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The **DLC DL pro** unites TOPTICA's well-established DL pro laser head with its patented resonator design and the all-digital control electronics DLC pro. Owing to its low noise and drift values, the DLC DL pro achieves even narrower linewidths and better stability.
At the same time, the system provides a most convenient user interface with intuitive touch, dial and total remote control. For detailed specifications of the DLC pro, please see page 38-40. Just like the first laser of the *pro* series, the DL pro, demonstrated how much even a a well-established instrument like the DL 100 can be further improved, the first *pro* laser control electronics, the DLC pro, leads to a huge improvement in performance.

Options

- Single and double-stage isolators (page 45)
- Fiber-coupled output with FiberDock (single-mode, polarization-maintaining)
- DLC pro Lock, integrated digital frequency stabilization (page 39)
- DLC ext allows to combine the DLC pro with advanced locking modules DigiLock 110 and FALC 110 (p. 41-43)
- Beam shaping (page 22)
- Motorized wavelength selection with an accuracy of approximately ± 0.2 nm (for most wavelengths, page 22)

Main advantages

The main advantages of the DLC DL pro for the user include large mode-hop-free tuning, alignment-free operation and the highest acoustic and thermal stability of any ECDL on the market.

This translates to a product that delivers the most reliable and convenient operation for high-end laboratory work.

Sophisticated and patented technology

To achieve the highest performance and ease of use, the DL pro mechanics possesses degrees of freedom exactly where they are needed. Coarse and fine-tuning have been skillfully separated: A well-defined rotation of the grating performs coarse tuning and precisely selects any requested wavelength within the gain spectrum of the diode. Mode-hop-free tuning is realized by a system of robust flexure joints that require only tiny adjustments. They rotate the laser's grating around the perfect "virtual" pivot point.

The compact and stable external-cavity resonator has its first mechanical resonance above 4 kHz - one reason for its superior acoustic stability. Special care has been taken in choosing dimensions and materials with reduced sensivity to variations of the ambient temperature. In addition to its stability, the DL pro is easy to align: The experienced user can even exchange the laser diode on-site.

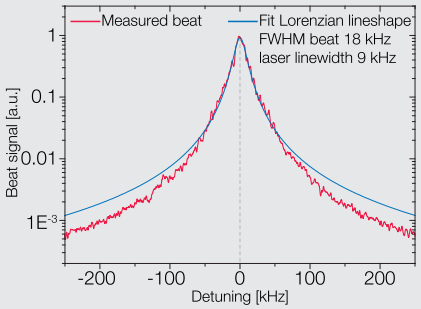


Laser system DLC DL pro with well established laser head and all-digital control electronics.

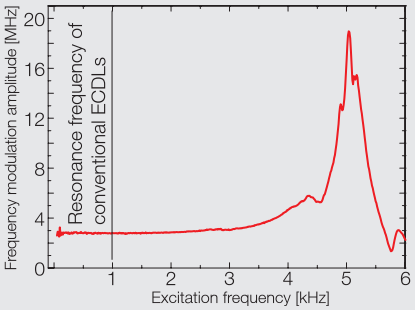
Key Features

- Available between 369 nm .. 1770 nm
- All-digital, intelligent control electronics DLC pro
- Power stabilization to external signal and pressure compensation included
- Ultra-stable patented resonator design (DE 10 2007 028 499 and US 7970024)
- Optimized virtual pivot point
- 20 - 50 GHz mode-hop-free tuning
- Convenient alignment-free coarse-tuning from outside the laser head
- Fast current AC & DC modulation

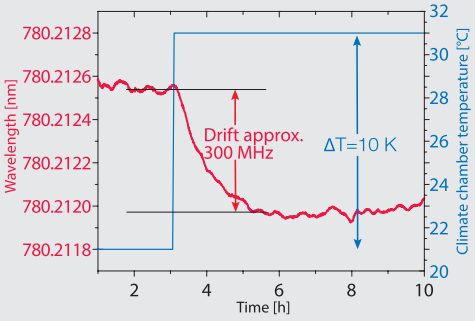
Check our regularly updated diode stock list:
www.laser-diodes.com



Measured beat signal of two free-running DL pro at 1160 nm. 100 scans with sweep times of 50 ms have been averaged. The two laser systems are of the same built and contribute equally to the residual noise.



DL pro piezo transfer function. Below 4 kHz no acoustic resonances can be detected.



Laser frequency response to a 10 Kelvin air temperature change (laser and electronics inside a climate chamber).

DLC DL pro HP
Higher Power from Tunable Diode Lasers



DL pro HP laser head.

Key Features

- Available between 394 nm .. 640 nm
- Up to 110 mW single-frequency, tunable output
- Excellent stability against mode-hopping
- Typical linewidth 100 .. 500 kHz
- For details of the laser controler DLC pro see page 38-40.

