup></b> |                 |                 |                 |                 |
| 1064nm   | 2 [0.6]         | 2 [0.6]         | 2 [0.6]         | 2 [0.6]         |
| 532nm  | 3 [1.0]         | 3 [1.0]         | 3 [1.0]         | 3 [1.0]         |
| 355nm  | 4 [1.3]         | 4 [1.3]         | 4 [1.3]         | 4 [1.3]         |
| 266nm  | 6 [2.0]         | 6 [2.0]         | 6 [2.0]         | 6 [2.0]         |
| <b>Pulse Duration (ns) <sup>(3)</sup></b>        |                 |                 |                 |                 |
| 1064nm   | 9-12            | 9-12            | 9-12            | 9-12            |
| 532nm  | 8-11            | 8-11            | 8-11            | 8-11            |
| 355nm  | 7-10            | 7-10            | 7-10            | 7-10            |
| 266nm  | 7-10            | 7-10            | 7-10            | 7-10            |
| <b>Beam Parameter</b>                            |                 |                 |                 |                 |
| Beam Diameter (mm) <sup>(4)</sup>                | 9.5             | 8.0             | 6.4             | 6.4             |
| Beam Divergence (mrad) <sup>(5)</sup>            | <0.8            | <0.8            | <0.8            | <0.8            |
| Pointing Stability (µrad) <sup>(6)</sup>         | <50             | <50             | <50             | <50             |
| Timing Jitter <sup>(7)</sup>                     | <0.5            | <0.5            | <0.5            | <0.5            |
| Linewidth @ 1064nm (cm <sup>-1</sup> )           | <0.7            | <0.7            | <0.7            | <0.7            |
| Lamp Life (pulses)                               | 10 <sup>8</sup> | 10 <sup>8</sup> | 10 <sup>8</sup> | 10 <sup>8</sup> |
| <b>Services</b>                                  |                 |                 |                 |                 |
| Voltage  | 100-250VAC      | 100-250VAC      | 100-250VAC      | 100-250VAC      |
| Frequency  | 50/60Hz         | 50/60Hz         | 50/60Hz         | 50/60Hz         |
| Power Phase                                      | Single          | Single          | Single          | Single          |
| Cooling  | Air Cooled      | Air Cooled      | Air Cooled      | Air Cooled      |
| Ambient Temp <sup>(8)</sup>                      | 5-35°C          | 5-35°C          | 5-35°C          | 5-35°C          |
| PSU Type   | LPU1000         | LPU1000         | LPU1000         | LPU1000         |

