Wavelength-tunable air-cooled, diode-pumped, Q-switched lasers

Q TUNE

Q-TUNE laser head

Q-TUNE is a diode-pumped laser source combined with an Optical Parametric Oscillator (OPO) that generates a tunable wavelength output in the 410 – 2300 nm range with a linewidth narrower than 6 cm^{-1}. An optional second-harmonic generation (SHG) module extends the tuning range into the UV, covering 210 – 410 nm with a linewidth narrower than 12 cm^{-1}.

With a pulse duration of < 5 ns and a pulse repetition rate of up to 100 Hz, Q-TUNE is a practical laser source for time-resolved spectroscopy, metrology and photo-acoustic imaging. At the core is QLI's water-free laser crystal pumping technology, enabling high beam quality and pulse energies of up to 100 mJ without water cooling infrastructure.

The laser is engineered as a turnkey system: compact, user-friendly and low-maintenance. No chiller or bulky under-table power supplies are required. All electronics are integrated into the Q-TUNE housing. The only external unit is a mains adapter providing 12 or 28 VDC and 50 – 150 W (model dependent), as well as an air-purging unit.

Both the pump laser and the OPO are controlled through a single Ethernet port via a built-in web server. No control software needs to be installed – any computer or mobile device with a modern web browser can operate the Q-TUNE. An API is also available for integration with user systems.

In addition to the tunable output, Q-TUNE provides two additional output ports for access to the pump laser beams.

FEATURES

- Seamless laser and Optical Parametric Oscillator (OPO) integration
- Turnkey performance due to water-free pump laser design
- Microprocessor controlled operation with self-optimisation, self-calibration capability
- Guaranteed > **2 G shot** pump-diode lifetime
- **Hands-free** automated tuning from **210 to 2300 nm**
- Up to **100 Hz** pulse repetition rate
- Up to **8 mJ** pulse energy in visible range
- **< 6 cm^{-1}** linewidth
- Internal or external triggering modes
- Separate output ports for access to pump laser wavelengths
- Low power consumption – **from 50 to 150 W** depending on model
- Air purging for long lifetime of UV optics

OPTIONAL EQUIPMENT

- Compact spectrometer for monitoring of OPO wavelength and linewidth
- Motorized attenuator for VIS or NIR range
- Broadband OPO pulse energy monitor
- Fiber coupled OPO output

APPLICATIONS

- Temporally resolved laser spectroscopy (for example, Light Induced Fluorescence Spectroscopy (LIFS))
- Nonlinear laser spectroscopy
- Confocal microscopy
- Metrology
- Photo-acoustics imaging

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SPECIFICATIONS [1]

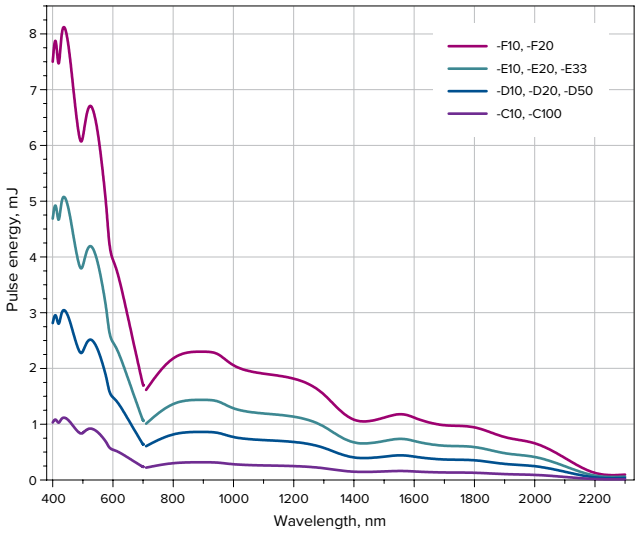
Model	Q-TUNE									
	-C10	-C100	-D10	-D20	-D50	-E10	-E20	-E33	-F10	-F20
Wavelength range, nm [2]										
OPO	410 – 2300 nm									
SH extension	210 – 410 nm									
Pump laser wavelength	1053 nm	1064 nm	1053 nm	1064 nm		1053 nm		1064 nm	1053 nm	
Pulse repetition rate [3]	10 Hz	100 Hz	10 Hz	20 Hz	50 Hz	10 Hz	20 Hz	33 Hz	10 Hz	10 Hz
Pulse energy [4]	> 1 mJ		> 2 mJ			> 5 mJ			> 8 mJ	
Linewidth	< 6 cm^{-1}									
Pulse duration [5]	< 5 ns									
Pulse-to-pulse stability [6]	< 4.5 % RMS									
Polarization										
Signal	vertical									
Idler	vertical									
Typical beam diameter [8]	3 mm		4 mm			5 mm			6 mm	
Power drift [7]	± 3.0 %									
Typical beam divergence [9]	< 3 mrad		< 4 mrad			< 5 mrad				
Jitter [10]	< 0.5 ns RMS									
Pump laser outputs [11]										
Max pulse energy at [12]										
Fundamental	15 mJ		30 mJ			50 mJ			70 mJ	
2nd harmonic	7 mJ		15 mJ			20 mJ			30 mJ	25 mJ
3rd harmonic	5 mJ		9 mJ			20 mJ			30 mJ	25 mJ
Dimensions										
Laser head (W×L×H) [13]	390 × 620 × 153 mm^3									
Air-purging unit and power adapter (W×L×H) [14]	482 × 460 × 106 mm^3									
Operating requirements										
Cooling requirements	air-cooled (water-free)									
Ambient temperature	15 – 25 °C									
Relative humidity (non-condensing)	10 – 80 %									
Mains voltage [15]	90 – 230 VAC, single phase, 47 – 63 Hz									
Average power consumption	< 50 W	< 150 W	< 100 W	< 150 W		< 100 W	< 150 W			

