An application calls for a tunable laser with narrow linewidth, but also high power? TOPTICA offers a family of amplified diode lasers. Depending on the requirements, the TA pro, BoosTA and BoosTA pro can do the job.

The TA pro is a member of TOPTICA’s pro series and consistently follows the concept of maximum stability and ease of use. This product consists of a grating stabilized diode laser and a tapered semiconductor amplifier.

This Master-Oscillator Power-Amplifier (MOPA) concept combines the tunability and linewidth of the DL pro seed laser with the high power and excellent beam quality available from tapered amplifiers.

Master oscillator and power amplifier are independently driven by a pair of temperature and current controllers. Patented, flexure-based mirror mounts ensure easy coupling of the master laser into the tapered amplifier. At the same time, the highly stable design prevents intensity fluctuations that might arise from beam pointing variations. For beam shaping, TOPTICA uses custom-made optical components, achieving an excellent beam profile and highest single-mode fiber-coupling efficiencies.

The TA pro laser head is available as SYST TA pro with the analog DC 110 double-stage rack system (see page 43) and as DLC TA pro with the DLC pro, TOPTICA’s new all digital control electronics.

In the latter version, the DLC pro 19” rack includes two low-noise current controllers, two temperature controllers, a scan control with HV amplifier for the ECDL’s piezo and readily comprises advanced digital locking functions. More information on the new DLC pro can be found on pages 41/42.

A straightforward solution to amplify existing lasers is the BoosTA pro system, featuring the power-amplifier of the TA pro, along with its superior heat management and beam-shaping optics for input and output beams. The BoosTA pro system comes with TOPTICA’s compact current and temperature controller DC HP and achieves highest output powers at low intensity-noise.

The established BoosTA system is a low-cost, compact amplifier module. It combines the tapered amplifier chips of the TA pro with electronics built into the laser head. For the experienced scientist it allows easy integration into an existing setup.

HIGH POWER
Amplified Diode Lasers
**TA pro**

**High Power in pro Technology**

**Compact integration with high-quality components**
The TA pro consists of a grating-stabilized diode laser and a tapered semiconductor amplifier. A high-quality optical isolator placed between master laser and amplifier eliminates spurious back-reflections and thus guarantees spectrally robust operation.

Between isolator and tapered amplifier a probe beam is tapped off and made available for spectral stabilization and monitoring purposes. All mechanical and optical components are integrated in a housing that is machined from one solid block. The complete system has proven its stability in numerous tests both in TOPTICA’s laboratories and in many customers’ experiments.

**Key advantages**
The integrated MOPA (Master-Oscillator Power-Amplifier) system provides unmatched stability against acoustic noise, vibrations and ambient temperature changes. The TA pro is easy to align, very stable when aligned, and it offers the best possible beam quality available from tapered amplifiers.

The TA pro comes in five standard wavelengths, but further wavelengths between 632 nm and 1275 nm are available as well. The output power at a specific wavelength depends on available TA chips and master laser diodes. Thanks to a new high-current laser driver, the most powerful TA pro systems now achieve power levels up to 3 W.

Electronics integrated in the TA pro laser head feature a DC & AC-coupled modulation board, which enables a direct and safe modulation of the master laser current at frequencies up to 200 MHz.

The AC-coupled branch of the modulation board can be configured as Bias-T input, increasing the modulation bandwidth to several hundred MHz. The TA chip itself also features a fast and broadband modulation board, which can be used for active power stabilization. A large variety of locking electronics can be found on pages 45 ff.

The DLC TA pro, a system comprising a TA pro laser head with DLC pro electronics, is available from Q2 / 2014.

**Options**
- Optical isolator for TA output (recommended)
- Fiber-coupling of TA output
- Fiber-coupling of probe beam output
- Locking modules for SYS DC 110: DigiLock 110, FALC 110, PID 110
- DLC pro Lock option for DLC pro (p. 41 - 42)

**Key Features**
- MOPA concept with DL pro master and tapered amplifier
- Powers up to 3 W
- Excellent beam quality: typ. $M^2 < 1.5$
- DC & AC-coupled modulation ports for both master laser and amplifier
- Probe-beam output
- Analog or digital control electronics

Check our regularly updated diode stock list: [www.laser-diodes.com](http://www.laser-diodes.com)
TOPTICA provides five TA pro TOPSeller systems, which have proven themselves as workhorses in numerous quantum optics laboratories around the world.

