

Owners Manual

Cobolt Tango™ Pulsed 1535 nm DPSSL laser



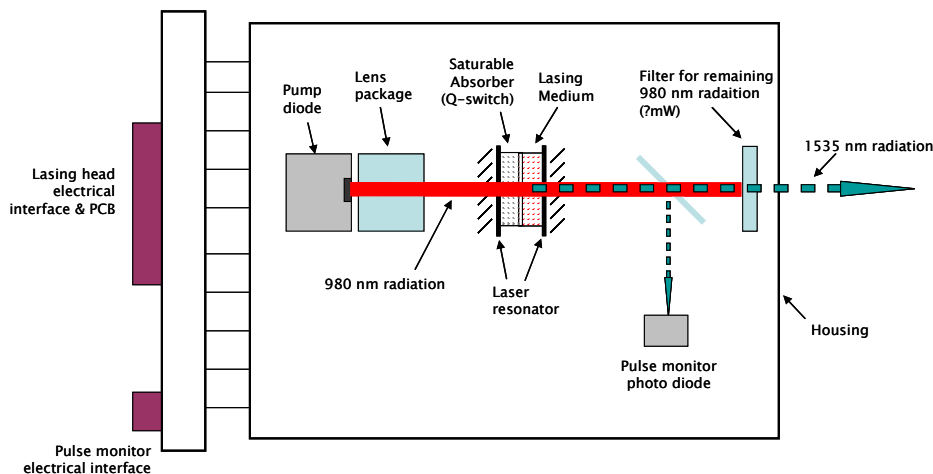
1. General

Cobolt Tango™-LAB is a compact diode-pumped solid-state laser device operating at a fixed wavelength of 1535 nm. The laser has a compact package and emits a high quality laser beam with stable characteristics over a wide range of operating conditions. The laser is designed and manufactured to ensure a high level of reliability.

The emission of high peak power pulses, the eye-safe wavelength and the compact package make the Cobolt Tango™ laser ideal for use in various types of demanding range finding and remote sensing applications.

2. Laser Design

The Cobolt Tango™ laser is a passively Q-switched diode-pumped solid-state laser. The laser design is based on microchip technology and, hence, employs a monolithic resonator. The microchip, consisting of Er:Yb-doped glass as gain medium and Co²⁺-doped Spinel as saturable absorber, is pumped by a diode laser at 980 nm. The laser emits pulsed radiation at 1535 nm in a close to diffraction limited beam through an exit window. The residual IR radiation from the pump is contained within the laser housing by filtering optics. The laser assembly is equipped with elements for temperature control of the active laser components. Temperature control signals and driving currents are supplied via electrical interfaces. The laser also contains an InGaAsP photo diode which converts each emitted optical pulse to an electrical signal, accessed via a separate second electrical interface. This feature allows the user to conveniently monitor the emitted pulses, eg. for triggering purposes.

