CoBrite DX-1
Continuously Tunable Laser

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User's Guide

CoBriteDX1

Tunable Laser Instrument Series

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ID Photonics GmbH, Neubiberg, Germany

V1.24

Content

1 General Information

1.1 Warning Laser Safety

The laser sources specified by this user guide are classified according to IEC 60825-1 (2007) Laser Notice No. 50 dated 2007-June-24 and comply with CFR 1040.10 except deviations per Laser Notice No. 50, July 2001 Key Feature Number 4.

This device is a Class 1M laser product for use only under the recommended operating conditions and ratings specified in this document. Use of controls or adjustments or performance of procedures other than these specified in this product datasheet may result in hazardous radiation exposure.

Do not view the laser output from this device directly with optical instruments (e.g., eye loupes, magnifiers, microscopes). Viewing the laser output with certain optical instruments within a distance of 100mm may pose an eye hazard. The class 1M laser product definition is based on all conditions defined in this section.

Please pay attention to the following laser safety warning: Under no circumstances look into the end of an optical cable attached to the optical output when the device is operational. The laser radiation can seriously damage your eyesight. Do not enable the laser when there is no fiber attached to the optical output connector. The laser is enabled by pressing the 'Laser on' button in the operating software delivered with the instrument. The laser is on when the red LED on the front panel of the instrument is lit. The use of optical instruments with this product will increase eye hazard.

In doubt about laser safety requirements consult a trained laser safety instructor for local safety requirements of this product.

1.2 Compliance Statement Electromagnetic Compatibility and device safety

Hereby, we confirm that the system has been demonstrated and audited for compliance for the following directives.

1.2.1 International

IEC 60950-1:2005, modified+Cor.:2006 + A1:2009, modified

CISPR 11:2003 in accordance with EN 61326-1: 2006

1.2.2 United States of America

FCC 47 CFR Part 15, Subpart B Class A, Measurement process ANSI C63.4 (2009)

1.2.3 European Union

EN 55022:2011

EN 61326-1: 2006

EN 61000-6-2: 2006

EN 61000-6-4: 2011

EN 61000-3-2: 2010

EN 61000-3-3: 2009

This conformity statement for includes EU directive 2002/95/EG (RoHS) and EU directive EG1907/2006 (REACH).

1.3 Limitation of communication interfaces

Operation of all USB Ports is limited to a maximum cable length of 3m and a maximum length of 30m for all Ethernet ports present.

1.4 European WEEE Directive Compliance

ID PHOTONICS has established processes in compliance with the Waste Electrical and Electronic Equipment (WEEE) Directive, 2002/96/EC. This product should not be disposed of as unsorted municipal waste and should be collected separately and disposed of according to your national regulations. In the European Union, all equipment purchased from ID PHOTONICS can be returned for disposal at the end of its useful life. ID PHOTONICS will ensure that all waste equipment returned is reused, recycled, or disposed of in an environmentally friendly manner, and in compliance with all applicable national and international waste legislation. It is the responsibility of the equipment owner to return the equipment to ID PHOTONICS for appropriate disposal. If the equipment was imported by a reseller whose name or logo is marked on the equipment, then the owner should return the equipment directly to the reseller. If you have questions concerning disposal of your equipment, contact ID PHOTONICS's at WEEE@id-photonics.com.

1.5 Line Voltage Selection

CoBrite Mainframes operate from any single-phase AC power source that supplies 100 ~ 240VAC at a frequency at 50/60 Hz. The input line voltage setting is done automatically by *CoBrite* power supply.

1.6 Service

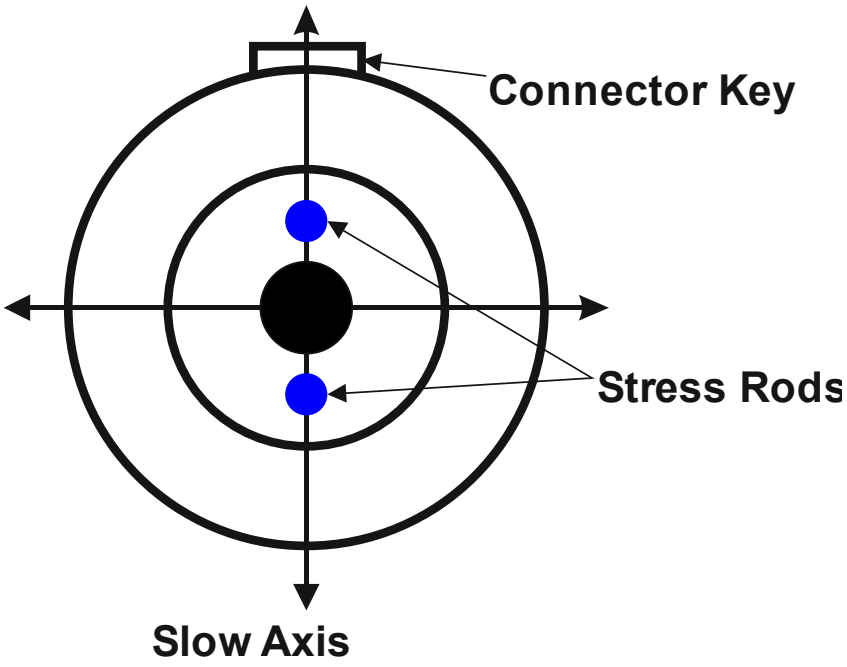
Do not attempt to service or adjust this instrument unless an authorized person is present. Do not install substitute parts or perform any unauthorized modifications to this instrument. Contact ID Photonics or your local distributor to obtain service support.

1.7 Help and User feedback

ID Photonics GmbH is dedicated to continuously improve customer experience of our products. Thus, if you have any feedback that might help us to improve our products send us an E-Mail to: feedback@id-photonics.com

1.8 Optical output of Laser Ports

Each laser port features a polarization maintaining Fiber output which can be both used with standard single mode fibers and polarization maintaining fibers. The emitted E-field is oriented along the slow axis of the fiber.



1.9 Safety

1.9.1 General Safety Precautions

The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument.

ID Photonics assumes no liability for the customer's failure to comply with these requirements.

Before operation, review the instrument and manual for safety markings and instructions. You must follow these to ensure safe operation and to maintain the instrument in safe condition.

1.9.2 General

This product is a Safety Class 1 instrument (all units except CoBrite DX1, provided with a protective earth terminal). The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

1.9.3 Environment Conditions

This instrument is intended for indoor use in an installation category II, pollution degree 2 environments. It is designed to operate at a maximum relative humidity of 95% and at altitudes of up to 2000 meters.