Check our regularly updated diode stock list:
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Due to new laser diode developments, the maximum single-frequency output power of visible and UV tunable diode lasers is no longer limited by the damage threshold of the laser diode. However, achieving reliable single-frequency operation of an external cavity diode laser (ECDL) becomes increasingly difficult at high power levels.

Small variations of the laser diode current or its temperature can cause mode-hopping - which corresponds to an abrupt jump in laser frequency by several GHz - or even lead to multi-mode operation of the laser.

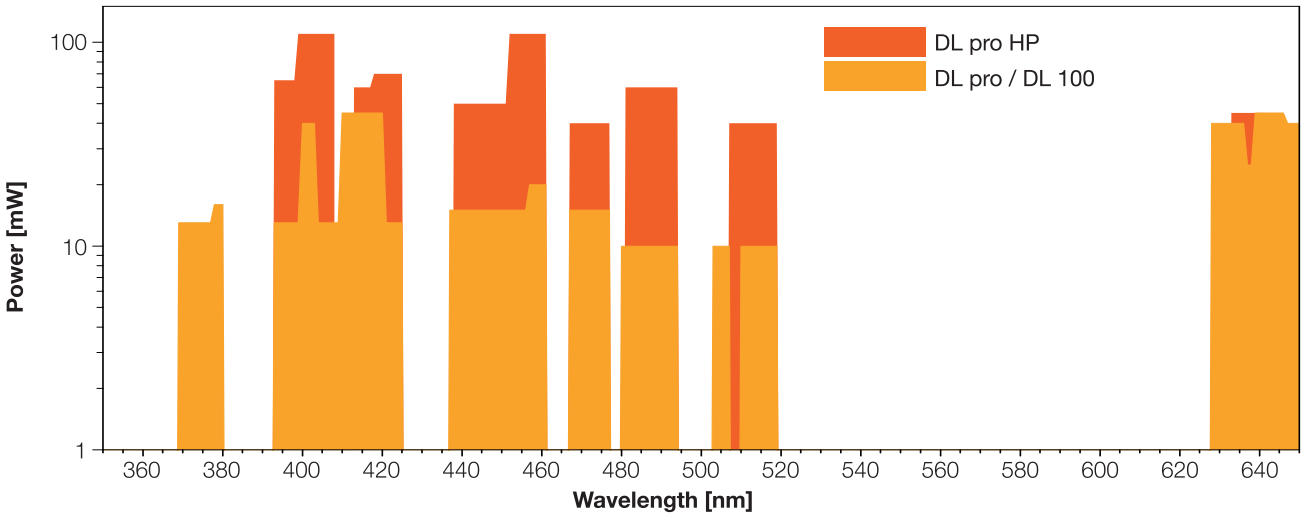
Higher power from visible & UV ECDLs
The new DLC DL pro HP diode laser overrides former output power limits of ECDLs in two ways. First, it features a specific version of the DL pro laser head with a proprietary resonator design and provides increased single-mode power at „visible“ wavelengths. Second, the new digital driving electronics DLC pro enables unmatched current and temperature stability. The combination of both achievements delivers record values of stable single-frequency output power from visible or UV ECDLs, for example 110 mW at 399 nm or 461 nm.