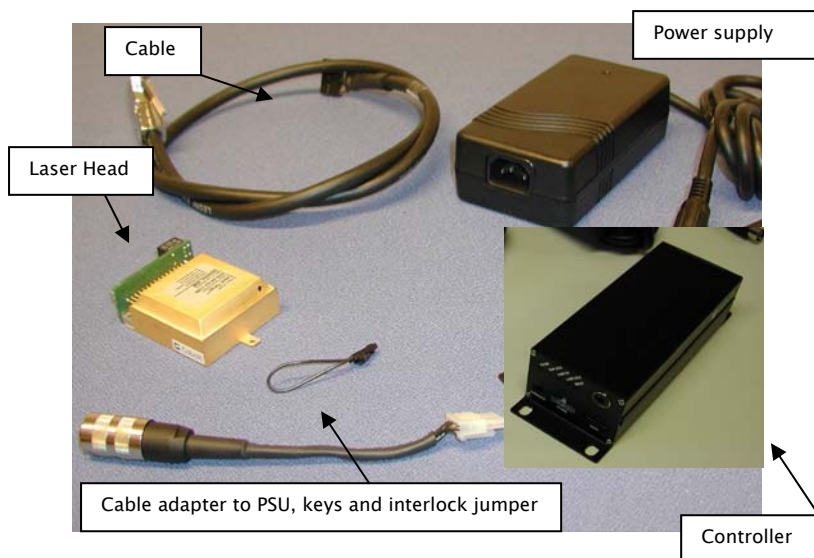


Cobolt Tango™-LAB laser design

US Patent 6,778,563

3. Laser System Description

The Cobolt Tango™-LAB laser system consists of four main parts: the Laser Head, the Controller, the Cable and the Power Supply Unit. The cable supplied with the laser should always be used to connect the Laser Head with the Controller.



Cobolt Tango™-LAB laser system

3.1. Laser Head

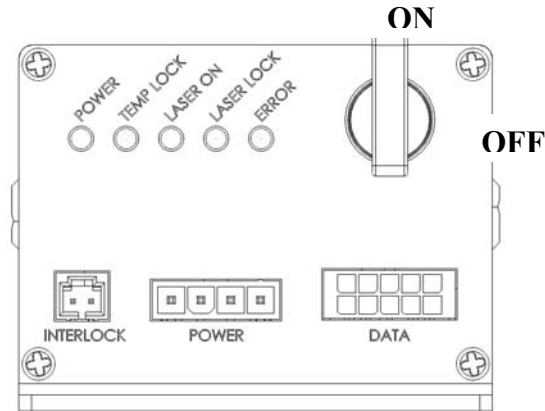
The Laser Head contains pump diode, laser microchip and temperature control elements in a hermetically sealed package. Attached to the back of the laser head is the PCB interface electronics. The pulsed 1535 nm radiation is emitted from the laser head through an exit window. The laser head gets electrical power and control signals from the Controller via a 20-conductor cable. The laser head also contains an InGaAsP photo diode which converts each emitted optical pulse to an electrical signal. This signal allows monitoring of the emitted pulses, eg. for triggering purposes, and is accessed on the PCB at the back of the laser head.

3.2. Controller

The Controller supplies driving current and control signals to the Laser Head. The operation set points of the Controller are specific to each Laser Head and have been fixed during manufacturing.

The status of the laser operation is given via LED indicators;

<i>POWER</i>	Power is supplied.
<i>TEMP LOCK</i>	The temperatures of the Peltier elements have been locked to their set points
<i>LASER ON</i>	Laser light is on in constant current mode.
<i>LASER LOCK</i>	Laser light is on and the output power has been locked to set point.
	The laser is operating according to specifications
<i>ERROR</i>	An error has occurred. No laser light.



Schematics of Driver Unit front side

The Controller can be operated in two ways;

- Connecting 5 VDC power supply to the Controller and setting the Turn Key to its vertical ON-position initiates an automatic start-up sequence. The laser will be running according to specifications in <5 min. The status of operation is monitored via LED signals. Setting the Turn Key to its OFF-position puts the laser in stand-by mode (status LEDs = TEMP LOCK)
- The operation of the Controller can also be controlled and monitored via the Data port (supports RS232 commands and analog signals). See section 8 for further details.

When power is supplied to the Controller, the temperature control elements are operating to reach set point values.

The Controller is featured with a 2-pin remote interlock connector. The connector must be short-circuited with an interlock jumper (included at delivery) for operation of the laser. To make use of the remote interlock as a safety switch, remove the jumper and connect to an external switch. Note: when the interlock circuit has been opened during operation, the laser needs to be disconnected from and then reconnected to the power supply in order to start-up again. Alternatively, it can be re-started using a special sequence of RS-232 commands, see section 8 for further details.

The Cobolt Samba™ and Fandango™ lasers are also available with a smaller Controller version suitable for OEM integration. Contact Cobolt's support for more information.