Refer to the specifications tables for the ac mains voltage requirements and ambient operating temperature range.

> **Note**: Before connecting electrical power to the unit, make sure the unit could acclimatize to ambient temperature for at least 2 hours to avoid damage by i.e. condensed humidity on electrical parts inside the unit.

1.9.4 Fuse Replacement

For continued protection against the possibility of fire, replace the fuse only with a fuse of the specified voltage, current and type ratings.

1.9.5 Before Applying Power

Verify that all safety precautions are taken. The power cable inlet of the instrument serves as a device to disconnect from the mains in case of hazard. The instrument must be positioned so that the operator can easily access the power cable inlet. When the instrument is rack mounted the rack must be provided with an easily accessible mains switch.

1.9.6 Maximum ratings

ALWAYS operate the unit within the maximum ratings. Ignoring these limits may result in permanent damage to the unit and loss of warranty.

1.9.7 Ground the Instrument

(this section does not apply to DX1 type chassis)

To minimize shock hazard, the instrument chassis and cover must be connected to an electrical protective earth ground. The instrument must be connected to the ac power mains through a grounded power cable, with the ground wire firmly connected to an electrical ground (safety ground) at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

1.9.8 Do Not Operate in an Explosive Atmosphere

Do not operate the instrument in the presence of flammable gases or fumes.

1.9.9 Do Not Remove the Instrument Cover

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made only by qualified personnel.

Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

Opening the instrument will result in loss of all warranty given for the instrument and may exhibit lethal health risks.

Keep away from live circuits inside the equipment. Operating personnel must not remove equipment covers. Only factory authorized service personnel or other qualified service personnel may remove equipment covers for internal subassembly or component replacement or any internal adjustment. Do not install substitute parts or perform any unauthorized modification of the equipment or the warranty may be voided.

1.9.10 Ventilation

Keep a space of 30 cm or more between the rear side of the device and any other objects such as walls to guarantee sufficient cooling of the device.

Never block the air fan and ventilation openings.

1.9.11 Cleaning the Instrument

To avoid personal injury, power down the device and disconnect it from line voltage before performing any of the following procedures.

To clean the exterior surface, perform the following steps:

Remove loose dust on the outside of the instrument with a lint-free cloth.

Use a soft cloth dampened with water to clean the device. Use 75% isopropyl alcohol solution as a cleaner. Do not use any abrasive or chemical cleaning agents.

1.9.12 Safety Symbols on Instruments

1.9.12.1 Warning or Caution

If you see this symbol on the product, you must refer to the manuals for specific Warning or Caution information to avoid personal injury or damage to the product.

1.9.12.2 ESD Safety Warning

This sign indicates that the respective modules, boards or RF inputs and outputs are susceptible to damage by electro static discharge (ESD), and require proper protection procedures for storage and handling.

1.9.12.3 Output of Laser Radiation Warning

This sign does indicate a source of optical radiation that may emit close to the location this label is present. Follow according laser safety procedures as listed below and defined in general rules at all times.

1.9.12.4 Wear Eye Protection

Wear eye protection if exposure to high-intensity rays or laser radiation exists according to Laser safety rules and best practices.

1.9.12.5 Do Not Directly View Optical Laser Port Output

Under no circumstances should you use any optical instruments to view the optical laser port output directly.

1.9.12.6 Precautions with Connectors

It is essential to ensure that all optical connectors are in good condition. Dirty connectors can lead to poor performance, while broken connectors can cause damage to other equipment!

Before using a microwave connector, check it visually, using an optical microscope (20x magnification is recommended). If the connector needs to be cleaned, swab it with clean isopropyl alcohol. Dry the connector by blowing it with clean compressed air or nitrogen.

Before an optical connector is used, check it visually by using an optical microscope as recommended by the manufacturer of the connector. If the connector needs to be cleaned, apply the cleaning procedure recommended by the manufacturer of the connector.

Make sure you are familiar with these issues to avoid damage to your device and possible violation of warranty.

Important!

Before connecting the inputs or outputs to any measurement equipment or device under test, make sure that a suitable attenuator, if necessary, is fitted.

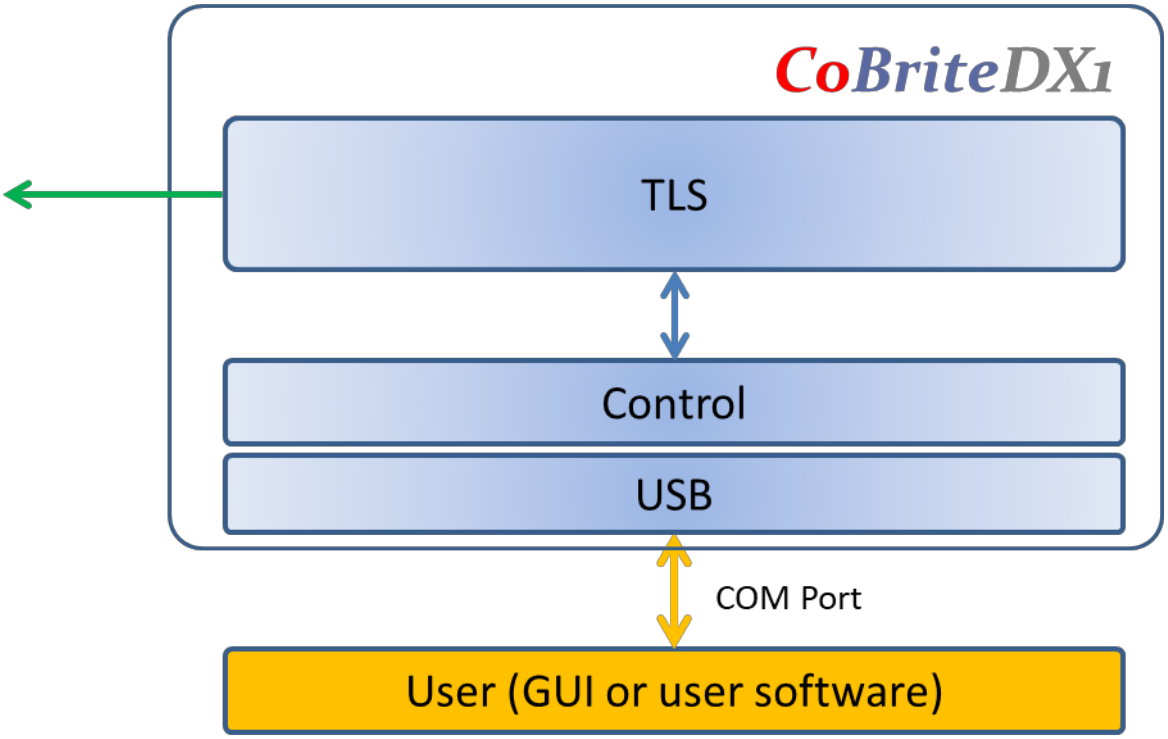
2 Unit Overview

CoBriteDX1 is tunable laser instrument hosting 1 tunable laser port

Different laser types are offered allowing users to adapt for various use cases such as coherent transmission, EDFA testing and insertion loss profile measurement.

