Cobolt 05-01 Series

High Power | Single Frequency | CW Diode pumped lasers

355 nm	515 nm	640 nm
457 nm	532 nm	660 nm
491 nm	561 nm	1064 nm

HÜBNER Photonics | Coherence Matters.

CONTENTS

1. Introduction

The Cobolt 05-01 Series lasers are continuous-wave diode pumped laser (DPL) devices operating at a fixed wavelength between 355 nm and 1064 nm. The lasers are built using proprietary HTCure™ manufacturing technology for ultra-robustness in a compact hermetically sealed package.

The lasers emit a very high quality laser beam with stable characteristics over a wide range of operating conditions. Single frequency operation provides a narrow spectral bandwidth and long coherence length. The lasers are designed and manufactured to ensure a high level of reliability.

The Cobolt 05-01 Series lasers are intended for stand-alone use in laboratory environments or for integration as OEM components in instruments for applications including fluorescence microscopy, flow cytometry, DNA sequencing, HCA, Raman spectroscopy, interferometry, holography and particle analysis.

2. Safety

2.1. General

Cobolt 05-01 lasers are Class IIIB (3B) and Class IV (4) laser products that emit laser radiation within the visible and Near Infrared (NIR) spectrum. Residual emissions from the pump diode are contained within the laser head housing via filtering optics. The residual emission does not exceed Laser Class 1.

Product	Wavelength (nm)	Nominal Output Power (mW)	Laser Class CDRH (IEC)
Zouk™	355 nm	10, 20	IIIB (3B)
Twist™	457 nm	100, 200	IIIB, (3B)
Calypso™	491 nm	200	IIIB (3B)
Fandango™	515 nm	300	IIIB (3B)
Samba™	532 nm	500, 1000, 1500	IV (4)
Jive™	561 nm	200, 300	IIIB (3B)
		500	IV (4)
Bolero™	640 nm	500	IV (4)
Flamenco™	660 nm	100, 300	IIIB (3B)
		500	IV (4)
Rumba™	1064nm	500, 1000, 2000, 3000	IV (4)

Symbols in the manual

WARNING – LASER RADIATION This symbol is used to call attention to important laser safety information

WARNING – STATIC MAGNETIC FIELD This symbol is used to call attention to important magnetic field safety information

CAUTION – GENERAL This symbol is used to call attention to important general operator and equipment safety information

NOTICE – GENERAL This symbol is used to call attention to best practices when using the equipment and does not indicate a hazard.

2.1. Beam Hazards

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. Lasers may pose a risk of igniting flammable materials and in event of ignition gasses and fumes may be generated. All equipment used in close proximity to the laser beam should be suitably fire resistant and the facility should be properly ventilated. It is advised to perform a risk assessment for the facility and equipment prior to using the laser. In the case of integration into a larger system, laser safety compliance must be evaluated in the end product.

WARNING   Remove all watches, rings, and other reflective jewelry before working with lasers. Always wear the appropriate eye protection from the wavelengths integrated into the system. Verify the accessible emission wavelength and power before operating. **Never look directly into a laser beam.**

The device must be handled by skilled personnel experienced with lasers, in a laboratory environment and with access to adequate laser safety equipment. The laser head clearly displays a yellow warning label that shows the location of the laser beam aperture. This label must be visible unless the laser beam is totally enclosed. If the laser does not function, do not attempt to open any part of the device, or the warranty will be voided. Call or e-mail your local Cobolt representative for consultancy and to request an RMA number (see back cover for contact information).

Laser radiation may ignite flammable materials and combustible gasses in the beam path and, in event of ignition, fumes may be generated. All equipment used in close proximity to the laser beam should be suitably fire resistant and the facility should be properly ventilated.

 CAUTION Use of controls or adjustments or performance of any procedures other than those specified herein may result in exposure to hazardous radiation.

The table below describes the irradiance in W/cm² and appropriate level of eye protection in terms of optical density (OD) for each product line.

Product	Wavelength (nm)	Nominal Output Power (mW)	Irradiance (W/cm²)*	Eye protection Requirement**
Zouk™	355 nm	10, 20	7	OD 4
Twist™	457 nm	100, 200	66	OD 4
Calypso™	491 nm	200	66	OD 3
Fandango™	515 nm	300	99	OD 4
Samba™	532 nm	500, 1000, 1500	497	OD 4
Jive™	561 nm	200, 300	99	OD 3
		500	166	OD 4
Bolero™	640 nm	500	166	OD 4
Flamenco™	660 nm	100, 300	99	OD 4
		500	166	OD 4
Rumba™	1064nm	500, 1000, 2000, 3000	466	OD 4

The equations below describe how to use the nominal output power (mW) and beam area to calculate the irradiance (W/cm²) and how to use the Warning label (Max) power (mW) and the Accessible Emission Limit (AEL) (mW) per laser safety standard IEC 60825-1:2014 to calculated the required optical density (OD) for eye protection per wavelength.

$$\text{Irradiance} \left(\frac{W}{cm2}\right) = \frac{110\ \%\ \text{of Nominal Laser Power (mW)}}{\text{Beam area at bottom tolerance (cm}^2)}$$

$$\text{Require Attenuation of Laser Safety Glasses (OD)} = \log_{10}\left\{\frac{\text{Warning Label Power (mW)}}{60825 - 1\ \text{Laser Class 1 AEL (mW)}}\right\}$$

 WARNING Always wear the appropriate eye protection for all of the specified emitted wavelengths. Verify the accessible emission wavelengths and power levels on the warning label before operating.

2.2. Safety features

The laser is equipped with all required safety features as described in the laser safety standard 60825-1. Disabling any safety features negate the CE/CDRH compliance of this product. If any part of the delivered equipment is replaced with a part not supplied by Cobolt or if the equipment is not properly grounded system may not conform to CE / CDRH compliance standards listed in section 12 : Compliance (CDRH models only). Disabling any of the safety features nullifies the CE marking and violates the laser safety standard.

Remote Interlock Connector

The remote interlock connector is a connector which permits the connection of external controls placed apart from other components of the laser product. When the terminals of the connector are open-circuited, emission is interrupted and no radiation will be accessible. The remote interlock connector permits easy addition of an external interlock in laser installation. See section 4.3 for a detailed description of the remote interlock circuit and operation.

Manual Shutter (Beam Stop)

The laser head is equipped with a manual shutter, which functions as the beam stop, capable of preventing human access to laser radiation. The aperture location and the open and close positions of the shutter are indicated on the top surface of the laser head.

Key Control

The CDRH compliant model comes with a key-switch on the Controller which must be connected for the laser to operate. When the key is in the OFF position, the laser is prevented from emitting. The key must be actively turned to the ON position each time the laser is powered on. When the key is removed from the system laser radiation is not accessible.

Laser Radiation Emission Warning

The Controller incorporates information LEDs which display whether power is connected, the laser is on, or a fault has occurred. The "ON" LED is illuminated whenever the device is emitting or could emit light. See section 3.4 for details on the controller. The emission warning indicators are also visible in the Cobolt Monitor™ software, see section 8 for details on the control software.
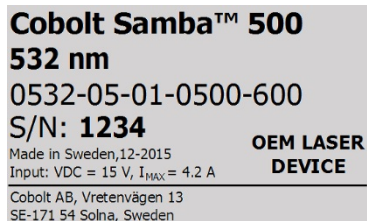
2.3. Equipment Safety

Always install all power supplies used in the laser system to properly grounded power outlets. The laser head and controller must be mounted on a common ground plane, such as an optical table. Cobolt lasers contain a laser diode which is sensitive to electrostatic discharge (ESD).
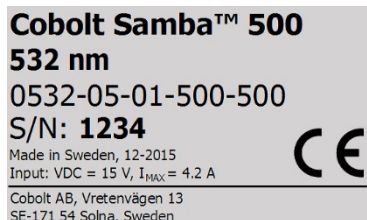
2.4. Warning and Identification Labels