3.3. Cable

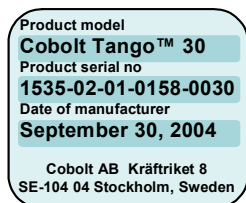
The Cable connects the Laser Head to the Controller. The Cable length is 1 m and minimum bending radius 2 cm. The connector on the driver is a female HD d-sub 26 pins and the connector on the PCB at the laser head is a "Molex male 20 pins. The signal from the photo diode is taken from a MMCX connector on the back of the PCB. The coaxial cable must be less than 0.5 m in order to not disturb the output pulse.

3.4. Power Supply

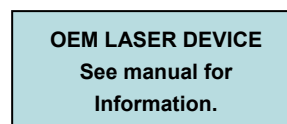
The Power Supply unit is plugged into a standard power outlet and accepts any input voltage from 100-120 and 200-240 VAC, 50-60 Hz. The output is 5 (±0.25) VDC and maximum 8 Amps (max 40 W).

3.5. Warning and identification labels

The Laser Head displays an OEM statement label. More detailed information about this OEM statement can be found under section 1 and 9 in this manual. These labels must be visible unless the laser beam is totally enclosed. The Laser Head and Controller are also provided with a manufacturer's identification label including a serial number which is unique for each laser system.

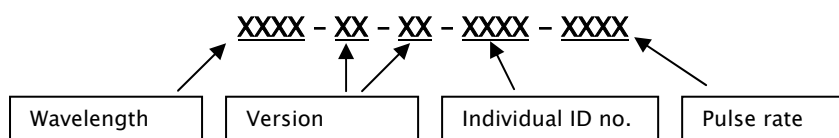


Manufacturers identification label



OEM statement label

Serial number description:



4. Specifications

4.1. Optical

Centre wavelength	1535±2 nm
Peak power	>1 kW
Repetition rate	3±1 kHz
Pulse length	4±1 ns
Spatial mode	TEM ₀₀ , M ² <1.2
Spectral bandwidth	< 0.05 nm
Beam divergence (Full angle, 1/e ²)	< 7 mrad, full angle
Beam symmetry (Gaussian fit)	>0.85:0.85
Beam diameter at aperture	400±100 µm
Beam angle accuracy*	<±5 mrad
Beam position accuracy*	<±0.2 mm
Beam pointing stability (after warm-up)	<10 µrad/°C (over 10–40°C)
Pulse to pulse amplitude jitter	<20%
Pulse to pulse repetition rate jitter	<2%
Long-term repetition rate (average power) stability (3 hs)	<3% pk-pk (over 3 hs, after warm-up and at ±3 °C ambient temperature)
Polarization	random
Residual IR emission	<2 mW

(* relative to beam position reference pins as indicated in laser head drawing under section 5)

4.2. Operational and Environmental requirements

Power consumption, total system	<20 W (typical <10)
Maximum heat dissipation of Laser Head (40°C ambient)	<10 W (typical <5)
Maximum Laser Head baseplate temperature	55 °C
Warm-up time, from OFF	<2 min
Ambient temperature, operation	0–50 °C non-condensing
Ambient temperature, storage	–20 – +70 °C
Humidity	25–60 % RH non-condensing
Ambient Air pressure	560–1050 mbar
Shock tolerance, storage (10 ms impact)	80 g
Heat sink thermal resistance, Laser Head and Controller	<0.5 K/W

4.3. Electrical interfaces

<u>Interfaces</u>	<u>Connector</u>	<u>Function</u>
Input power Controller	Molex “Mini-Fit Jr” 4-pin	Power supply to Driver Unit
Laser Head to Controller	Molex 90130–1220 20-pin	Connection to Laser Head
	MMCX	Trig signal output
Controller to Laser Head	HD-sub 26, female	Connection to Controller
Trig signal output Laser Head	MMCX	Trig signal output
Data port Controller	Molex “Mini-Fit 3.0” 10-pin	Control and monitoring via RS232 commands or analog signals
Remote interlock Controller	Molex “C-Grid” 2-pin	>2.4V=Disable, <0.8V=Enable (1kOhm pull up to 5V)
Warm-up time		2 min