User data transfer is provided via a SCPI interface utilizing a USB interface that installs as a virtual COM port. Therefore, no specific API Software or similar needs to be installed on host computers while providing a standardized communication protocol so that any user environment is able to communicate with unit.

A windows installable Graphical User Interface is provided as part of the package.



3 Getting Started

This instrument can only be operated using the ID Photonics Control Software using Windows7 or later only.

Note: Please install the GUI **including according drivers** before using connecting the instrument to a computer!

3.1 Connection of Hardware

- Connect optical fibers to the laser output ports or make sure that no laser radiation can be uncontrollably emitted by the unit.
- Connect the power supply of the unit using the supplied Power Cord and switch on the unit using the switch located at the back of the unit (MX und DX4 only).
- If operating a MX type unit (modular chassis), insert the supplied Laser lock key into the lock located on the front plate and turn it. Press the “power on” button located on the front panel to start the unit
- Wait for at least 30seconds and proceed with Software installation as described below.

3.2 Installation of Control Software

Connect the supplied installation medium and start “CoBrite_Installer.exe” located in “GUI_Installer” directory if it is not automatically executed.

> **Note**: If installing updates of the GUI Software, do NOT select the “CDM20802 driver” as it will install multiple instances of the driver.

Follow the instructions shown on the screen. Once finished, an icon is installed on your computer to start the GUI. Note that the software requires Microsoft .NET framework R3.5 or higher. This is available won any Windows XP PC with Service pack 2 or later.

Once the software is installed, connect to either to one of the available USB Ports or the Ethernet Port. See section “Interfaces” for details. If the USB Port is connected for the first time, it will now automatically install a required driver to operate the instrument.

Please start the Control Software “Cobrite” **after** the installation of the required driver is completed.

3.3 Troubleshooting

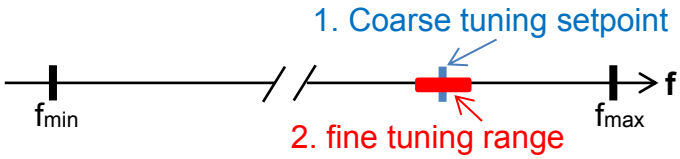
3.3.1 Instrument was not detected by the GUI

Please change to the directory “Driver” on the supplied installation medium and execute the file “CDM20802.exe” which installs a driver.

Reconnect the USB connection to your computer. The instrument should now correctly be detected.

3.4 Laser tuning modes

Coarse tuning allows accessing the full specified tuning range while fine tuning (FTF) allows for offsetting from the coarse tuning set point by a small range. The resulting set point is the sum of coarse tuning set point and FTF/fine tuning value.



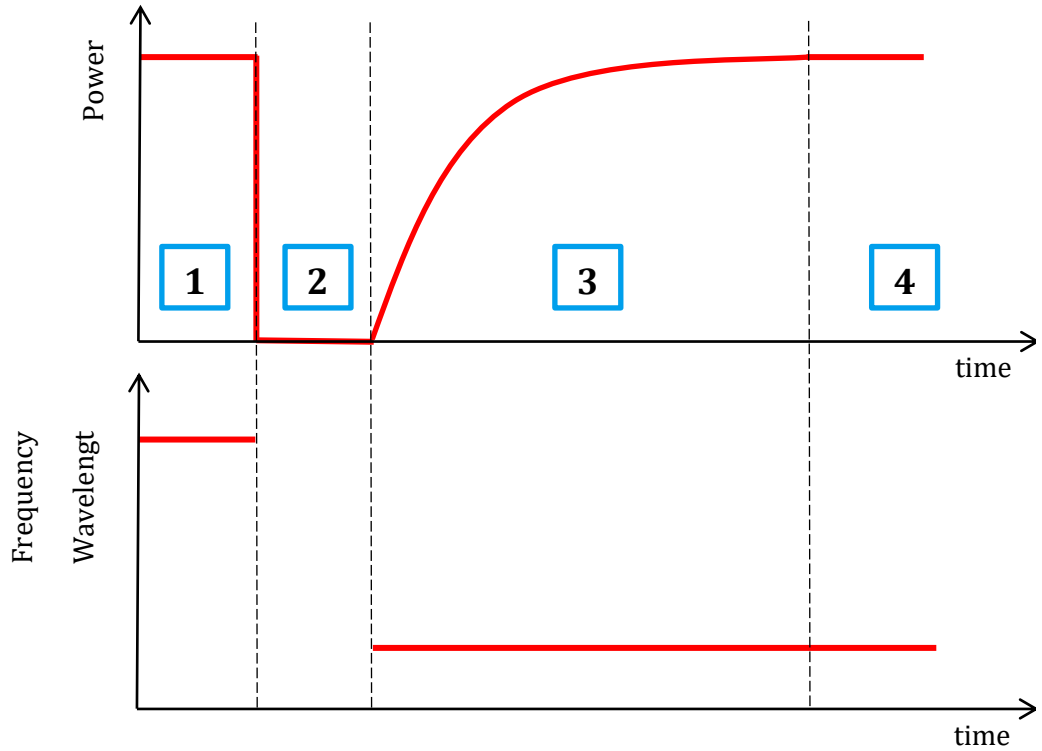
3.4.1 Coarse tuning

This tuning mode allows tuning the laser to any frequency of the available range specified for the laser port. The tuning process will require the output to be disabled for a short period of time.

Description of tuning process:

1. Output will be switched off (~1 second)
2. Output is switched on using new frequency
3. Power is increased until final output power is reached.
4. Power is stabilized, tuning process is completed.