The upper face of the laser head contains a yellow label with laser safety warning and classification information, the wavelength and maximum power of the unit. It also shows the location of the laser beam from the aperture and indicates the open and close positions of the manual shutter. This label must be visible unless the laser beam is totally enclosed. A silver label showing information about the laser model, manufacturer date and location, and the power supply voltage and current, is located on the laser head. Lasers shipped to customers in the USA also contain a label of CDRH compliance.
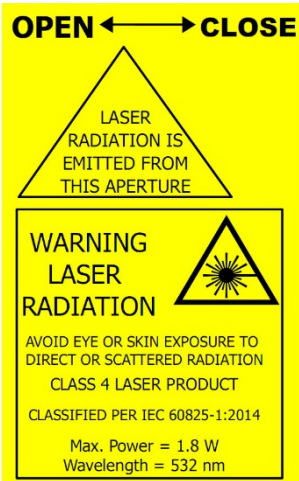
Manufacturer Identification Labels

Cobolt Samba™ 500
532 nm
0532-05-01-0500-600
S/N: **1234**   **OEM LASER**
Made in Sweden,12-2015   **DEVICE**
Input: VDC = 15 V, I_{MAX} = 4.2 A
Cobolt AB, Vretenvägen 13
SE-171 54 Solna, Sweden

OEM Label

Cobolt Samba™ 500
532 nm
0532-05-01-500-500
S/N: **1234**   C E
Made in Sweden, 12-2015
Input: VDC = 15 V, I_{MAX} = 4.2 A
Cobolt AB, Vretenvägen 13
SE-171 54 Solna, Sweden

CE marking for CDRH models only

OPEN ←→ CLOSE

LASER RADIATION IS EMITTED FROM THIS APERTURE

WARNING LASER RADIATION

AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION

CLASS 4 LASER PRODUCT

CLASSIFIED PER IEC 60825-1:2014

Max. Power = 1.8 W
Wavelength = 532 nm

Aperture Warning Labels

Complies with 21 CFR 1040.10 and 1040.11
except for deviations pursuant to
Laser Notice No. 50, dated June 24, 2007

Laser Notice No. 50 Label
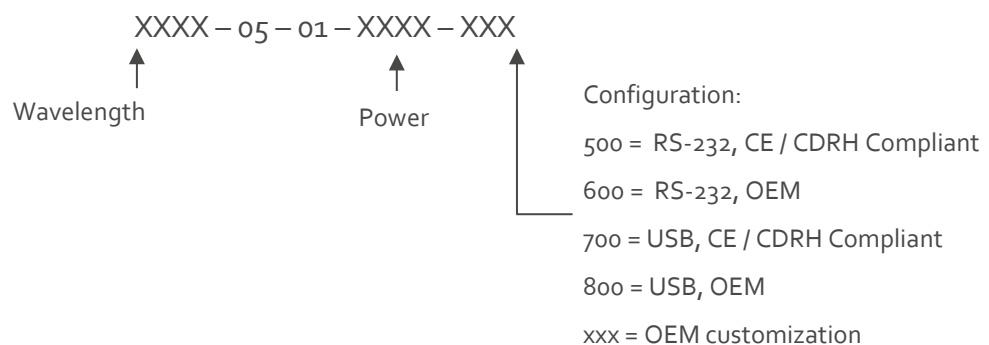
CDRH models shipped to USA

3. Overview

Cobolt 05-01 Series laser systems consist of four main parts: the laser head, the Controller, the Cable and the Power Supply (not shown). The cable provided should always be used to connect the laser head with the Controller. Always install the laser system to a properly grounded power outlet. . If any part of the supplied equipment is replaced with a part not supplied by Cobolt or if the equipment is not properly grounded system may not conform to CE / CDRH compliance standards listed in section 12 : Compliance (CDRH models only). Disabling any of the safety features nullifies the CE marking and violates the laser safety standard.
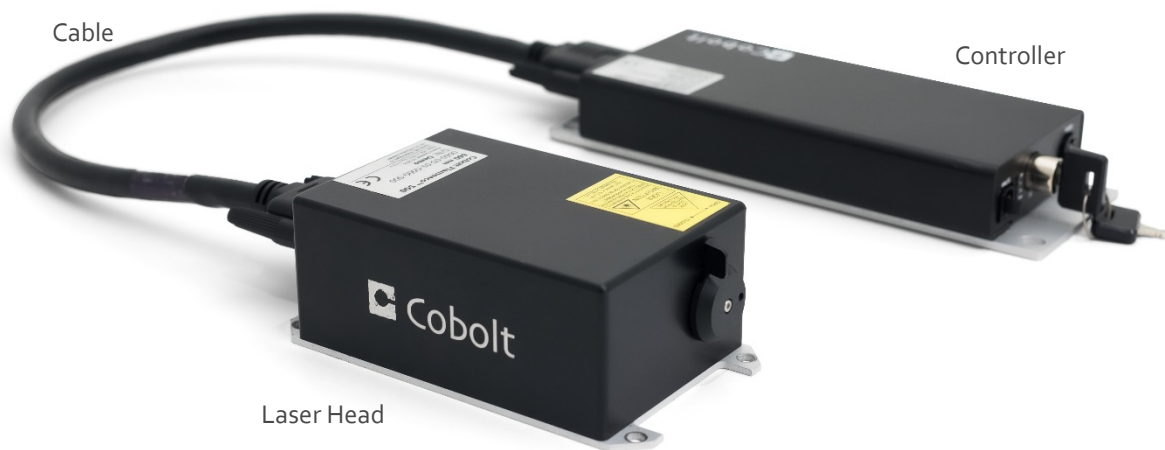
3.1. Model number

Cobolt lasers are sold in two configurations: CDRH and OEM, described in section 3.2. The model numbers are composed as described below.

XXXX – 05 – 01 – XXXX – XXX

Wavelength   Power

Configuration:

500 = RS-232, CE / CDRH Compliant

600 = RS-232, OEM

700 = USB, CE / CDRH Compliant

800 = USB, OEM

xxx = OEM customization

3.2.   Configuration

3.2.1. CDRH Compliant

The CDRH compliant system is supplied with a key switch on the Controller, which must be connected, along with a remote interlock connector. Once power is supplied, laser radiation starts when the key is turned from the OFF position to the ON position. The status of operation can be monitored via LEDs on the Controller. Setting the key to its OFF position puts the laser in stand-by mode. **The CDRH model is CE compliant.**

The standard CDRH model consists of:

- Laser head
- Controller with key switch
- Keys
- 1 m Controller Cable
- 15 V / 6 A   DC power supply unit

3.2.2. OEM

The OEM system is supplied **without** a key switch on the controller. Connecting the power supply to the controller initiates an automatic start-up sequence. If the remote interlock is connected, laser radiation will start automatically as soon as power is supplied and internal temperatures are stabilized.

The OEM model consists of:

- Laser head
- Controller
- Controller Cable
- 15 V / 6 A   DC power supply unit

3.3.   Laser Head

The laser head contains pump diode, laser cavity, beam shaping optics and thermoelectric coolers (TEC) for temperature control of the cavity and pump diode. The laser head contains an optical feed-back loop which ensures long-term power stability of the emitted visual beam. The laser head features a manual mechanical shutter as well as a laser hazard label and a laser classification label. The Laser Head gets electrical power and control signals from the Controller via a 26-pin HD Sub-D cable. All configurations covered in this manual are available with all CDRH and OEM controller configurations.

3.4. Laser Controller

The Controller supplies driving current and control signals to the Laser Head. All Laser Heads are delivered with a controller. The operation set points are specific to each Laser Head and have been fixed during manufacturing. The operation set points are stored in the laser head so the controller can be interchanged or replaced.

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

POW	Green	Power is supplied.
ON	Orange	Laser emission is on. This light is on in modulation mode if laser emission is possible.
LOCK	Orange	Laser light is on and the output power has been locked to set point. The laser is operating according to specifications.
ERROR	Red	An error has occurred.