The stability and ease of use with TOPTICA’s pro technology enables scientists to focus on their experiments and not on the laser system driving the setup. Upon request, TOPTICA offers high-power versions with specially selected TA chips and a dedicated current controller.

TOPTICA’s TA pro TOPSeller systems are value priced and can be combined with multiple options. Optical isolation of the output beam is highly recommended. With TOPTICA’s analog or digital locking electronics wavelength stabilization is easy and convenient.

All TA pro TOPSellers are available with the new all-digital controller DLC pro from Q2 / 2014.

Customized versions:

TOPTICA’s amplified diode lasers are open and flexible systems, and can be modified according to individual needs.

Customized versions of the TA pro include:

- High-power laser systems with up to 3 W output
- Special master resonator for narrow linewidth
- DFB diode as master-laser
- Motorized wavelength selection

Options:

- Optical isolator for TA output
- Fiber-coupling of TA output
- Fiber-coupling of probe beam output
- Locking modules for SYS DC 110
- DLC pro Lock option for DLC pro

**SYST TA pro 670**
- Lithium laser cooling
- Wavelength range 671 - 675 nm
- Max. output power 0.5 W
- Beam quality M² < 1.5
- Mode-hop-free tuning 20 - 30 GHz

**SYST TA pro 760**
- Rubidium D2 laser cooling
- Wavelength range 770 - 795 nm
- Max. output power 1.5 W (3.0 W with high power option)
- Beam quality M² < 1.5
- Mode-hop-free tuning 30 - 50 GHz

**SYST TA pro 780**
- Lithium laser cooling
- Wavelength range 771 - 785 nm
- Max. output power 0.5 W
- Beam quality M² < 1.5
- Mode-hop-free tuning 20 - 30 GHz

**SYST TA pro 795**
- Potassium laser cooling
- Wavelength range 783 - 797 nm
- Max. output power 1.5 W (2.0 W with high power option)
- Beam quality M² < 2
- Mode-hop-free tuning 30 - 50 GHz

**SYST TA pro 850**
- Cesium laser cooling
- Wavelength range 840 - 865 nm
- Max. output power 1.0 W (2.0 W with high power option)
- Beam quality M² < 1.5
- Mode-hop-free tuning 30 - 50 GHz

Magneto-optical trap of lithium atoms. T. Esslinger, ETH Zürich, Switzerland.
For customers who wish to boost the power of existing lasers, coherent stand-alone amplifiers offer an attractive solution.

TOPTICA's BoosTA product line provides efficient optical amplification without compromising the high spectral and spatial beam quality of the master laser.

**Semiconductor optical amplifier for more laser power**

The BoosTA pro, TOPTICA's new stand-alone optical amplifier, increases the output power of a DL pro or any other linearly polarized master laser by up to 20 dB. Following TOPTICA's well-established pro-technology, the TA chip is mounted in a compact unit with optimized heat management and beam-shaping optics. A compact, external power supply (DC HP) drives the amplifier head and allows effortless operation - even of current-hungry TA chips at wavelengths with lower gain. Researchers thus benefit from output power levels up to 3 W.

The BoosTA pro head also includes a high-bandwidth current modulation board, which - when used in a closed feedback loop - allows compensating power fluctuations of the master laser by adjusting the amplifier gain. The board features a protective circuit to avoid the risk of chip damage. The beam management of the seed laser can be greatly simplified by fiber input coupling, which is optionally available as well as fiber-output coupling. Optical output isolation is provided by TOPTICA. The BoosTA pro head has sufficient space for a 60 dB isolator to protect the TA chip from back reflections.