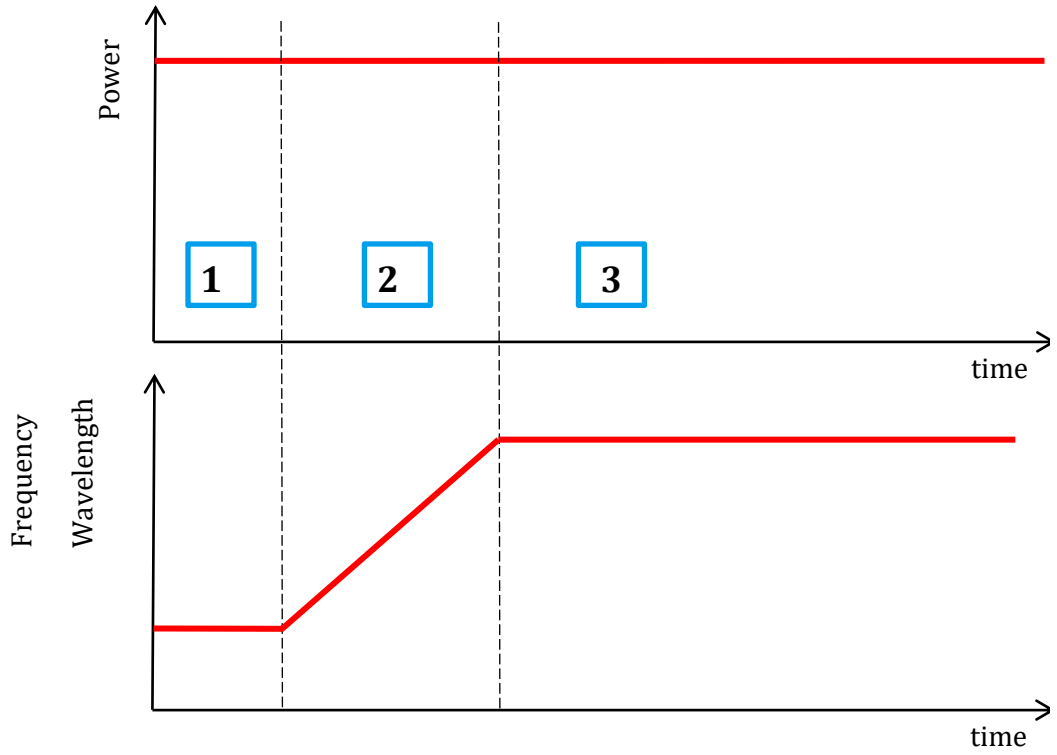
Note that the time to tune the laser is the actual time required to tune the laser, the software based tuning indicator may indicate a tuning state for a longer time period than the actual tuning requires.



3.4.2 Fine tuning (FTF)

Fine tuning allows detuning the laser within a smaller range from the target frequency set using the coarse tuning parameter. The laser will detune to the target setting with output power on during the tuning process which changes the output frequency in a linear ramp. Tuning target setting resolution depends on the laser type. Refer to the specification for details.

1. –Tuning is triggered
2. Tuning process taking ~1second per GHz. Power remains constant – Power remains constant
3. Laser settles on new value



4 Interfaces

4.1 Available Interfaces for different chassis variants

4.1.1 CoBrite$_{DX1}$

This chassis provides connectivity via USB located at the rear side of the instrument. See section 5.3.2 for details on how to connect via USB Port using the supplied GUI.

4.1.2 CoBrite$_{MX}$

This chassis series provide connectivity via USB located at the faceplate; 1 USB & Ethernet located at the rear side of the instrument. See section 5.3.2 for details on how to connect via USB Port using the supplied GUI.

See section 5.3.1 for details on how to connect via Ethernet Port using the supplied GUI.

4.2 USB Port

USB ports are available on all chassis variants and offer identical functionality in case several USB Ports are available on a chassis.

> **Note**: Please install the GUI including according drivers before using these ports as there are special drivers required to operate them!

If the standard GUI is used to connect to those Ports, it will be automatically detected by the GUI software. See section 5.3.2 for details.

4.2.1 Usage of USB Port for custom remote control

USB ports will install as virtual COM Ports to the attached computer and therefore allow quick and easy access by any standard Terminal Program such as the Windows built in “Hyper Terminal”.

> **Note**: Use the following settings for operation:
>
> Serial speed: 115.200
>
> Data format: 8N1 (= 8 bits, no parity bit, 1 stop bit)
>
> Flow control must be off

4.3 Ethernet Port (CoBrite$_{DX4}$ or CoBrite$_{MX}$ only)

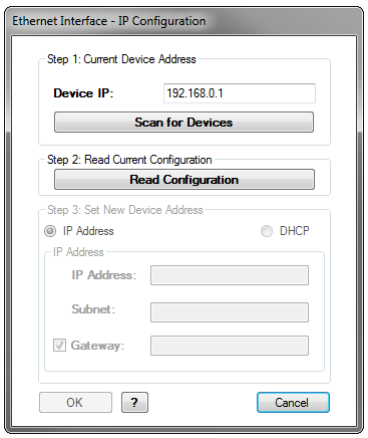
This port is accessed using Telnet protocol. The most common freeware telnet Tool is “Putty” which can be easily set up to connect to the Ethernet Port. Putty can be found on the installation medium.

If the standard GUI is used, there is no dedicated Telnet functionality needed as it is built into the software. Just enter the IP Address and the GUI program will connect.

Note: The standard IP address of this port is: 192.168.0.1, Port# 10001

4.3.1 Changing the IP address

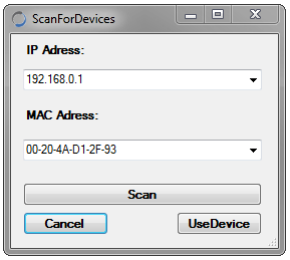
The IP address can be changed using the Host GUI provided with the system in the main window. Click <Configuration> - <IP Address> to start the configuration process. This dialog is only available if the GUI is currently connected via Ethernet. In the pop up window, the current IP address is shown as default



Note: Configuring a new Address is only possible if the current target IP is reachable and the GUI is connected via Ethernet.

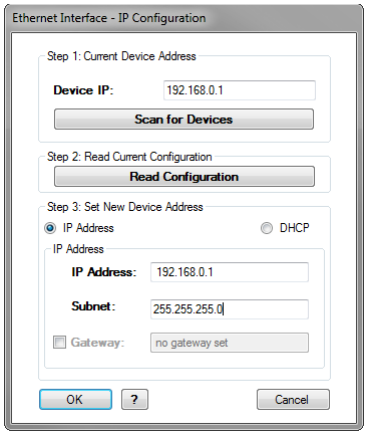
. If you want to configure a different interface, press “Scan for Devices” to scan for active instruments in your network. Depending on configuration of your network, the device might not be found but still be reachable. In this case, enter the IP Address manually and press ok.

