EIKONAL Optics

NLD-02

High Power Nanosecond Pulsed Laser

FEATURES

- Pulsed 905-nm laser diode source
- 2.6 ns pulse width @ 100 nJ / pulse
- Efficient, 0.6 NA focusing optics
- Repetition rate up to 100 kHz
- TTL trigger levels

APPLICATIONS

- Time-of-flight measurements
- Ceilometer and aerosol measurements
- Detector testing and characterization

DESCRIPTION

Compact, 905-nm pulsed laser diode with a nanosecond rise time. Pulses are triggered by a TTL-like signal (Figure 1).

SPECIFICATIONS

Rise time	≤ 0.7 ns
Pulse width (typ.)	2.6 ns
Output energy (typ.)	100 nJ/pulse
Max pulse rate	100 kHz
Nominal wavelength	905 nm
Wavelength range	895–915 nm
Spectral FWHM	9 nm
Trig hi threshold	$V_{trig} \geq 3.5$ V
Trig lo threshold	$V_{trig} \leq 1.5$ V
Trig range	$0 \text{ V} \leq V_{trig} \leq 5$ V
Trig rise time	35 ns (nominal)
Trig input impedance	50 Ω
Operating temp	5-30 °C
Dimensions	80 x 45 x 25 mm
Supply (included)	+24 V DC

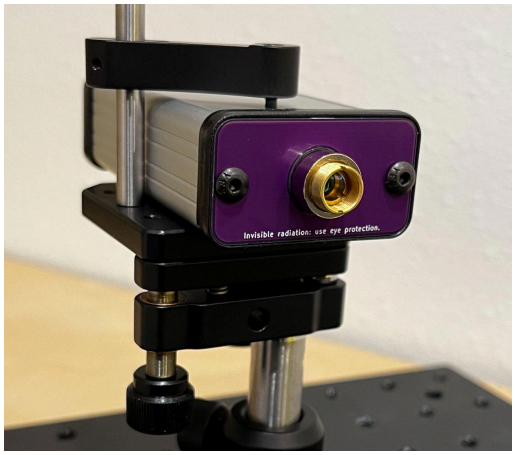

Figure 1. Pulsed laser module front.

OPERATION

A nanosecond electrical pulse energizes a laser diode, producing a short pulse of light. Triggering is accomplished via a fast-switching MOSFET, which discharges an LRC network with a nanosecond time constant. Pulse width and pulse energy can be modified by customizing the properties of this network per specific customer requirements.

The unit runs from a single, included +24 V DC power supply. The high voltage that drives the diode is generated on board by an efficient, low-ripple DC/DC converter. The DC/DC converter provides sufficient current to provide a pulse rate of 100 kHz.

Triggering Laser Pulses

The unit has no power switch. Pulses are only enabled when a digital trigger pulse is applied to the SMA connector (Figure 2). The amplitude of the trigger must exceed 3.5 V with an output impedance capable of driving a 50 Ω load, **while observing the**

minimum and maximum voltage limits of 0 V and 5 V. The nominal trigger rise time is 35 ns and can be driven by a square wave from a conventional function generator (e.g. Agilent 33120A), taking care to ensure voltage limits are within range.

Figure 2. Back panel showing SMA pulse trigger and barrel power connector.

The energy per pulse is stable with trigger rate (Figure 3) and operates from single pulses up to a maximum frequency of

$$f_{max} = 100 \left(\frac{E}{100\ nJ}\right)^{-1} \text{ kHz.}$$

At trigger frequencies exceeding this threshold, the driver / diode may suffer permanent damage.

By default, the unit is set up to deliver 100 nJ pulses (green triangles in Figure 3) and the maximum allowed trigger frequency is 100 kHz. The unit can be easily configured to deliver higher or lower pulse energies (e.g., blue circles or red crosses in Figure 3). If you would prefer one of these alternative configurations, please contact us prior to placing your order.

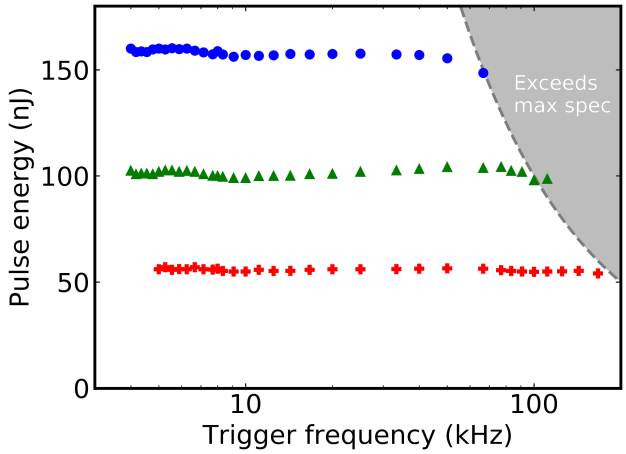

Figure 3. Energy per pulse as a function of triggered pulse rate. The default unit ships with a nominal pulse energy of 100 nJ (green triangles) and can be operated at trigger rates from single pulses to 100 kHz. The blue circle and red cross alternative configurations are available upon request at no additional cost.