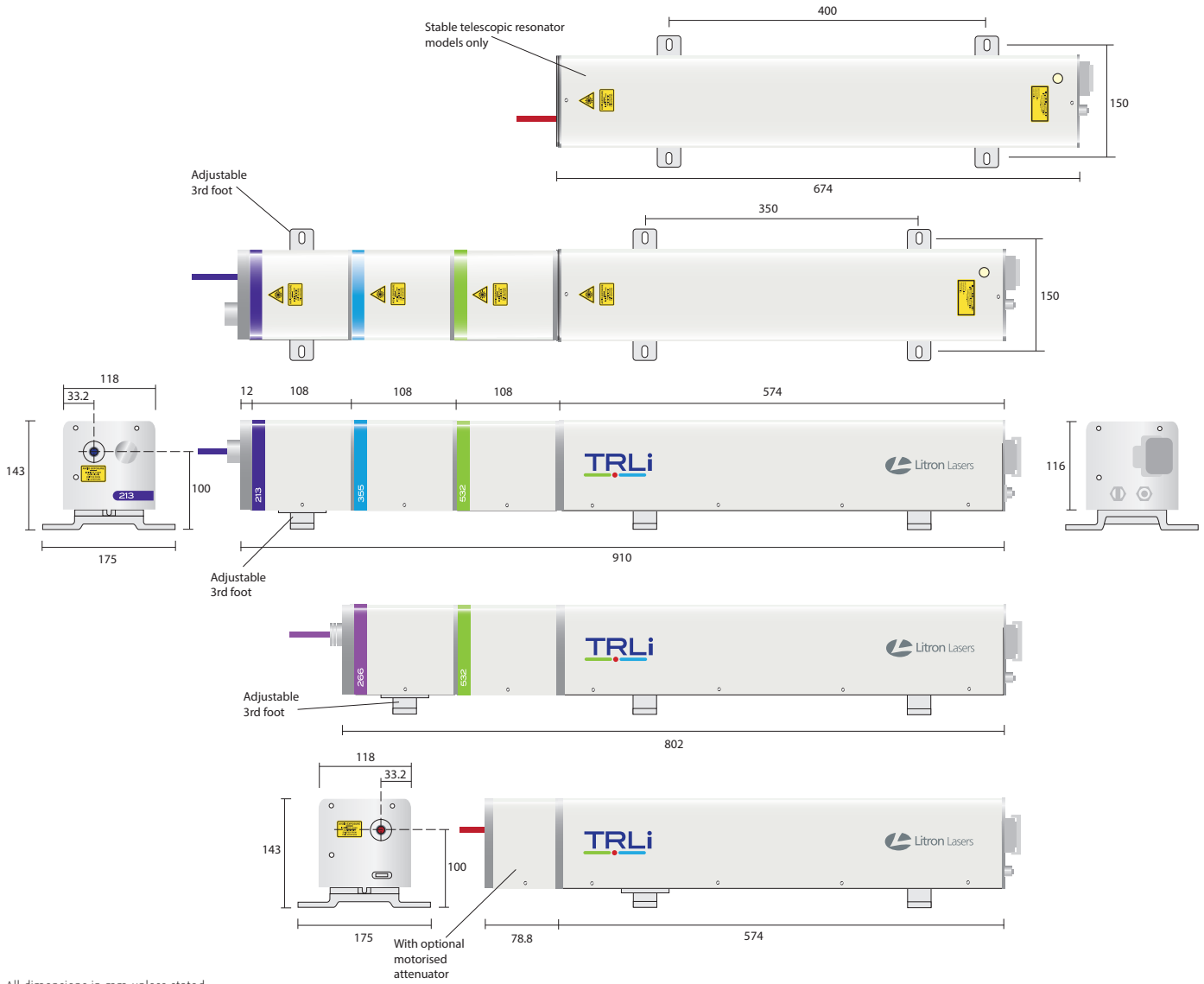
TRL-HR 250-100: Pulse shape at 100Hz



1. Contact Litron for more information
  2. Peak-to-Peak Energy - 100% of pulses.
  3. FWHM - Fast photodiode and >1GHz oscilloscope.
  4. Beam diameter is rod diameter - FWHM diameter will be smaller.
  5. Full angle for 90% of the output energy.
  6. Half Angle.
  7. Jitter is measured with respect to the Q-switch trigger input.
  8. 50Hz or 60Hz to be specified at time of order.
  9. 0 to 80% relative humidity (non condensing).
  10. >8 lpm at <5 bar.
- \* LPU1000 - 110VAC option requires autotransformer to be specified on order.

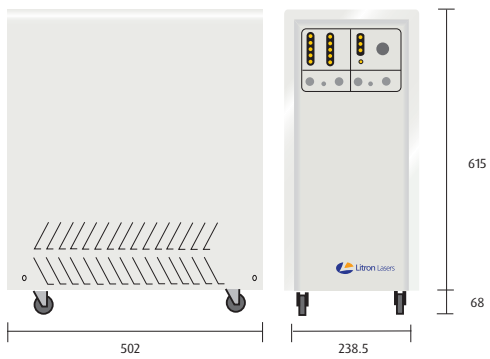
## MECHANICAL DATA

Laser Head with Doubler, Tripler, Quadrupler & Quintupler Units

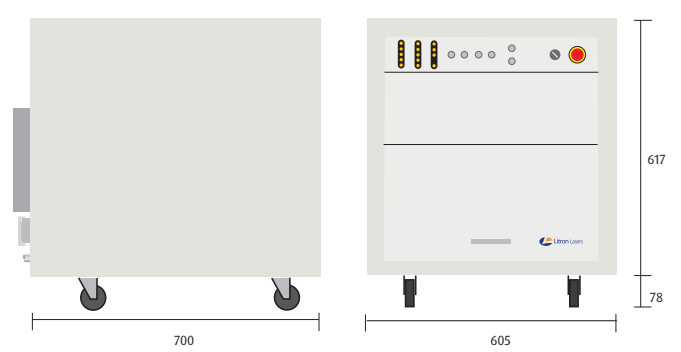


All dimensions in mm unless stated.

### LPU1000 PSU



### 12U Rackmount PSU



# TRLi Series

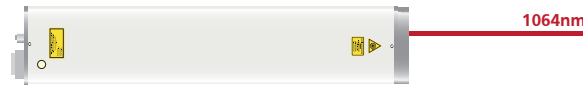
Flexible model options to suit most applications

All model options are available with harmonic auto-tuning, auto-stabilisation and variable motorised attenuator.

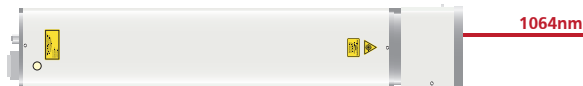
Other model options include:

Built-in harmonic diode pointer.

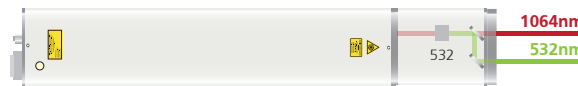
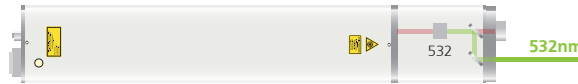
Options for 1064nm output



Options for 1064nm output with optional motorised attenuator



Options for 532nm output



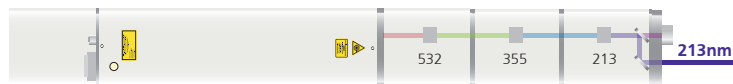
Options for 355nm output



Options for 266nm output



Option for 213nm output



\*For details on 213nm, please contact Litron directly



Our policy is to improve the design and specification of our products. The details given in this document are not to be regarded as binding.



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