IP and Ethernet MAC addresses and instruments found are displayed in a dropdown list. Select the IP address of the instrument that you wish to change by pressing “UseDevice”.



In the next step, press “Read Configuration” to retrieve and edit the current setting.

Enter the new IP and subnet address you want to set to the instrument for a fix IP or select “DHCP” if you have a DHCP server present in your network and the IP address of the instrument shall be assigned dynamically by this server.



Note: If DHCP was chosen and the instrument is not able to retrieve an IP address from a server, a default IP address will be used by the instrument and might not be reachable from the host computer.

After pressing “OK”, the program will change the IP address of the device.

Note: If the chassis IP is not located in the same subnet as the Host IP, a warning will be issued that the chassis might not be reachable for reconfiguration. Please make sure by appropriate configuration of your network that the chassis is actually reachable via a TCP connection.

4.3.2 Troubleshooting

If you are unable to connect to the instrument and change the IP address, connect a crossover Ethernet cable between the host computer and the chassis. Use the DOS shell command with administrative rights

“arp -s <current IP> <MAC Address of instrument>”

, i.e. “arp -s 172.168.1.127 00-20-4A-CC-44-07”

for setting a temporary IP address in the same subnet as the host PC to the instrument interface.

5 Description of instrument operation using pictographic GUI

5.1 PC requirements

The following minimum Hardware and Software is required to operate the Graphical User interface:

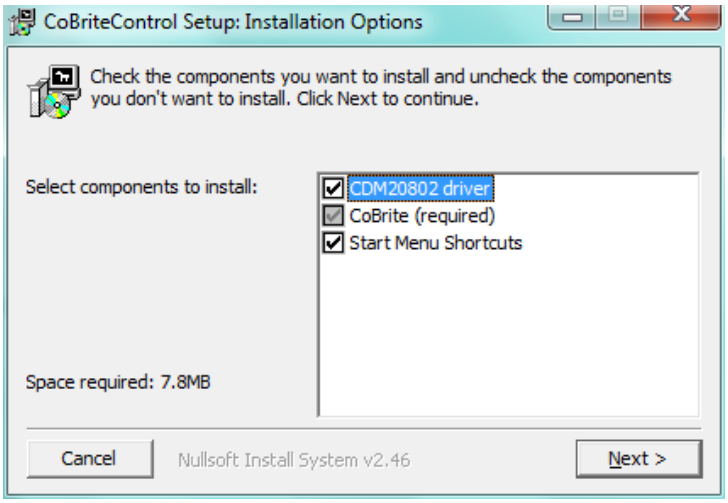
- Windows 7 PC
- 1 available USB Port or Ethernet connection; depending on connection type to chassis
- Microsoft .NET Framework R3.5 or higher
- 50MByte Hard-Disc Space
- 2GByte Memory
- Administrative rights for installation of control software

5.2 Installation of Control Software

Before connecting the USB Port from your computer to the instrument follow the Software installation procedure.

Note: If connecting the instrument before Software installation, the instrument will not be detected correctly.

- Insert Data medium supplied with instrument into computer
- Change to Directory “GUI_installer” which now should be apparent on your computer
- Right Click on “CoBrite_Install.exe” and select “Run as Administrator”. Your computer should return the following start screen



- Make sure that the option “CDM20802 driver” is selected

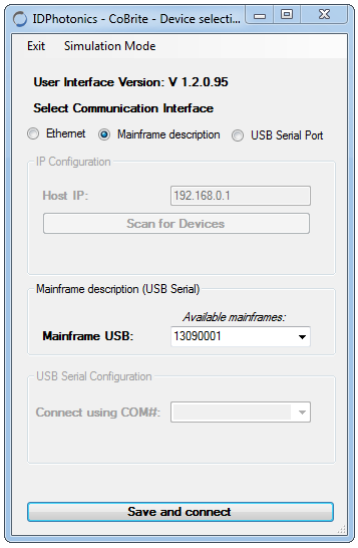
  Note: If installing updates of the Software, do NOT select the “CDM20802 driver” as it will install multiple instances of the driver.

- Follow instructions given by installer software. You may chose custom options in the process.
- Now, supply power to the instrument. A red status LED should light up that indicates power to the instrument
- Plug in the USB cable to the instrument and your computer
- Once plugged in, your computer should start automatically configuring drivers for the instrument. Your computer will signal once installation is done

- Now start the Software under “Start – Programs – CoBrite

5.3 Start screen

After starting the GUI software the following screen will appear:



First, chose which interface is used to connect to the instrument by clicking on “Ethernet”, “Mainframe description” or “USB Serial Port”. If USB is used, we recommend using “Mainframe description”.

5.3.1 Ethernet

(Not applicable for CoBriteDX1 as this instrument provides no Ethernet port)

Note: Make sure your network allows the usage of TCP Port #10001 for communication.

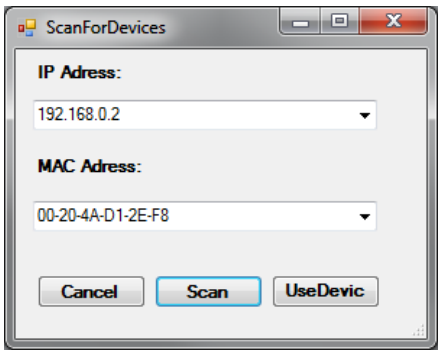
This option will require entering the IP address of the mainframe. See section 4.3 for details how to set this. Once the IP address is entered, press the “Save and connect” button to connect to the instrument.

If you know the IP address of the instrument, enter it in field “Host IP” and press “Save and connect”. Do NOT use “Scan for devices” in this case as the Host IP field will overwritten.

5.3.1.1 Scan for devices

Allows to scan and auto detect for chassis connected to the local area network. This achieved by sending a broadcast token to all Ethernet devices attached to the local area network. Please make sure that firewalls are configured correctly to allow this function to operate properly to use it.

Note: Depending on configuration of your network, the device might not be found by this feature but still be reachable for regular connection. In this case, enter the IP Address manually and press ok.



5.3.2 Mainframe description

The default option will automatically detect all *CoBrite* chassis connected to the host computer via USB and list them by their serial number in a drop-down menu.

Note: This is the recommended option to connect to the instrument

Once a mainframe is selected, press the “Save and connect” button to connect to the instrument.

5.3.3 USB serial port

This option can be used to connect to the instrument via the virtual Com Port option as described in chapter 4.2. It is recommended using the default option to connect via Mainframe description to the instrument.