PERFORMANCE

Typical pulse profiles are shown in Figure 4. The pulse is triggered using a HP 8112A pulse generator (0–4.5 V) at 10 kHz with a trigger rise time of 4.5 ns and width of 100 ns. The laser pulse is detected using a 0.12-mm diameter InGaAs photodiode (Thorlabs DET01CFC) with a 1.2 GHz bandwidth.

The output is recorded with a Tektronix TDS 784D (t_{rise} = 350 ps). For the default shipped configuration (green line), the measured rise time of the pulse is 0.7 ns. The measured pulse width is 2.6 ns.

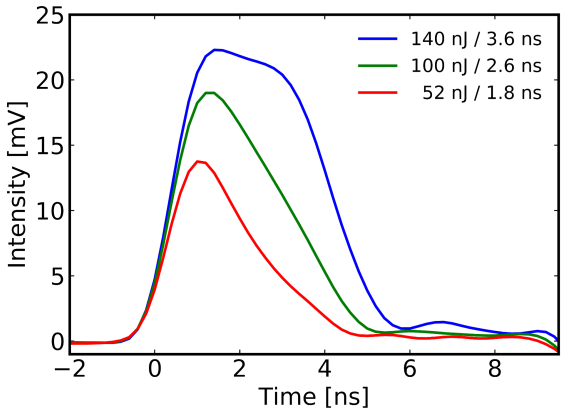

Figure 4. Laser pulse measured with a Thorlabs DET01CFC InGaAs detector and a Tektronix TDS 784D (combined rise time of 0.46 ns). The measured width of the default shipped configuration (green line) is 2.6 ns. The traces are labeled with the delivered energy per pulse (post collection lens).

OPTICS

The unit is equipped with a NA = 0.6, *f* = 4.0 mm aspheric glass lens with a 700–1100 nm antireflection coating, which collects approximately 90% of the emitted energy. The lens is mounted in a M9 threaded lens holder that permits focus adjustment. The emitting area of the diode is 200 µm x 10 µm and therefore images to a line source. To produce a compact, bright spot additional optics are needed. Figure 5 shows an example of reimaging the emitting area with anamorphic magnification. The three junctions in this triple-stack diode are clearly visible, and the original aspect ratio of 20:1 is reduced to 3:1.

REQUIRED ACCESSORIES

- SMA 50 Ω coaxial cable
- +24 V DC supply (included)

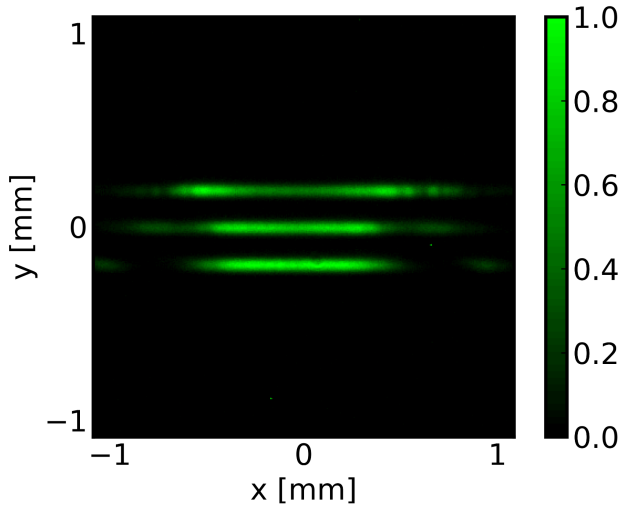

Figure 5. Laser diode reimaged with built-in focusing lens and an external cylindrical lens. The three stacked laser emitters are resolved, and the 200 µm x 10 µm emitting region is reimaged into a 1.2 mm x 0.4 mm rectangle.

WARNINGS

Our instruments are sensitive opto-electronic devices designed for professional use in a laboratory setting. As such you must strictly observe standard procedures for avoiding contamination of optical surfaces and establishing safe electronic operation, including observing input voltage limits and polarities and control of electrostatic discharge.

You must read and understand this document before operating.

- Invisible Class 3B laser: Avoid intentional exposure to direct or reflected beam. Viewing of a class 3B laser beam is hazardous to the eye and diffuse reflections can also be hazardous.
- Observe precautions for handling electrostatic sensitive devices.
- Do not exceed the control voltage limits of < 0V or > 5V applied at the central

conductor of the modulation input of the SMA connector.
- Do not apply RF modulation at frequencies above the max spec.
- The internal circuitry generates dangerously high voltages. The equipment should be installed, adjusted and serviced only by qualified electrical service personnel familiar with the construction and operation of high voltage hazards. Failure to observe this precaution could result in bodily injury or death.

QUALITY ASSURANCE

All units are tested and qualified by our technicians and test results are included with shipping to guarantee your device is working as described in this document.