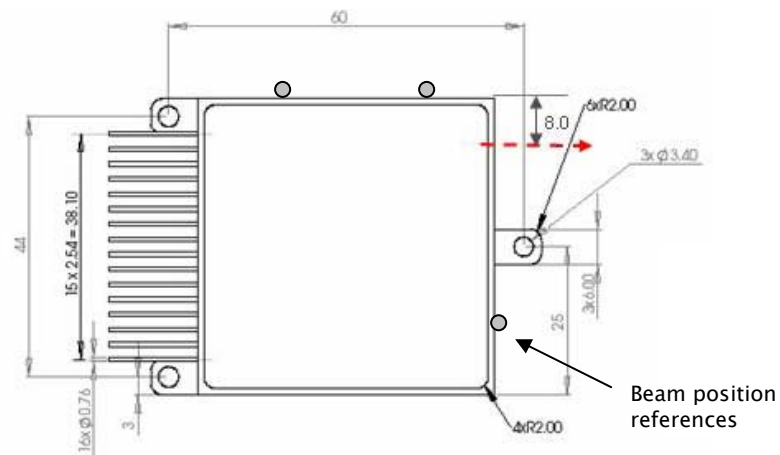
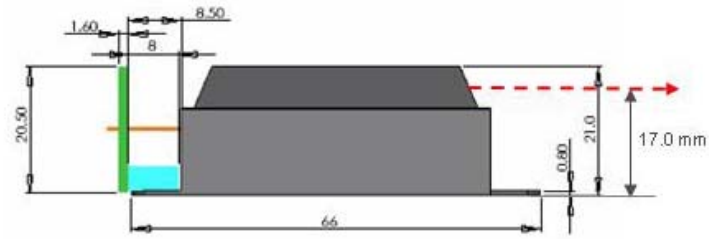
4.4. Mechanical

Dimensions	
Laser Head	50 x 68 x 21 mm
Controller	189 x 67 x 25 mm
Fixation holes, Laser Head	Size M3, spacing (44) x (60) mm
Fixation holes, Controller	spacing (51) x (178) mm
Cable (Laser Head – Controller)	1 m length, >2 cm bending radius

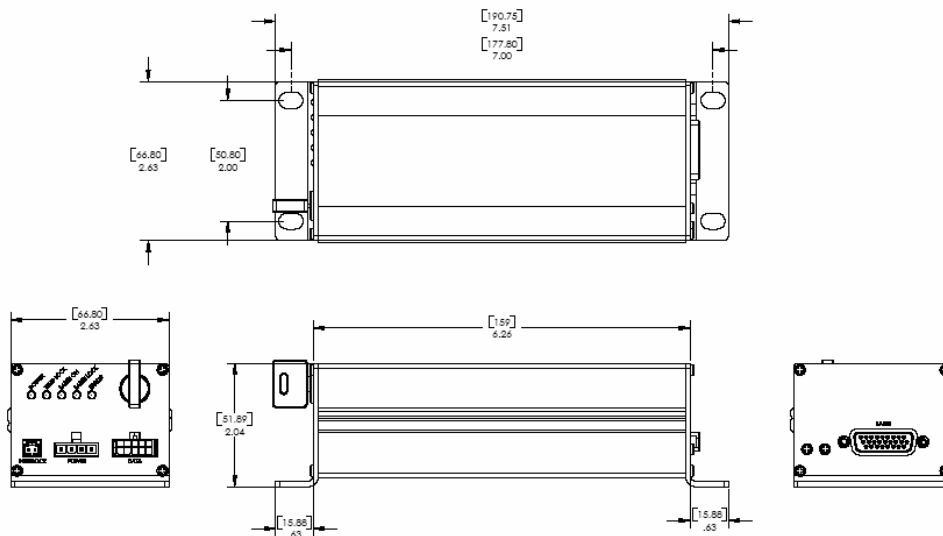
The information presented here is believed to be accurate and is subject to change without notice.

The specifications contained herein cannot be guaranteed outside of normal operational conditions.