When power is supplied to the Controller, regardless of on/off state, the temperature control elements are operating to reach set point values. The Controller includes a remote interlock connector, pin 1-2 according to Section 4.3. The operation of the laser can be controlled and monitored via the data port that supports either USB or RS-232 commands. See Section 7.3 for further details. RS-232 controllers may also be delivered with a RS-232 to USB adaptor.

3.5. Controller Cable

The controller cable connects the laser head to the Controller. The standard (CE compliant) cable length is 1 m. The cable has a minimum bending radius of 8 cm. When connected care should be taken not to bend or break any of the 26 pins.

3.6. Power Supply Requirements

An appropriate Power Supply Unit (PSU) is supplied by Cobolt with the laser and must be plugged into a properly grounded standard power outlet. The output from this PSU is 15 VDC / 6 A. The power supply accepts 100 – 240 V AC and 50-60 Hz. Ripple and noise 1% peak-peak max, 20 MHz bandwidth. The accepted voltage range for the Cobolt Bolero™ is 15 V - 28 VDC; all other Cobolt 05-01 lasers accept 11 V - 28 VDC. Full performance is only guaranteed at 15 VDC / 6 A.

The power supply provided with Cobolt 05-01 lasers are certified to perform in an ambient temperature of 40°, when integrating this power supply into a larger system care must be taken to ensure that the power supply is not exposed to temperatures above 40°C.

3.7. 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 < 0.2 K/W. This value is the difference between the maximum allowed Laser Head base plate temperature (50°C, 45° C for Cobolt Bolero™) and the maximum specified ambient temperature at the air-heatsink interface (40°C , 35°C for Cobolt Bolero™), divided by the maximum power dissipated from the laser (55 W for the highest power models at high ambient temperatures). The mounting surface should be flat (within ± 0.05 mm over mounting surface). It is recommended to use a thermal heat compound between the Laser Head and the heat sink to provide good thermal contact. The Cobolt 'HS-04 Laser Head Heatsink with fans' meets these requirements, see www.cobolt.se for more information on heat sinks. For assistance in thermal management and system integration, please contact Cobolt's technical support.

Heat Sink Requirements and typical maximum heat dissipation for Cobolt 05-01 Series.
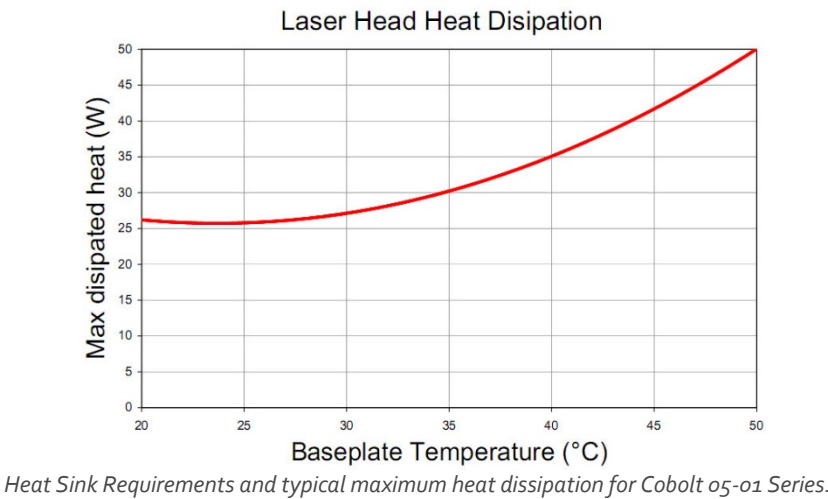
4. System Description

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. The output power can be adjusted using control commands, see Section 7.3. Specifications are guaranteed at 100% of nominal power after warm-up is complete.

4.1. Specification

4.1.1. Optical Specifications

	Centre wavelength[1]	Output power (mW)
Zouk™	354.8 ± 0.3 nm	10, 20
Twist™	457.0 ± 0.3 nm	100, 200
Calypso™	491.5 ± 0.3 nm	200
Fandango™	514.8 ± 0.3 nm	300
Samba™	532.1 ± 0.3 nm	500, 1000, 1500
Jive™	561.2 ± 0.3 nm	200, 300, 500
Bolero™	639.6 ± 0.3	500
Flamenco™	659.6 ± 0.3 nm	100, 300, 500
Rumba™	1064.2 ± 0.6 nm	500, 1000, 2000, 3000

	Zouk™	Twist™	Calypso™	Fandango™	Samba™	Jive™	Bolero™	Flamenco™	Rumba™
Beam Diameter (µm)	700 ± 50								1000 ± 50
Divergence (full angle, $1/e^2$) (mrad)	< 0.8	< 1.2					< 1.4	< 1.5	< 1.6
Noise 20 Hz – 20 MHz (peak-peak)	< 2 %		< 5 %	< 2 %	< 1 %		< 7 %	< 1 %	
Noise 20 Hz – 20 MHz (rms)	< 0.2%		< 0.5%	< 0.2%	< 0.1 %		< 1.0 %	< 0.1 %	
Long-term power stability (8 hours)	< 2 % (±3 ˚C)								
Spatial mode	TEM_{00}, M^2 < 1.1								
Spectral linewidth	< 1 MHz (< 0.001 pm)								
Wavelength stability (8 hours)	< 2pm (± 2 °C)								
Coherence length	> 100 m								
Beam symmetry at aperture	> 0.90 : 1			> 0.95 : 1					
Beam waist location (vs exit)	± 200 mm								
Beam angle accuracy	< 5 mrad								
Beam position accuracy	< 0.25 mm								
Beam pointing stability (10-40˚C)	< 10 µrad/˚C, (typical < 5 µrad/˚C)								
Polarization ratio (linear, vertical)	> 100:1								
Residual IR emission	< 1 mW								

1. The wavelength is fixed with this accuracy, while drift is <0.02nm. The wavelength is specified in air.

4.1.2. Operation and Environmental Specifications – Laser Head

|	
Power supply	15 VDC, 6 A
Intended use environment	Laboratory (indoor)
Pollution Degree	2
Power consumption, total system	< 63 W (typical < 55 W)
Maximum Laser Head baseplate temperature	50°C (45°C for Cobolt Bolero™)
Ambient temperature, operation	10 – 40 °C (35°C for Cobolt Bolero™
Ambient temperature, storage	-10°C to +60 °C
Humidity	0- 60 % RH non-condensing
Ambient Air pressure	950-1050 mbar
Heat sink thermal resistance, Laser Head	< 0.14 K/W
Warm-up time, from OFF	< 3 min
Communication protocol	USB or RS 232

4.1.3. Electrical Interfaces - Controller

Interfaces	Connector	Function
Input power	Kycon KPJX-45, 4-pin	Power supply to Controller
Laser Head to Controller	HD-sub 26-pin, male	Connection to Laser Head
Controller to Laser Head	HD-sub 26-pin, female	Connection to Controller
Data port	USB-type mini B	Control and monitoring via control commands
Remote interlock & Analog signals	Molex 90130-3206	Analog input 5 – 12 V => Laser ON Analog input < 2.7 V => Laser OFF

4.1.4. Mechanical Interfaces

|	
Dimensions:	
Laser Head	125 x 70 x 45 mm (4.9 x 2.8 x 1.8 inches)
Controller	190 x 72 x 28 mm (7.5 x 2.8 x 1.1 inches)
15V PSU	115 x 50 x 35 mm (4.6 x 2.0 x 1.4 inches)
Fixation holes, Laser Head	$\varnothing$ = 4x 4.5 mm (M4); 115 mm x 55 mm
Fixation holes, Controller	$\varnothing$ = 4x 6.4 mm (M6); 178 mm x 51 mm
Laser Head weight	< 0.6 kg