5.3.4 Simulation mode

This mode allows operating the GUI without Hardware attached by configuring any arbitrary Shelf configuration. It is used for demonstration and test purposes.

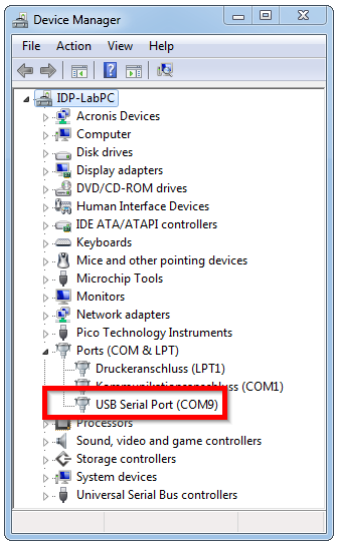
Once “Save and connect” is pressed, the setting is saved automatically for next startup.

5.4 Troubleshooting

5.4.1 Instrument was not detected by the GUI

Open Windows device manager which can be found in Windows Control Panel.

Open the “Ports (COM & LPT) section. If correctly installed and plugged in, a COM Port is listed here indicating the device is available. If several ports are shown here and identification of the device is not possible, unplug the USB connector and check if one of the Ports disappears. Plug in again.



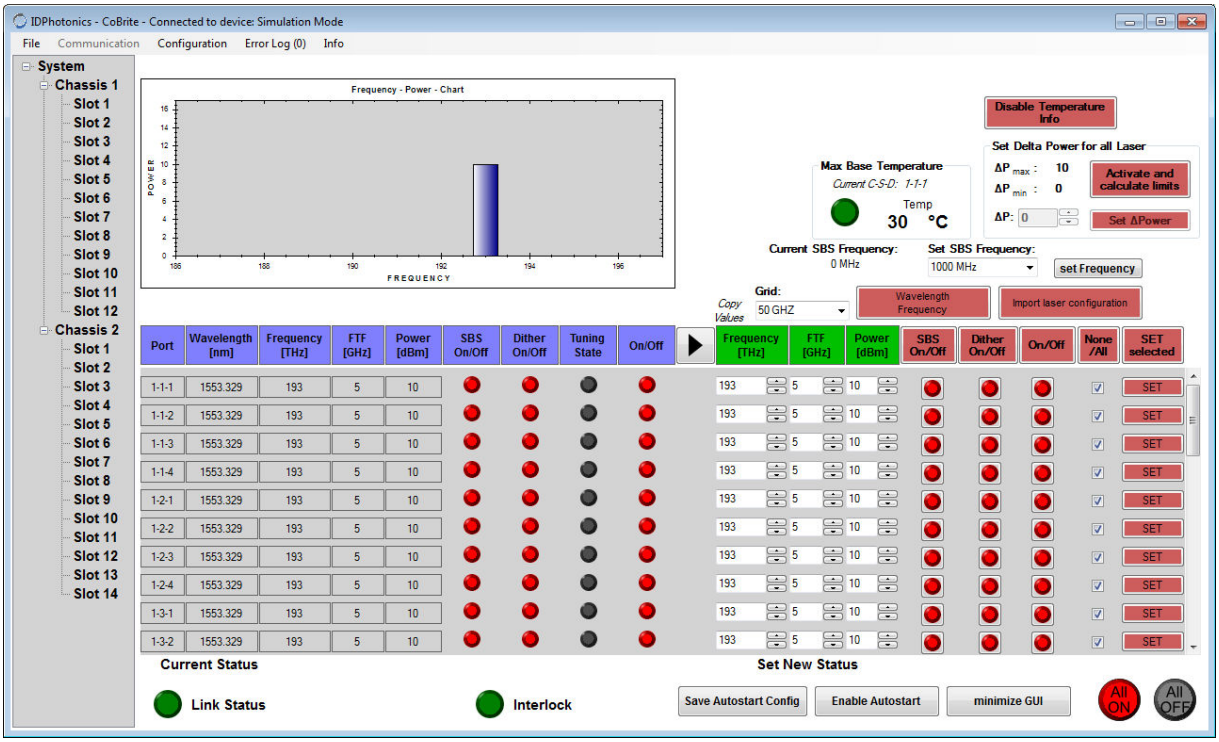
If no matching COM Port can be identified or an “unknown device” is displayed, the driver is not installed correctly.

Please change to the directory “Driver” on the supplied installation medium and execute the file “CDM20802.exe” which installs a driver.

Reconnect the USB connection to your computer. The instrument should now correctly be detected.

5.5 System view

Once the connection to the instrument is made, the software will retrieve the current card configuration and will give a system overview as depicted below which shows an example of 96 laser ports.



5.5.1 Tree view

Tree view is located on the left hand side of the GUI and gives a quick overview on installed laser ports. It also allows switching to chassis and slot level view by clicking on the according chassis or Slot.

5.5.2 Spectral viewer

This diagram gives a quick overview of the current laser configuration. Each bar represents one laser port. The height of represents the laser power. Right click on the diagram for options for zooming and viewer manipulation.

Laser ports that are turned off are not displayed.

5.5.3 Status table “Current Status”

The status table is located displays the current status of all optical parameters for all lasers. It is continuously updated. Use the scroll control on the right hand side to browse through all available lasers.

5.5.4 Set table “Set new Status”

The right hand side of the table allows setting all optical parameters and the state of the output. Dial in the required values and press the according “Set” Button to

configure the laser. The set command will set all parameters shown to the according laser. All parameters dialed in will be automatically coerced to the minimum or maximum value permissible.

Available Parameters are:

5.5.4.1 Laser frequency

Use this button to dial in frequency to be used by laser. This control is automatically coerced to maximum and minimum possible frequency.

> **Note**: If Laser is currently operating at a different frequency, Laser light will be shut off for tuning process. A warning window appears before the operation is executed. If you require continuous tuning, refer to the Fine tuning feature described below

5.5.4.2 Fine tuning (FTF)

This option allows deviating Laser frequency from initial set value. As opposed to "Laser frequency" tuning, the Laser remains switched on during tuning and keeps optical specifications stable. Furthermore, relative tuning granularity is superior over "Laser frequency" tuning.

> **Note**: If Laser was previously set using the "Laser frequency" option, Fine tuning will be temporarily disabled for a few seconds to let the laser stabilize before fine tuning can be performed.

5.5.4.3 Output Power

This control allows configuring output power of Laser. Control coerces to available power range.