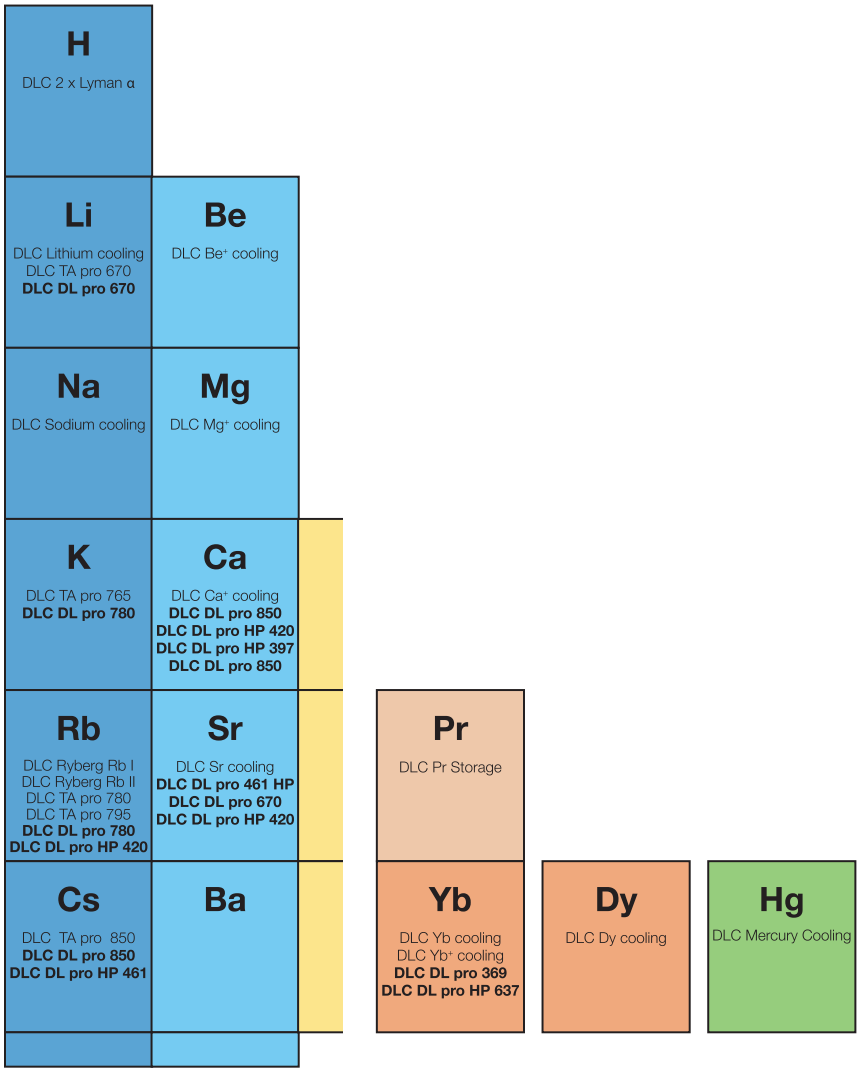
Coarse- and fine-tuning
Manual coarse tuning of the wavelength is possible across the full gain spectrum of the laser diode (for blue and UV diodes approximately 2-3 nm) and mode-hop-free fine-tuning covers scan ranges up to 50 GHz. Typical short term linewidths are below 150 kHz, corresponding to coherence lengths of > 600 m. Standard wavelengths include 399 nm, 423 nm and 633 nm. Other wavelengths between 394 nm and 640 nm are available on request. See preconfigured TOPSeller on the next page.

Integrated optical isolator
The DL pro HP laser head features two inputs with protection circuit for fast AC & DC modulation of the laser diode current. These are typically used for fast frequency modulation or locking. A preselected 35 dB optical isolator is also integrated. The DLC pro digital electronics (see page 38-40) allows convenient operation via touch screen and remote control.

Options

- Fiber-coupled output with FiberDock (single-mode, polarization-maintaining)
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- DLC ext allows to combine the DLC pro with advanced locking modules DigiLock 110 and FALC 110 (p. 41/42)
- Beam shaping
- Motorized wavelength selection with an accuracy of approximately ± 0.2 nm





A number of TOPSeller systems are available, e.g. for laser cooling or excitation of specific transitions. Listed in this cut-out of the periodic table are all TOPTICA TOPSeller solutions for each element. Direct diode lasers are marked in bold letters. TOPSellers based on amplified TA solutions (see page 26) or frequency-converted NLO systems (see page 34) are mentioned for completeness.

The DLC DL pro is used in various applications and it is designed to be used with various laser diodes. TOPTICA is in close contact with researchers to identify and meet the specific needs. Some applications are in fact so popular that we have defined laser systems specific to them. For example the most popular application of the DL pro is the laser cooling of rubidium, in which the laser wavelength is tuned very close to the Rb D1 line at 780.24 nm.

The ten TOPSellers of the DLC DL pro and DLC DL pro HP are direct solutions for the most popular applications. They are configured just in the way they are required for the immediate integration to the lab. The fitting laser diode and optical isolator are included. This allows for shorter delivery times of a few weeks and, due so simplification in the production process, for reduced prices relative to the configurable systems.



Magneto-optical trap of rubidium atoms.
I. Bloch, MPQ Garching, Germany.

DLC DL pro	850	780	670	633	369
Typical applications	Cs cooling, Ca ion repump	Rb cooling and repump, K cooling and repump	Li cooling and repump, Sr ion clock transition	HeNe laser wavelength	Yb ion cooling
Peak power (mW) behind isolator, specified (typical)	70	105	25	32	13
Wavelength (nm)	840 - 875	765 - 805	664 - 674	631 - 635	369.2 - 370.2
Linewidth (kHz @5 µs delay)	100	100	200	200	100
Included optical isolator	> 60 dB	> 60 dB	> 60 dB	> 60 dB	> 28 dB
DLC DL pro HP	**637**	**461**	**420**	**399**	**397**
Typical applications	NV center, Yb ion clear out laser	Sr cooling, Cs Rydberg	Ca cooling, Sr ion cooling, Rb Rydberg	Yb cooling	Ca ion cooling
Peak power (mW) behind isolator, specified (typical)	45 (50)	110	70	50	65
Wavelength (nm)	635 - 639	457 - 461	420 - 423	399 - 402	396.5 - 398.5
Linewidth (kHz @5 µs delay)	500	150	150	150	150
Included optical isolator	> 35 dB	> 35 dB	> 35 dB	> 35 dB	> 35 dB

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