4.2. Mechanical Drawings

4.2.1. Laser Head
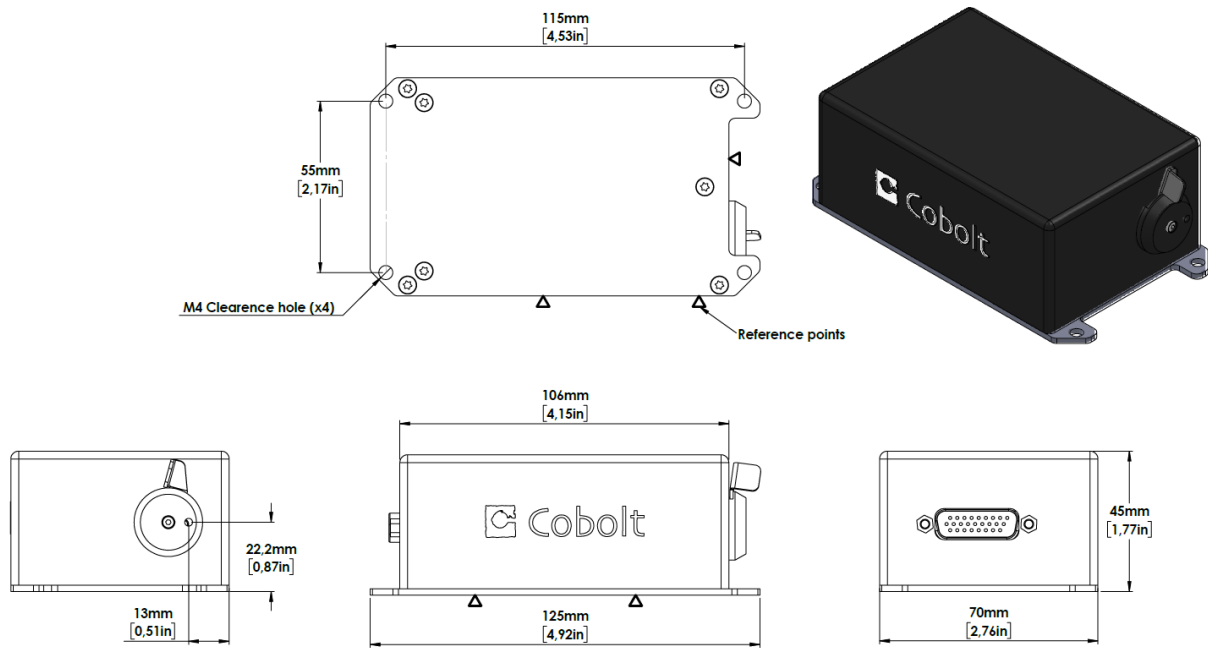
Laser head mechanical outline. Dimensions in mm [inches].

4.2.2. Laser Controller
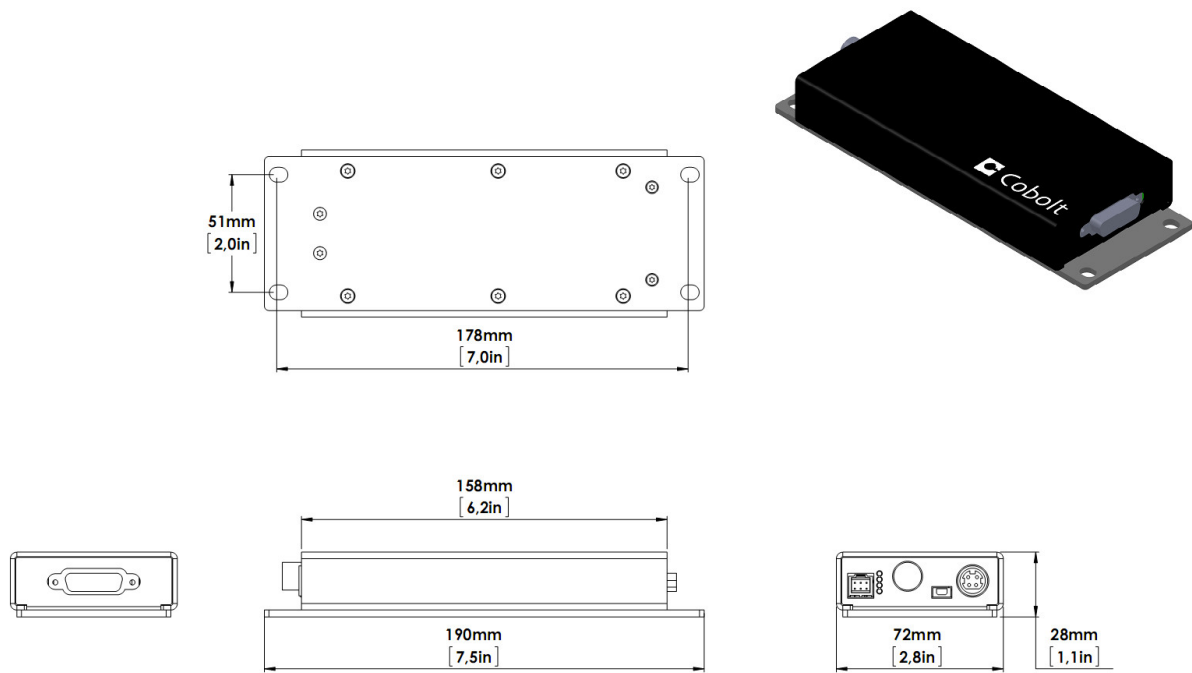
Controller mechanical outline. Dimensions in mm [inches].

4.3.   Remote Interlock Connector

The remote interlock connector is located at pin 1 and 2 of the Molex connector on the Controller. The connector can be short-circuited with an interlock jumper (included at delivery) for operation of the laser. To use the remote interlock connector with an external switch, connect a pin 1 and 2 on a Molex plug. After the remote interlock connector has been opened the laser will need to be reset by disconnecting from and then reconnecting to the power supply in order to start again. Alternatively, it can be re-started using a special sequence of commands, see Section 7.3 for further details. The signal level is between 0V and +5V with a pull up resistor, and the current required to ground the remote interlock connector is 5 mA. The time delay in the hardware is <1ms, but after filtering by the firmware the reaction time is extended to < 20ms.

4.4.   Direct ON/OFF control

The Direct On/Off Control feature enables turning the laser ON/OFF using a 5-12 VDC signal. After having configured the Controller for Direct Control operation (factory set or by executing @cobasdr 1), the laser can only start-up when 5-12V VDC (max 12.5 VDC) is applied to pin 3 on the analog connector with 0 VDC on pin 2 as reference. Shifting the signal to 0 VDC on pin 3 will turn the laser off and put the laser in stand-by mode (status LED:s is POW and not flashing).

NOTICE This function is not available for CDRH compliant models. The Direct on/off feature should never be used as remote interlock connector. A remote interlock socket is provided for this purpose on the laser head. This input only controls the on/off state of the laser and cannot be used to modulate the power output.
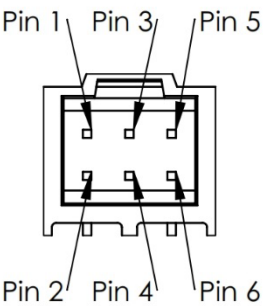
4.5. Pin assignment

All equipment connected to the system should be limited energy as described by IEC 61010:1.
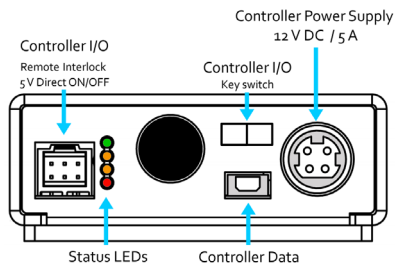
4.5.1. Controller I/O connector
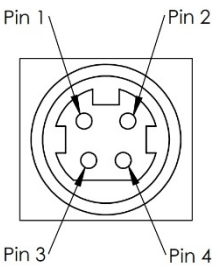
Manufacturer Molex 90130-3206, mates with 90143-0006.

Pin	Function
1	Remote Interlock (connect to pin 2 for enable)
2	0 V - GND
3	Remote On/Off (+5V Input)
4	TST (Internal Cobolt use only)
5	LED "Laser on" (5V)
6	LED "Error" (5V)

4.5.2. Power supply connector
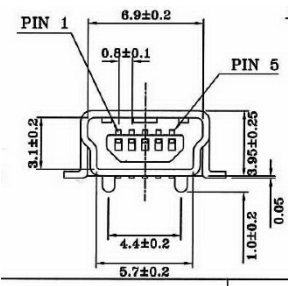
Kycon KPJX-4S, mates with Kycon KPPX-4P. Grounded shield.