**Options**
- Optical output isolator (integrated in amplifier head)
- Fiber-coupled input
- Fiber-coupled output
- Operation with standard rack SYS DC 110

**Key Features**
- Compact amplifier module
- Gain up to 20 dB (x 100)
- Output power up to 3 W
- External control electronics (DC HP)
- Maintains spectral properties of master oscillator
- Many wavelengths available (631 .. 1275 nm)

Check our regularly updated diode stock list: www.laser-diodes.com

**BooSTA pro - Power at selected wavelengths**

<table>
<thead>
<tr>
<th>Wavelength [nm]</th>
<th>633</th>
<th>650</th>
<th>675</th>
<th>785</th>
<th>780</th>
<th>915</th>
<th>970</th>
<th>1010</th>
<th>1070</th>
<th>1100</th>
<th>1135</th>
<th>1170</th>
<th>1250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Power [W]</td>
<td>0.15</td>
<td>0.25</td>
<td>0.5</td>
<td>2</td>
<td>2</td>
<td>1.5</td>
<td>3</td>
<td>1.5</td>
<td>2</td>
<td>1.5</td>
<td>1</td>
<td>1.5</td>
<td>1.5</td>
</tr>
</tbody>
</table>

BooSTA pro with DC HP.

BoosTA pro laser head with Fiber-in, Fiber-out (FiFo).
Compact and economic semiconductor optical amplifier

For customers with moderate power requirements, the BoosTA offers an economic alternative to the BoosTA pro while still being superior to self-built solutions. It comes pre-aligned and tested with a seed laser, and users can readily insert it into their experimental set-up.

The BoosTA comprises a selected tapered amplifier chip as well as proprietary collimation optics, which help achieve the best possible output beam profile. Control electronics for TA chip temperature and driver current is integrated into the laser head. The current can either be set manually via a rotary potentiometer, or remotely via an RS 232 interface. An external power supply minimizes the impact of thermal and electronic radiation (EMC) on the amplifier head.

Fiber input and output coupling as well as integration of an optical output isolator in the amplifier head are optionally available like for the BoosTA pro. The fiber-coupled system provides high flexibility in the optical beam path, reduces complexity on the optical table and increases the long-term stability of the experimental set-up.

It is even possible to combine two different seed lasers, e.g. in a polarization-maintaining fiber array, and amplify both wavelengths simultaneously in a single BoosTA system. This concept is widely used for the generation of tunable, continuous-wave terahertz radiation.

Available BoosTA power levels depend on the particular TA chip, as listed in the BoosTA – BoosTA pro comparison table below. The most powerful BoosTA systems achieve an optical output of 1.5 W.

Typical saturation behavior of tapered amplifier chips at different amplifier currents (seed power levels exceeding 40 mW are not recommended).

<table>
<thead>
<tr>
<th>Wavelength [nm]</th>
<th>633</th>
<th>650</th>
<th>675</th>
<th>765</th>
<th>795</th>
<th>808</th>
<th>850</th>
<th>915</th>
<th>970</th>
<th>1010</th>
<th>1070</th>
<th>1135</th>
<th>1170</th>
<th>1250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Power [W]</td>
<td>0.15</td>
<td>0.25</td>
<td>0.5</td>
<td>1.3</td>
<td>1.5</td>
<td>1.2</td>
<td>1.2</td>
<td>1.3</td>
<td>1.2</td>
<td>1</td>
<td>1.2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Max. Power, [W]</td>
<td>0.15</td>
<td>0.25</td>
<td>0.5</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1-5</td>
<td>3</td>
<td>1-5</td>
<td>2</td>
<td>1-5</td>
<td>1</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Key Features

- Compact amplifier module
- Gain up to 20 dB (x 100)
- Output power up to 1.5 W
- Integrated, compact control electronics
- Maintains spectral properties of master oscillator
- Many wavelengths available (631 .. 1083 nm)

Check our regularly updated diode stock list: www.laser-diodes.com

BoosTA vs. BoosTA pro - Power at selected wavelengths

Options

- Optical output isolator (integrated into amplifier head)
- Fiber-coupled input
- Fiber-coupled output
# Specifications