5.5.4.4 Tuning state (Current status only)

Tuning state indicates whether a laser port is currently tuning. A red light indicates tuning activity while a grey color indicates the devices is settled and has achieved its optical performance.

5.5.4.5 Dither on/off

This option is available only for special versions of the laser. It Dis or enables a carrier frequency dither tone applied to the laser line which is used to keep the laser frequency fixed to a given setting. The dither tone may be disabled if the laser is in a

settled state. If a new parameter setting is sent to the laser and dither is off, the laser will temporarily switch on the tone and switch it off again once settled.

Note: Dither should be disabled only for short periods of time since some stabilization control loops are disabled causing the laser settings to drift off. This may cause the output power or the laser frequency to drift away. In some cases, the laser may become multimode. Switch on dither for a short period to let the unit settle again.

Note: In some instances, the laser host controller may detect that the laser is no longer working correctly and may switch on dither automatically in order to not damage the hardware.

5.5.4.6 Laser on

Button allows switching on and off the Laser. A Pop-up will appear requiring confirmation if Laser is switched on for Laser safety reasons. This Popup window can be disabled by editing the .ini File in the Program application directory. This directory is depending on Windows system path settings.

5.5.4.7 SBS on/off

This button will enable the Stimulated Brillion Scattering Suppression feature for this laser port. Note that the SBS Frequency needs to be set using the central SBS frequency button given in the GUI.

5.5.5 Grid

Use this drop down menu to select ITU grids from 25 GHz to 400GHz in order to allow easily dial in those Frequencies using the rocker switch button control “Laser Frequency”.

If “None” is selected, any arbitrary Frequency can be adjusted to the laser in 100MHz increments within available Frequency range.

5.5.6 Set delta Power

This feature allows modifying the output power of all available laser ports at the same time. Upon activation, it will calculate the maximum change possible for all lasers based on current setting and available power limits. Dial in a desired value using the “ΔP” field and click “Set ΔPower” to apply the new value to the “Set New Status” section.

5.5.7 Import Laser configuration

This button will open a File dialog that allows loading a configuration in to the set table. This can be either a file that was saved previously or a configuration generated by the user. Press the according set buttons or use the “Set all” button to activate the configuration.

The file format is ASCII csv based:

Example:

```
Chassis#,Slot#,Laser#,Frequency,FTF,Power,State,SBS,Dither
1,1,1,191.4,0,5.99,1,1,1
1,1,2,191.5,0,5.99,1,1,1
1,1,3,191.5998,0,6,1,1,1
1,1,4,191.6999,0,5.99,1,1,1
1,2,1,191.8079,0,5.96,1,1,1
1,2,2,191.905,0,6.01,1,1,1
1,2,3,192.2754,0,5.99,1,1,1
1,2,4,192.1069,0,6,1,1,1
```

5.5.8 Set selected

This button will configure the current parameters in the set table to all laser ports that were selected using the corresponding check box.

5.5.9 None/All

This button will select or deselect the checkboxes of all available laser ports.

5.5.10 Wavelength/Frequency button

This button allows entering the Laser Frequency in either frequency or wavelength format. Current values in the set table will automatically be converted.

5.5.11 Disable Temperature Info

This button will enable or disable the reading of temperature and laser current information from all lasers. This is useful for systems with a high port count increasing the refresh rate of the information read from the lasers.

5.5.12 Max. Base Temperature

The maximum laser housing temperature of all lasers is displayed including location identifier of this laser. This value is displayed for information only as all lasers are temperature compensated and will operate within specification for specified ambient temperatures if air flow to the chassis is not blocked. Note that Lasers will be switched off if the base temperature exceeds 60°C to prevent hardware damage.

5.5.13 Link status

This indicator signals status of communication between GUI and chassis controller.

5.5.14 Serial connection

This button will open a window that traces the communication between chassis controller and GUI. See section 4 for details on command structure of the mainframe.

5.5.15 Interlock

This indicator will remain on status green as there is no interlock feature on the chassis. Interlock is not available for CoBrite$_{DX1}$ and CoBrite$_{DX4}$.

5.5.16 Save autostart config

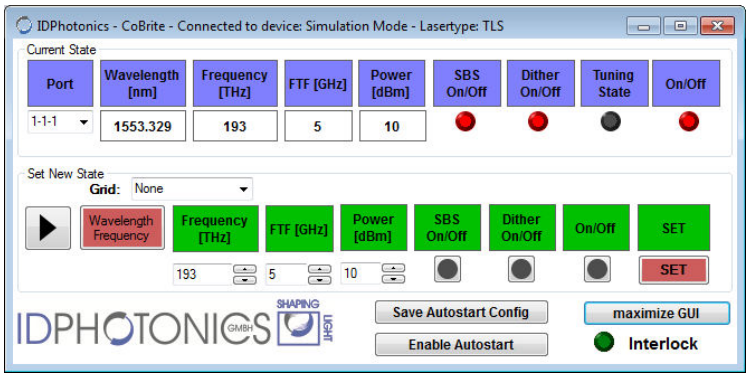
This button will save the current configuration of the laser ports to a local EEPROM of the instrument.

5.5.17 Enable Autostart

This button will enable recover the laser states after a power up to the state that was save using the “Save autostart config” button. This feature will work only if a valid configuration was saved before at least once using “Save autostart config”. Note that some system revisions do not support this feature.

5.5.18 Minimize GUI

This button will switch the GUI to a compact variant. This is the default view upon startup for DX4 and DX1 instruments.



5.5.19 All On/Off

Pressing this button will switch on or off all laser ports available.

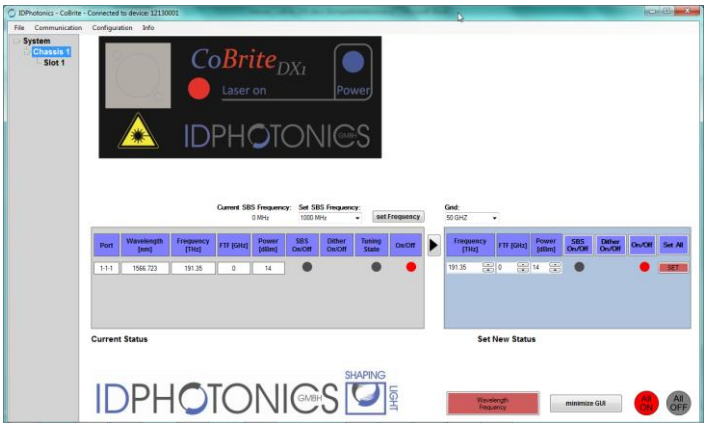
5.6 Chassis view

Chassis view is accessed by clicking on the chassis of the left hand side tree view.