Pin	Function
1	0 V
2	+11-28 VDC
3	0 V
4	+11-28 VDC

4.5.3. Data connector

Connector USB-type, manufacturer Hsuan Mao C8320-05BFDSB0, mates with connector mini-B.

Pin	Function (RS-232 / USB)
1	+5 V (USB only)
2	RS-232_TX / D-
3	RS-232_RX / D+
4	Not connected
5	0 V (GND)

5. Operating Instructions

As standard, all lasers are delivered with the Controller set in Auto-start mode. As soon as power is supplied to the Controller the temperature control elements are operating to reach set-point values and the laser emission will start, unless the key-switch is enabled (CDRH model).

5.1. Installation start-up operation

1. Mount the Laser Head on a suitable heat sink (see Section 3.5).
2. Ensure that the remote interlock jumper is connected.
3. Connect the Laser Head to the Controller with the Cable and fasten screws at both ends.
4. Connect the 15 VDC power supply to the mains outlet and then to the Controller.
5. The laser now goes through the following auto-start sequence:
   - Temperature stabilization (1-2 min). Status LEDs: POW flashing, then POW goes on.
   - Turn key switch to start the laser. Status LEDs: ON goes on (CDRH model only)
   - The laser starts (light is emitted) in a constant warm-up current constant for 60 sec. Status LEDs: ON goes on.
   - The laser locks to pre-set output power (<2 min) and operates according to specifications. Status LEDs: LOCK goes on.

NOTICE If the power does not match the power as stated on the test sheet see Section 11: Service for more information.

6. Operating Modes

There are two operating modes: constant power and constant current. The default mode for Cobolt 05-01 series lasers when shipped is constant power. In constant power mode the power is monitored on an internal photodiode, and this is used to regulate the current to maintain a constant power level. In constant current mode the laser runs at a set current level.

7. Operation via data port

To connect a Cobolt 05-01 Series lasers to a data port use mini-USB connection on the laser head for both RS-232 and USB communication. The appropriate cable is provided with all lasers.

7.1. Handshaking

Under no circumstances does the system initiate communication; it only transmits characters in response to a message. Every message generates a response, either a numerical value or the acknowledgment string "OK". In the event that the system receives a message that it cannot interpret, it responds: "Syntax error: illegal command". Every system response is terminated by a carriage return (ASCII 13) and a full stop is used with floating numbers.

7.1. RS232 configured controllers

To communicate with the laser, a communication cable is supplied. Each Controller is shipped from the factory with a fixed baud rate (115200). The other serial port parameters are: 8 data bits, 1 stop bit and no parity. Hardware flow control is not supported. Each command to the Controller must be terminated by a carriage return. 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).
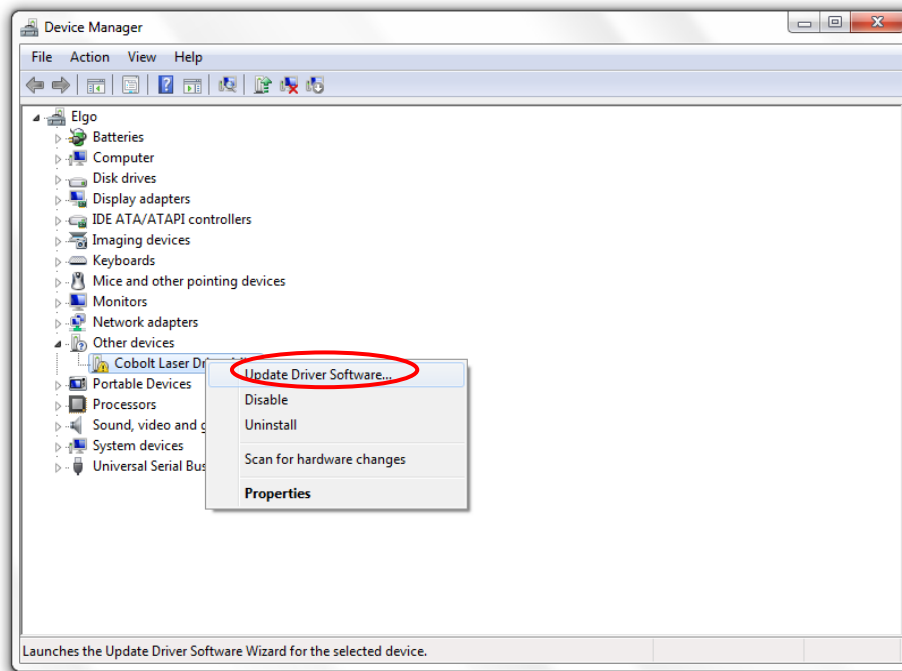
7.2. USB driver

When using Cobolt Monitor™ with Windows 10, the USB device is automatically detected. When using Windows 8 or earlier (e.g Windows 7, Vista, XP) it is necessary to install the Cobolt signed USB driver. To be able to connect to a Cobolt Skyra™ laser via USB, a USB driver must be installed on the computer. The USB driver can be downloaded from the Cobolt website (www.coboltlasers.com). When installed, a virtual COM port will be created to communicate with the laser. To install the USB driver in Windows 7 follow these instructions:
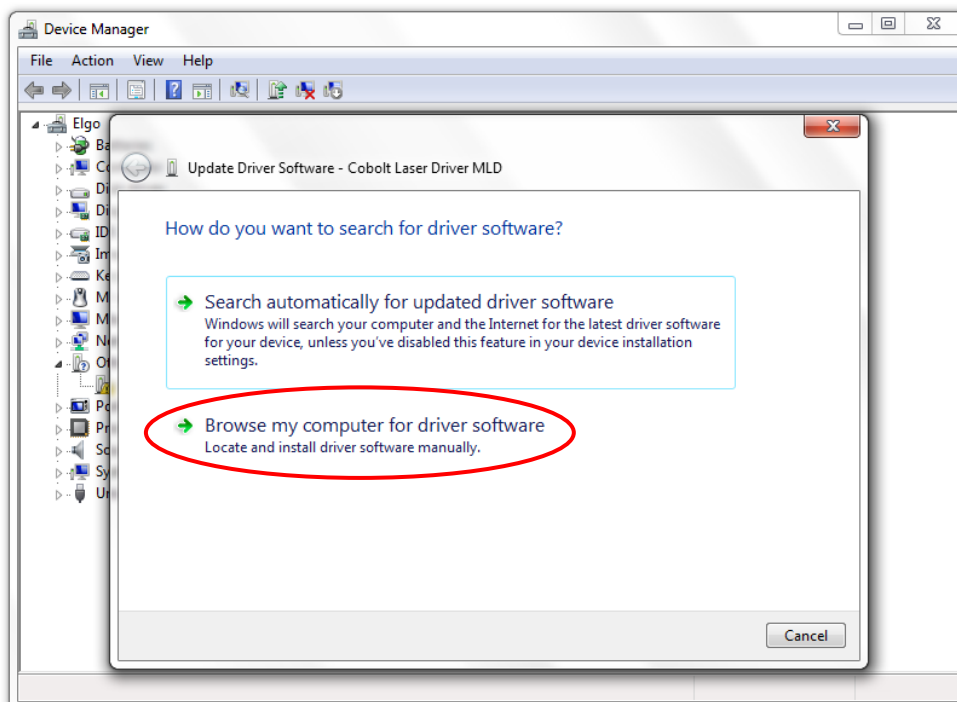
1. Go to the **Control Panel** and choose **Hardware and Sound**.
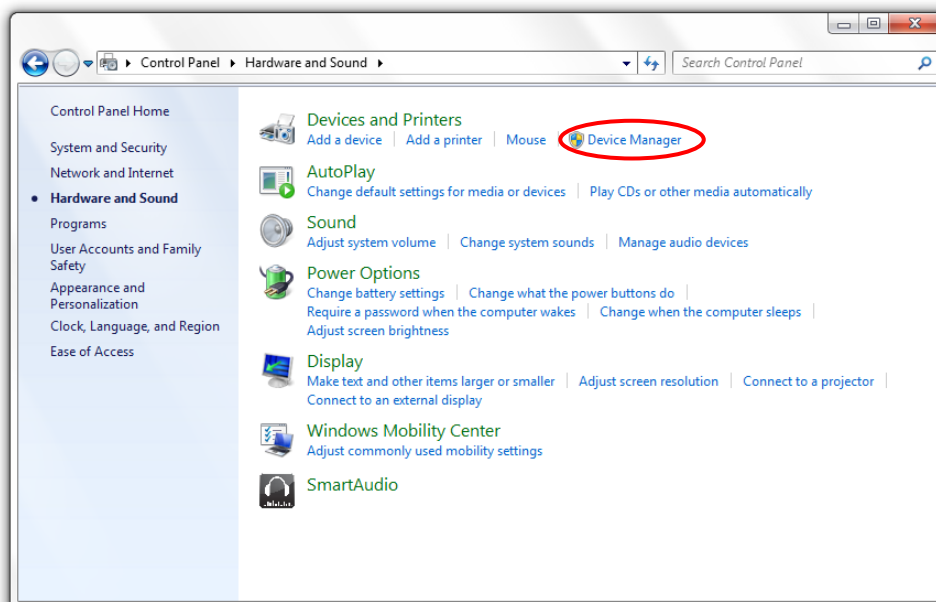
2. Under the **Devices and Printers** section, choose **Device Manager**.