1. Due to continuous improvements all specifications are subject to change. Unless stated otherwise all specifications are measured at 450 nm and max pulse repetition rate. The parameters marked typical are not specifications. They are indications of typical performance and will vary with each unit we manufacture.
2. Optional extension down to 210 nm is available with second harmonic generator.
3. Factory-set pulse repetition rate in internal triggering mode. Pulse repetition rate can be divided-down to 1 Hz.
4. Measured at 450 nm output. See tuning curves for pulse energies at other wavelengths.
5. FWHM level at 450 nm, measured with 350 ps rise time photodiode.
6. Measured during 30 seconds operation after warm-up.
7. Over 8 hour period after 20 minutes of warm-up, when ambient temperature variation is less than ± 2 °C. Power value is calculated once per second.
8. Beam diameter is measured 20 cm from laser output at the 4σ level.
9. Full angle measured at the 4σ level.
10. In respect to falling edge of pump-diode triggering pulse.
11. Laser pulse energy is optimized for OPO pumping and may differ from stand-alone laser specifications.
12. Outputs can be configured for simultaneous or non-simultaneous with OPO operation. Values indicated here are for non-simultaneous operation.
13. For model Q-TUNE-C10 housing dimensions – 390 × 620 × 135 mm^3.
14. Power adapter is integrated with air-purging unit.
15. Laser can be powered from an appropriate 12 or 28 VDC power source, depending on model. Please inquire for details.

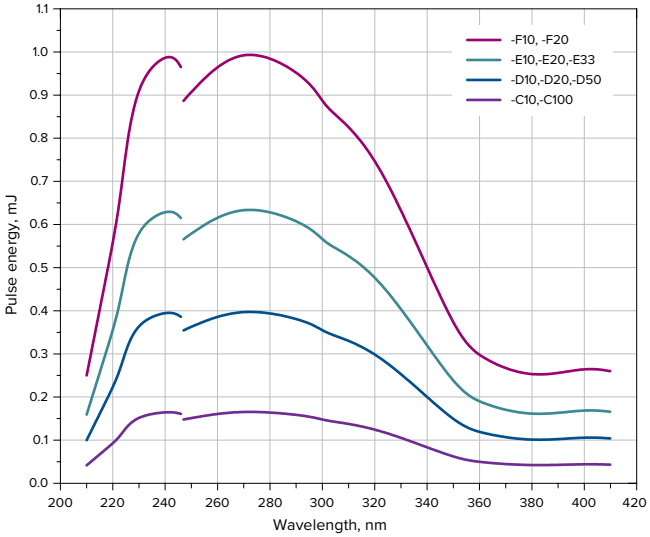
DANGER: VISIBLE AND/OR INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT, REFLECTED OR SCATTERED RADIATION