5. Mechanical Outlines



Laser Head mechanical outline (dimensions in mm)



Controller mechanical outline (dimensions in [inches] and mm)

6. Connector drawings & pin assignment

Interlock Connector

Molex 70553-0001, mates with 50-57-9402, terminal 16-02-0087

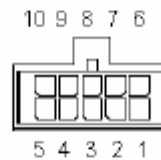
Pin	Function
1	Interlock (connect to pin 2 for enable)
2	0 V (ground)



Data Connector

Molex 43045-1002, mates with 43025-1000, 43030-009 terminal, 11-03-0043 extractor

Pin	Function
1	LASER ON LED
2	TEMP LOCK LED
3	POWER LED
4	RxD (RS-232 from computer)
5	Direct Control (connect to +5V for "ON")
6	LASER LOCK LED
7	ERROR LED
8	0 V (ground)
9	TxD (RS-232 to computer)
10	0 V (ground)



7. Operation Instructions

The laser is delivered with the controller set in auto-start mode. As soon as power is supplied to the controller, the laser will automatically go through the start-up sequence as described below. For instructions on how to operate the laser in manual start-up mode, contact Cobolt's support.

7.1. Installation Startup Operation

1. Mount the Laser Head on suitable heat sink (see section 9)
2. Ensure that the interlock jumper is connected
3. Connect Laser Head to Controller and fasten screws at both ends
4. Apply 5VDC to power supply connector on controller
5. The laser now goes through the following start-up sequence;
 - Temperature stabilisation (1-2 min). Status LEDs (RS232)= TEMP LOCK
 - Laser on (light is emitted) in constant current mode. Status LEDs (RS232) = LASER ON
6. Switching the laser ON/OFF (to/from stand-by mode) via RS-232 commands or Direct Control is described under section 8.

7.2. Closedown Operation

1. Disconnect 5VDC from power supply connector
2. Disconnect Laser Head from Controller (only required for shipping)

8. Operation via data port

8.1. Baud rates and serial port settings

Each controller is shipped from the factory with a fixed baud rate (19200), which cannot be changed in the field. The other serial port parameters are: 8 data bits, 1 stop bit and no parity. Hardware flow control is not supported. Command formatting and termination characters

Each command to the controller must be terminated in one of two equivalent ways:

- A line feed or “new line” character (ASCII 10).
- A “greater than” character '>' (ASCII 62)

All commands are case-sensitive. Leading and trailing white space is ignored, but command arguments must be delimited by a single space character (ASCII 32).

8.2. Handshaking

Under no circumstances does the controller initiate communication; it only transmits characters in response to a message. Every message to the controller generates a response, either a numerical value or the acknowledgment string “OK”.

In the event that the controller receives a message that it cannot interpret, it responds: “Syntax error: ” followed by the complete command string (minus the termination character) that caused the error. In the event that the controller receives a numerical value with an invalid checksum (see the next section), it responds: “Checksum error”. There are several configurations of the controller, and not all of the commands are supported by every unit. When a controller receives a valid command that it does not support, it responds: “Unsupported command”.

Every controller response is terminated by a carriage return/line feed pair (ASCII 13 followed by ASCII 10).

8.3. RS-232 commands

Command	Function	Argument	Returned value
hrs?	<u>Get system operating hours</u>		Float
ilk?	<u>Get interlock state</u>		0=OK 1=interlock open
l?	<u>Get laser ON/OFF state</u>		0=OFF 1=On
l	<u>Laser ON/OFF</u>	0=OFF 1=On	
i?	<u>Get drive current</u>		Float
leds?	<u>Status of 4 LEDs</u>		15 = "POWER" 14 = "TEMP LOCK" 12 = "LASER ON" 8 = "LASER LOCK" 7 = "ERROR"
@cobasdr	<u>Enable/disable direct control</u>	0=disabled 1 =enabled	
@cobasdr?	<u>Get direct control enable state</u>		0=disabled 1 =enabled
@cob1	<u>Laser ON after interlock</u>		
cf	<u>Clear fault</u>		
f?	<u>Get operating fault</u>		0 = no fault 1 = temperature fault 3 = open interlock 4 = constant power fault

For re-starting the laser with RS-232 commands after having opened the remote interlock switch, execute "cf" for clear fault followed by "@cob1".