3. Under **Other devices,** find the device called **Cobolt Laser Driver**. Right-click it and chose **Update Driver Software**.
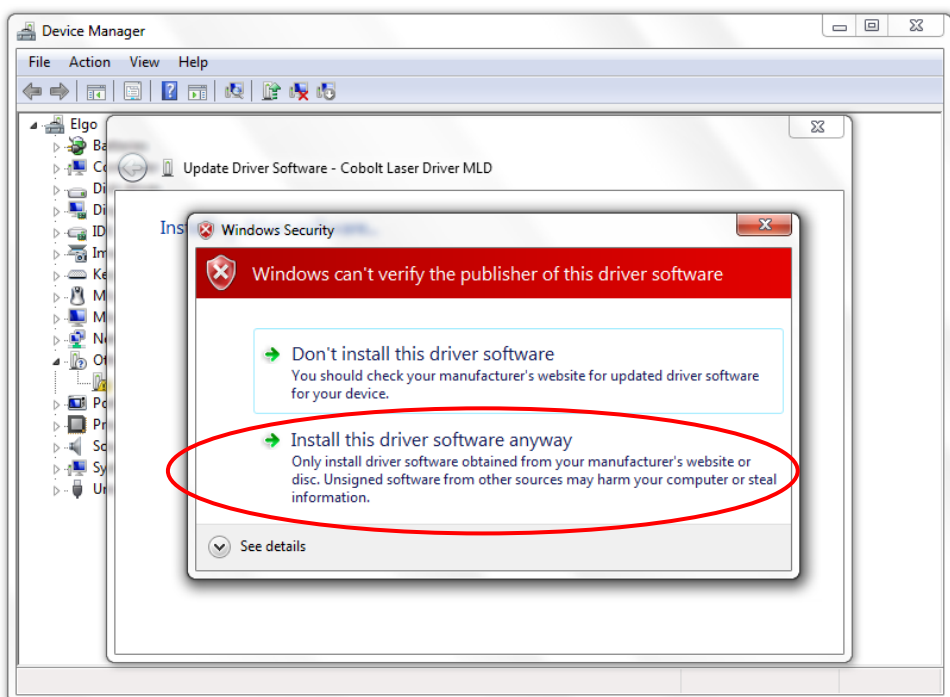

4. On the next screen chose the **Browse my computer for driver software** option.

5. Click **browse,** and find folder on your computer where the USB driver is stored.
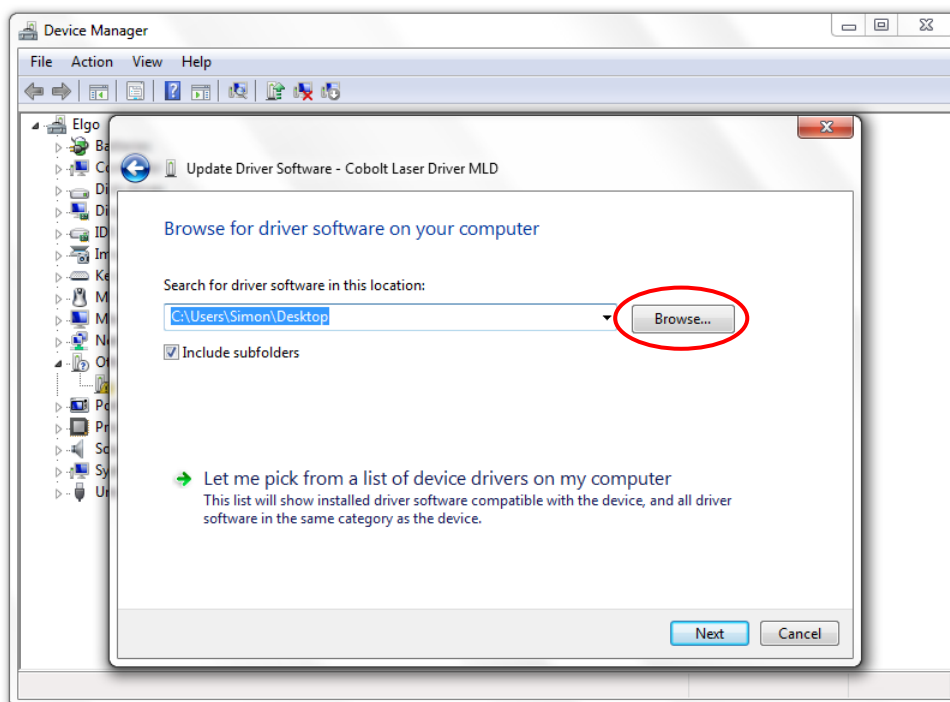
6. Windows security may warn you that the publisher of the driver is unverified. Choose **Install this driver software anyway**.

7. The installation should now be complete.

7.3. Communication commands

The laser is delivered with the Controller set in Auto-start mode (see section 5.1 for Auto-start sequence description). For system integration the Auto-start sequence can be disabled and the following commands can be used to control the laser (NOTE some commands require Auto-start to be disabled but others will work when Auto-start is active). As long as power is supplied to the Controller the temperature control elements are always operating to reach set-point values and the laser will be idle waiting for the next command. All arguments are in lower case and separated by a space (ASCII 32).

Command	Function	Argument	Returned value
ilk?	Get interlock state		0 = interlock closed (OK) 1 = interlock open
@cob1	Laser ON after interlock Forces the laser into Autostart without checking if autostart is enabled (OEM models).		
@cobas	Enable/disable autostart OEM models only, disabling autostart means the laser no longer goes through its warm up routine.	0 = disable 1 = enable	
@cobas?	Get autostart enable state		0 = disabled 1 = enabled
l?	Get laser ON/OFF state		0 = OFF 1 = ON
l1	Laser ON Requires autostart disabled. Use this command for manual ON (OEM models).		
l0	Laser OFF Use this command for manual OFF (OEM models).		
p?	Get set output power		Float (W)
p	Set output power	Float (W)	
pa?	Read output power		Float (W)
i?	Get drive current		Float (A)
slc	Set drive current	Float (A)	
leds?	Status of 4 LEDs		Int [0:15] Bit 0 = "POWER ON" Bit 1 = "LASER ON" Bit 2 = "LASER LOCK" Bit 3 = "ERROR" 1 = LED on 0 = LED off
f?	Get operating fault		0 = no fault 1 = temperature error 3 = open interlock 4 = constant power fault
cf	Clear fault		