CLASS 4 LASER PRODUCT

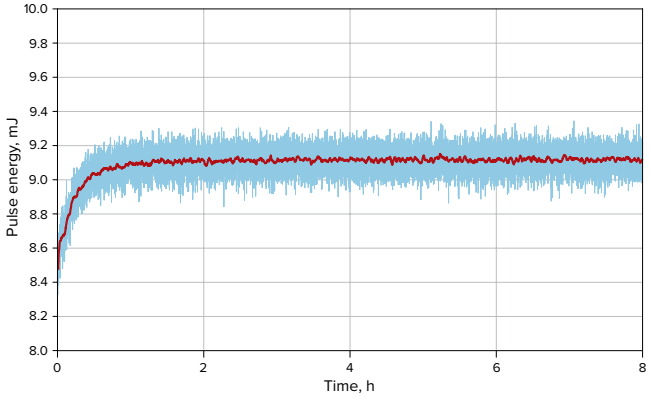
PERFORMANCE



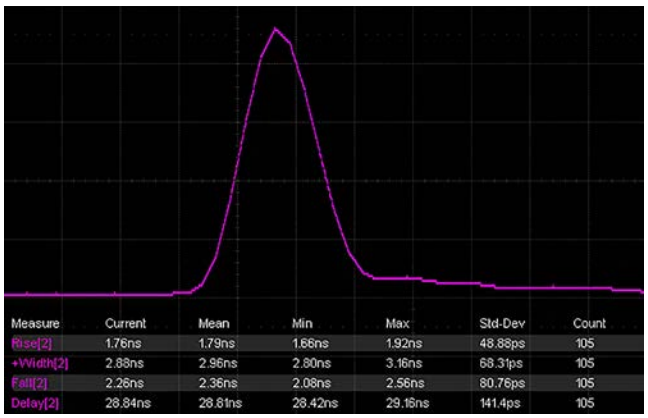
Q-TUNE tuning curves



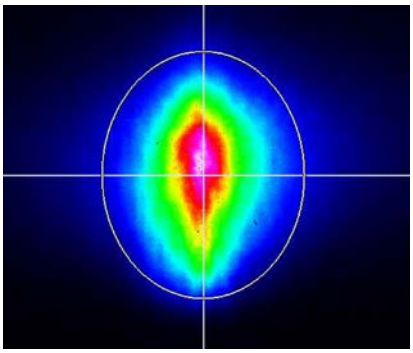
Q-TUNE-SH tuning curves



Long term stability of Q-TUNE-F10 @ 450 nm
Power drift: +0.47 %; -0.96 %



Pulse duration of Q-TUNE-F10 @ 450 nm



Q-TUNE-E10 beam profile
Axis length (X, Y) – (2915.0,3564.0) µm, effective diameter – NA, ellipticity – 81.8 %, wavelength – 450 nm

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PART NUMBERS

Q-TUNE-F10-SH-AT/VIS

Model

Pulse energy @ 450 nm
- C → > 1 mJ
- D → > 3 mJ
- E → > 5 mJ
- F → > 8 mJ

Default pulse repetition rate in Hz

Optional tuning range extension
- SH → 210 – 409 nm
- BB → broadband output in the 600 – 900 nm range

Optional items
- AT/UV → motorized attenuator for UV range
- AT/VIS → motorized attenuator for VIS range
- AT/NIR → motorized attenuator for NIR range
- AT/IR → motorized attenuator for NIR range
- EM/BB → pulse energy monitor for OPO output
- SPM1 → OPO wavelength monitoring in VIS range
- FC/UV → fiber coupler for UV range
- FC/VIS → fiber coupler for VIS range
- FC/NIR → fiber coupler for NIR range

OPTIONAL ITEMS

WF	Stand-alone wireless router for wireless laser control
RS	Stand-alone adapter for laser control via RS-232 port
PC	Laptop computer for laser control
EXP	Stand-alone pulse generator for variable repetition rate
CT19	19” mounted controller with integrated AC/DC power supply
CTA19	19” mounted controller with air-purging unit
CTBR	Front/rear panel with brackets for standard controller
PS19	19” form factor AC/DC power supply
APU2	Stand-alone air-purging unit with integrated AC/DC power supply
CST	Custom model

IMAGES

Front view of Q-TUNE laser head

Rear view of Q-TUNE laser head

Front view of air-purging unit APU2

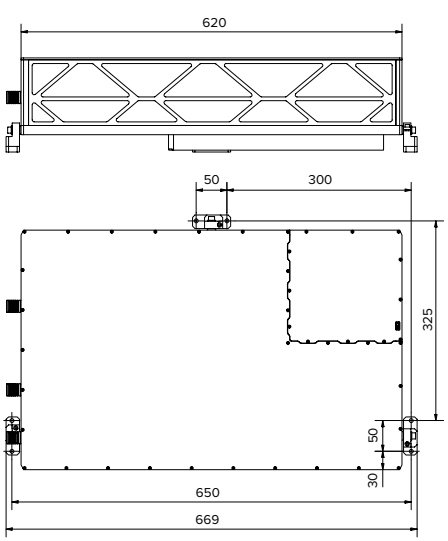
Rear view of air-purging unit APU2

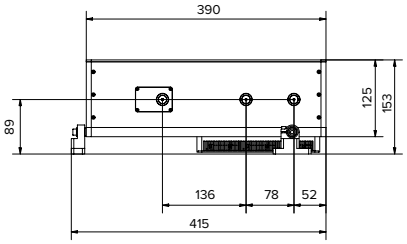
Fiber coupler FC

Motorized attenuator AT

Pulse energy monitor EM/BB

DRAWINGS





Outline drawings of Q-TUNE laser head (dimension in mm)