## Amplified Diode Lasers

<table>
<thead>
<tr>
<th>Specifications</th>
<th>TA pro</th>
<th>TA DFB</th>
<th>BoosTA pro</th>
<th>BoosTA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Configuration</strong></td>
<td>MOPA</td>
<td>MOPA</td>
<td>Amplifier</td>
<td>Amplifier</td>
</tr>
<tr>
<td><strong>Master laser</strong></td>
<td>DL pro (integrated)</td>
<td>DL DFB (integrated)</td>
<td>External</td>
<td>External</td>
</tr>
<tr>
<td><strong>Center wavelengths</strong></td>
<td>633 .. 1265 nm*</td>
<td>760 .. 1265 nm*</td>
<td>633 .. 1265 nm*</td>
<td>645 .. 1083 nm*</td>
</tr>
<tr>
<td><strong>Max. power</strong></td>
<td>3 W</td>
<td>1.5 W</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Coarse tuning</strong></td>
<td>10 .. 70 nm</td>
<td>1 .. 4 nm</td>
<td>10 .. 70 nm</td>
<td></td>
</tr>
<tr>
<td><strong>Typical mode-hop-free tuning</strong></td>
<td>20 - 50 GHz</td>
<td>1000 GHz</td>
<td>Depends on master laser</td>
<td>Depends on master laser</td>
</tr>
<tr>
<td><strong>Typical linewidth (5 µs)</strong></td>
<td>0.1 .. 1 MHz</td>
<td>1 .. 4 MHz</td>
<td>Depends on master laser</td>
<td>Depends on master laser</td>
</tr>
<tr>
<td><strong>Polarization</strong></td>
<td>Linear &gt; 100 : 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ASE background, typ.</strong></td>
<td>&lt; -40 dB</td>
<td>&lt; -40 dB</td>
<td>Depends on master laser</td>
<td></td>
</tr>
<tr>
<td><strong>Beam quality M²</strong></td>
<td>&lt; 1.5 (&lt; 2.0 for some higher-power chips)</td>
<td>&lt; 1.5 (&lt; 2.0 for some higher-power chips)**</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Divergence</strong></td>
<td>&lt; 1 mrad</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Beam height</strong></td>
<td>50 ± 1 mm</td>
<td>53.9 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Optical isolators</strong></td>
<td>Internal: 60 dB included, Output: optional 30 or 60 dB</td>
<td>Input: none, Output: optional 30 or 60 dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fiber-Coupling</strong></td>
<td>Output: optional</td>
<td>Input*** and Output: optional</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fiber-coupling efficiency</strong>**: min. (typ.)**</td>
<td>50 % (60 %)</td>
<td>50 % (60 %)**</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Control electronics</strong></td>
<td>DLC pro or SYS DC 110</td>
<td>DC HP</td>
<td>Integrated into laser head + external supply</td>
<td></td>
</tr>
<tr>
<td><strong>Frequency mod. option</strong></td>
<td>Included</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Intensity modulation option</strong></td>
<td>TA-Mod included</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Environment temperature:</strong></td>
<td>Operating / transport 15 - 30 °C / 0 - 40 °C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Environment humidity</strong></td>
<td>Non-condensing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Operating voltage</strong></td>
<td>100 - 120 V / 220 - 240 V AC, 50 - 60 Hz (auto detect)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Power consumption</strong></td>
<td>Typ. 120 W, Max. 300 W</td>
<td>Typ. 35 W, Max. 60 W</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Size head (L x W x H)</strong></td>
<td>400 x 192 x 90 mm³</td>
<td>275 x 115 x 90 mm³</td>
<td>312 x 100 x 85 mm³</td>
<td></td>
</tr>
<tr>
<td><strong>Size electronics (L x W x H)</strong></td>
<td>400 x 465 x 148 mm³</td>
<td>278 x 120 x 104 mm³</td>
<td>179 x 175 x 70 mm³</td>
<td></td>
</tr>
</tbody>
</table>

* Spectral coverage with gaps.
** With suitable TOPTICA master laser.
*** Requires linearly polarized light from FC/APC PM fiber.
**** With TOPTICA’s FiberDock, isolation required.

---

*Class 4 Laser Product EN 60825-1:2007. Visible or invisible laser radiation. Avoid eye or skin exposure to direct or scattered radiation. Caution - Class 4 visible and/or invisible laser radiation when open. Avoid exposure to the beam, avoid eye or skin exposure to direct or scattered radiation. Magnetic fields may be present which may affect the operation of certain pacemakers.*

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![Power vs. Wavelength](image_url)