@cobasdr	Enable/disable direct control See section 4.4 for description (OEM models only).	0 = disable 1 = enable	
@cobasdr?	Get direct control enable state		0 = disabled 1 = enabled
sn?	Get serial number		32-bit unsigned integer
hrs?	Get system operating hours		Float

For re-starting the laser with commands after having opened the remote interlock switch, execute "cf" for clear fault followed by "@cob1" to restart the laser. This command forces the laser into Auto-start enabled so Auto-start must be disabled if this is the required set up. On CDRH models the key switch is the only way to re-start.
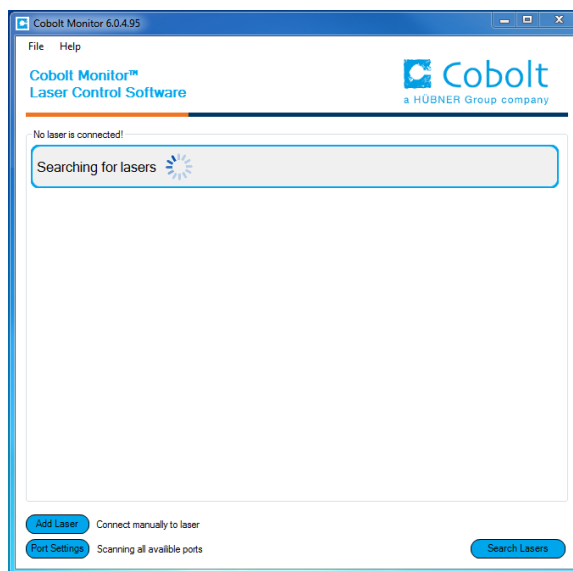
8. Cobolt Monitor™ Software

The Cobolt Monitor™ software provides a graphical way to monitor the laser performance and to change power, operation mode and other settings. The software can connect to the laser either via RS-232 port or via USB, depending on the type of controller. The USB driver must be installed manually and can be downloaded from the Cobolt website (www.cobolt.se), see section 7.2. Cobolt Monitor™ has been tested with operative systems Windows XP, Windows Vista, Windows 7 and Windows 8. Microsoft .NET 2.0 is required to run the Cobolt Monitor™ software. Most computers with operative systems Windows XP, Windows Vista, Windows 7 and Windows 8 have this included as standard.

8.1. Installation

Download the latest version of the Cobolt Monitor™ software from www.cobolt.se. The Cobolt Monitor™ software is a stand-alone executable, the executable file is packaged with other files needed to run the program in a .zip file. Save the .zip file and extract all files. The folder created after extracting the files can be placed on any storage device and Cobolt Monitor™ can be run from there. All files and folders contained in the .zip file must be present for the program to function properly.

8.2. Software instructions

The software automatically searches for Cobolt devices every 5 seconds and automatically connects the laser if detected. The software can identify USB connected lasers as well as RS232 connected lasers.

The first Cobolt Monitor™ window that appears in the Cobolt Monitor software.

Once the laser is connected it can be controlled from the box dedicated for the laser. The interface, found in the following figure, is intended for typical user cases. Only the relevant information is presented on this level, displaying only the status the laser is in and relevant choices to make. Here follows a short description of how to use the Cobolt Monitor™ software on this level.
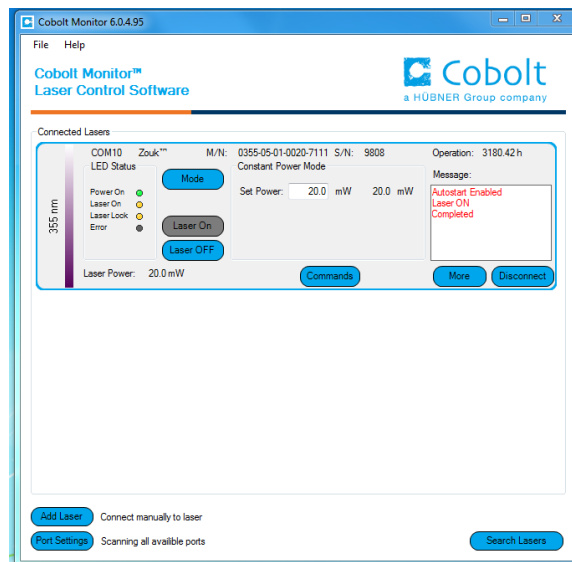
Laser successfully connected.

Laser ON – Turns the laser ON. If the laser is in autostart mode this is equivalent to "restart".

Laser OFF – Turns the laser OFF.

Mode – Gives a choice of operational modes possible to choose for the laser model. For 05 series lases Constant Power or Constant Current operation can be chosen. Only relevant choices are presented to the mode of operation chosen.

Commands – opens a command communications window to send commands directly to the laser controller.

Message – highlights important information of the laser status to the user.

Disconnect – allows the user to disconnect from the Cobolt Monitor™ software in a controlled way.

> **NOTICE** The communication cable should not be removed when the software is in connect state. The communication within the controller may then malfunction and this might require a power restart of the driver. To disconnect the laser click "Disconnect" or close Cobolt Monitor™ completely. It is also possible to disconnect by powering the laser OFF. In this case Cobolt Monitor™ will automatically close the window for that laser.

Clear Fault - is displayed in the event of a fault. The user can deal with the cause of the fault and then press "Clear Fault" and then restart the laser by clicking "Laser ON". Example: if the remote interlock loop is open the user must make sure the loop is closed again before issuing a "Clear Fault" followed by "Laser On".

More –an additional Cobolt Monitor™ window will open containing more detailed information of that laser's status.
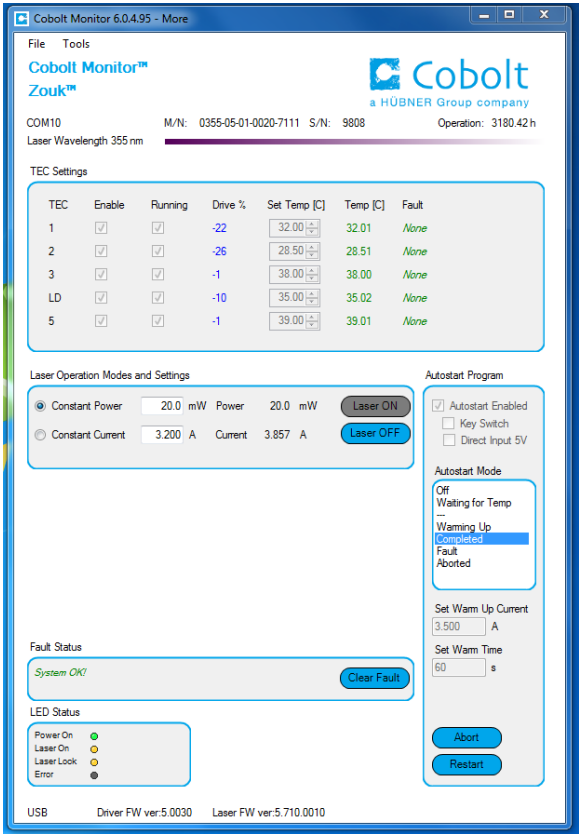
Cobolt Monitor™ software expanded to for more detailed monitoring.

TEC Settings – shows the running status and the fault status for the laser's internal thermoelectric coolers (TEC).

Laser Operation Mode and Settings - displays the set laser power. The user can switch between constant power mode and constant current mode. Likewise, there are boxes to set the constant power level and constant current level. The output power (as monitored measured on an internal photodiode) and the current through the laser pump diode are both displayed.

Autostart Program - displays whether the laser is in CDRH or OEM mode and displays the current laser operational status. 5V direct input is set here, see section 4.4. There are also buttons to "abort" the autostart sequence or to "restart" the laser after a fault.

> ⓘ **NOTICE** Specifications are only guaranteed in constant power mode, at 100% of nominal power.

Fault Status – displays ERROR messages. In the event of an ERROR, the laser action is stopped. When the reason for the ERROR event is understood and the problem is addressed the fault status can be cleared with "Clear Fault". If the Autostart Program is enabled, click restart to restart the laser.