Note: None of the given optical specifications on the laser emission can be guaranteed at output powers other than the factory set level. The output power should never be set to higher than factory set level.

8.4. Direct control

The Direct Control feature enables turning the laser ON/OFF using a 5VDC signal. After having configured the controller for Direct Control operation (factory set or by executing @cobasdr 1), the laser can only start-up when 5VDC is applied to pins 5 - 10 on the data port. Shifting the signal to 0VDC will put the laser in stand-by mode (status LEDs = "TEMP LOCK").

9. Thermal Management

To ensure operation within given specifications and for the warranty to be valid, the Laser Head must be attached to a heat sink providing a thermal resistance of <0.5 K/W (the heat sink itself plus the thermal contact with Laser Head). The mounting surface should be flat (within ± 0.05 mm over mounting surface), and it is recommended to use a thermal heat compound between the laser head and the heat sink to provide good thermal contact. The baseplate temperature should not exceed 55°C during operation of the laser. For assistance in thermal management and system integration, please contact Cobolt's technical support.

10. Warranty and Maintenance

Cobolt provides a system warranty of 1 year, with unlimited number of operation hours.

The Cobolt Tango™-LAB laser system is designed for modular replacement or repair in the event that the Laser Head, Controller or Power Supply malfunctions. Warranty is invalid if the laser system is operated outside of the specific limits and conditions as outlined in this document.

The Cobolt Tango™-LAB lasers are contained in sealed enclosures and should not be opened for any reason. The warranty will be voided if any of the system units are opened. All laser parameters are set at the factory, and there are no adjustments required. Maintenance is limited to wiping dirt off the enclosures and cleaning the aperture. Clean the aperture with a standard photographers' lens airbrush.

11. Safety and Precaution Instructions

The user should note that this laser product is delivered as an OEM component and does not comply with safety standards according to IEC or LAB.

"OEM / EXPORT

This laser device does not comply with US or European product requirements and is provided solely as an OEM component"

Cobolt Tango™-LAB emits up to 50 mW of 1535 nm laser radiation. Eye and skin exposure to direct or reflected laser light is hazardous and may be extremely harmful. Always wear eye protection appropriate to the beam wavelength and intensity. The device must be handled by personnel with experience of lasers, in a laboratory environment and with access to adequate laser safety equipment.

LASER LIGHT

AVOID EXPOSURE TO BEAM

Always install the laser system to a properly grounded power outlet.

CAUTION – use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

12. Declaration of conformity

The user should note that this laser product is delivered as an OEM component and does not comply with safety standards according to IEC or CDRH.

The Cobolt Tango™-LAB laser is RoHS compliant as defined by the EC Directive 2002/95/EC.

13. Disclaimers

Cobolt AB will assume no responsibility for damage incurred by faulty customer equipment, such as measurement equipment, cables etc, used in conjunction with Cobolt Tango™.

Cobolt AB makes no warranty of any kind with regard to the information contained in this guide, included but not limited to, implied warranties of merchantability and suitability for a particular purpose. Cobolt AB shall not be liable for errors contained herein nor for incidental or consequential damages from the furnishing of this information.

No part in this Users' Guide may be copied, reproduced, recorded, transmitted, or translated without the express written permission by Cobolt AB.

14. Return for repair

If the laser does not function, it must be returned to Cobolt AB for repair. Do not attempt to open any of the units, or the warranty will be voided.

1. Call or e-mail Cobolt AB or your local Cobolt representative for consultancy and to obtain an RMA-number (+46 8 545 91230, e-mail: info@cobolt.se).
2. Pack the unit for shipment using the original package, and ship it back to Cobolt AB.
3. If the unit is still under warranty, Cobolt AB will test and repair or replace the units at the option of Cobolt AB, within 14 days of receipt of the unit.
4. If the unit is not under warranty, Cobolt will contact you with options for repair or replacement.

Contact information

Cobolt AB headquarters

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