LED Status - displays the LEDs that are currently illuminated on the Controller, see section 3.4. These are displayed even if the laser is in OEM mode.

9. Troubleshooting

In the unlikely case of a problem occurring, use the table below to help identify the error. Some faults can be fixed remotely. Back reflections into the cavity can cause instability of operation. Isolators are available as an option. In case of a sudden voltage drop the laser will turn itself off and restart. If it is in CDRH configuration it will require that the key is turned on again. Contact Cobolt support or your local representative to identify corrective action.

LEDs	Status off	flashing	Explanation	Action
POW	x		Mains power off	Check connections
POW		x	Temperatures not stabilized	Check if heatsink is sufficient
LOCK		x	Laser cannot lock in constant power, current limit has been reached	Check for back reflections. Contact the factory.
ERROR		on	Error in laser parameters	If lights at start-up check cable connections, if lights >5s after start-up contact the factory.

10. Warranty and Maintenance

Cobolt provides a warranty of 12 months on Cobolt Zouk™, Twist™, Fandango™, Bolero™ and 24 months on Cobolt Calypso™, Samba™, Jive™, Flamenco™, and Rumba™ with unlimited number of operation hours. The laser systems are designed for modular repair or replacement in the event that the Laser Head or Controller malfunctions. Warranty is invalid if the laser system is operated outside of the specific limits and conditions as outlined in this document. The Cobolt lasers are contained in sealed enclosures and should not be opened for any reason. Disassembly of any part of the system (including the cable) means the system no longer complies with the EMC standards and will void the warranty. 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.

11. Service

Due to accuracy tolerances, calibration differences and allowed power drift there may be discrepancies between the Cobolt measurement of the optical output power and the customer measurement equipment. If the output power deviates from the reported value please contact your local Cobolt representative for an online re-calibration. If the laser does not function, do not attempt to open any of the units, or the warranty will be voided. Contact your local Cobolt representative for consultancy and to request an RMA number (see back cover for contact information). If an RMA number is issued and the laser needs to be shipped back to Cobolt or your local representative, please pack the complete system for shipment using the original package or equivalent. Ensure the unit is free from thermal paste before packing. The warranty covers repair or replacing the unit at the option of Cobolt.

12. Compliance (CDRH models only)

The CDRH model lasers (-5/700) are designed and manufactured to comply with the EC Low Voltage Directive and the EC EMC Directive in the CDRH-compliant configuration of laser head, 1 m controller cable, controller, key and Cobolt-supplied power supply. All equipment must be mounted on a common ground plane, such as an optical table. If any part of the delivered equipment is replaced with a part not supplied by Cobolt or if the equipment is not properly grounded, the system may not conform to CE / CDRH compliance standards listed in section 12. Disabling any of the safety features nullifies the CE marking and violates the laser safety standard.

$$\epsilon$$

The following harmonized and limits standards have been applied:

Electrical Safety:	EN 61010-1, IEC-61010-1, UL 61010-1 (Limited Energy System)
Laser Safety/Class	IEC-60825-1 , CDRH 21 CFR 1040.10 and 1040.11
EMC	IEC 61326-1

	EN 55011	Electromagnetic Emission , Class A
		FCC Part 15, subpart B, class A

Electromagnetic Immunity – Table 1 : Basic Electromagnetic Environment

EN 61000-4-2	Electrostatic Discharge
	±4 kV contact discharge and
	±2 kV, ±4 kV, ±8 kV air discharge
EN 61000-4-3	Radiated electromagnetic fields
	80 – 1000 MHz, 3 V/m with 80 % AM @ 1 kHz
	1.4 – 2.0 GHz, 3 V/m with 80 % AM @ 1 kHz
	2.0– 2.7 GHz, 1 V/m with 80 % AM @ 1 kHz
EN 61000-4-4	Fast transient / Burst
	AC Power input port ± 1,0 kV
EN 61000-4-5	Surge
	AC Power input port ±0,5 kV, ±1,0 kV Com. Mode
	AC Power input port, ±0,5 kV Diff. Mode
EN 61000-4-6	Conducted Immunity
	3 V with 80 % AM @ 1 kHz
EN 61000-4-11	Dips and Interruptions
	50 Hz and 60 Hz. Test voltages: 100 V and 230 V

RoHS	EU Directive 2011/65/EU

Contact your sales representative for a copy of the full Declaration of Conformity.

13. Disclaimers

Cobolt will assume no responsibility for damage incurred by faulty customer equipment, such as measurement equipment, cables etc, used in conjunction with Cobolt lasers. Cobolt 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 shall not be liable for errors contained herein nor for incidental or consequential damages from the furnishing of this information. No part in this manual may be copied, reproduced, recorded, transmitted, or translated without the express written permission by Cobolt.

Cobolt
a HÜBNER Group company
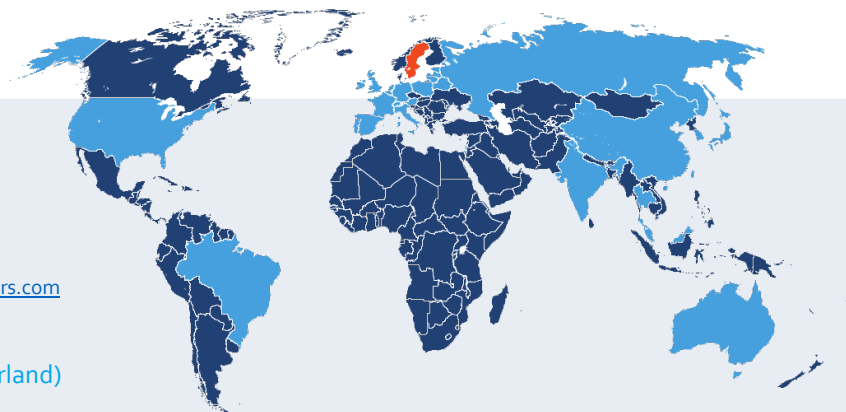
Cobolt Head Office

Cobolt AB
Vretenvägen 13
SE-171 54 Solna, Sweden

Phone: +46 8 545 912 30
Fax: +46 8 545 912 31
E-mail: info@coboltlasers.com

German Sales Office (incl. Austria and Switzerland)

HÜBNER GmbH & Co. KG
Heinrich-Hertz Strasse 2,
34123 Kassel, Germany

Phone: +49 6251 770 6686
Fax: +49 6251 860 9917
E-mail: photonics@hubner-germany.com

USA Sales Office

Cobolt Inc.
2635 North First Street, Suite 228
San Jose, California, 95134, USA

Phone: 1 (408) 708 4351
Fax: 1 (408) 490 2774
E-mail: info@coboltinc.com

Australia
Warsash Scientific Pty Ltd
www.warsash.com.au

_____

Benelux
Laser 2000 Benelux CV
www.laser2000.nl

_____

Brazil
Photonics Instrumentos
www.photonics.com.br

_____

China
DynaSense Photonics Co. Ltd.
www.dyna-sense.com

_____

**Estonia, Latvia
and Lithuania**
Optek Ltd
www.optek.lv

_____

France
Optoprim
www.optoprim.com

_____

India
Spectral Instrument System
www.spectralinstruments.com

_____

Israel
Lahat Technologies Ltd
www.lahat.co.il

_____

Italy
Crisel Instruments
www.crisel-instruments.com

_____

Japan
Kantum Electronics Co Ltd
www.kantum.co.jp

Pneum Co, Ltd Japan
www.pneum.co.jp

_____

Poland
Amecam
www.amecam.pl

_____

Russia and Belarus
Azimuth Photonics
www.azimp.ru

_____

South Korea
BM Laser Solutions Co,.ltd
www.bmlaser.co.kr

SM Tech
www.lasersystem.co.kr

_____

**Singapore, Malaysia
and Thailand**
Wavelength Opto-Electronic
www.wavelength-tech.com

_____

Spain and Portugal
Laser Technology SI
www.laser-technology.com

_____

Taiwan
Tayhwa Technology Co Ltd
www.tayhwa.com.tw

_____

HÜBNER