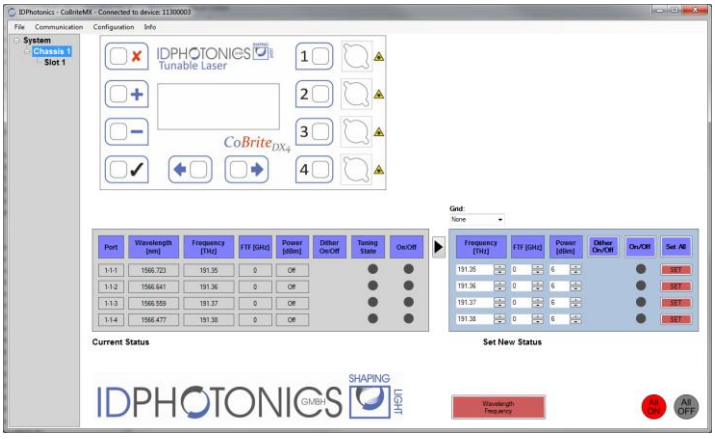
The current shelf layout is represented by a pictographic view of the chassis in the center of the GUI. Note that a restart of the GUI is required in case a new card is installed or removed.

Click on any slot to access parameters of laser ports located on that card which are represented in the table in the lower part of the GUI. Refer to section 5.5 on features available by this table.

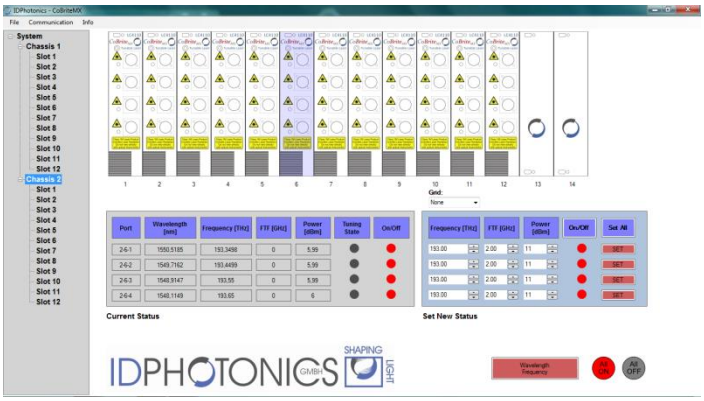
CoBrite$_{DX1}$:



CoBrite$_{DX4}$:

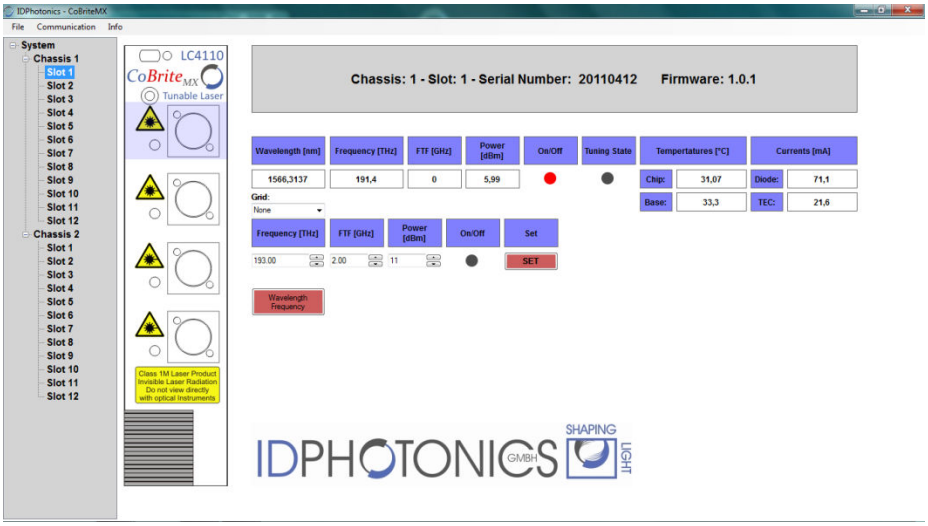


CoBrite$_{MX}$:



5.7 Slot view

Slot view is accessed by clicking on any slot of the left hand side tree view.



Click on any port to access parameters of laser ports located on that card which are represented in the left hand side of the GUI. Refer to section 5.5 on features available by this table.

5.7.1 ITLA temps & currents

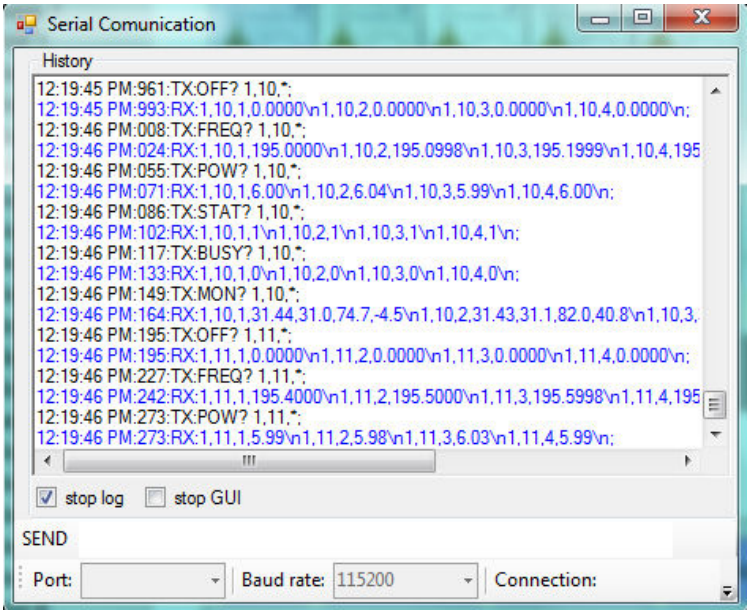
This view allows reading the current Laser chip and Base temperature of each laser as well as current laser diode current and TEC current.

5.7.2 Limits

This section displays the minimum and maximum values that can be adjusted to the according laser port.

5.8 Communication logging window

This window can be opened from the system view and allows tracing the communication between the GUI software and the chassis controller.



5.9 Info

This Menu item provides info of the Firmware version currently installed on the mainframe as well as the version of the User Interface. This information is helpful for debugging of issues. Furthermore, a link for download of the most recent revision of the GUI and links to the latest versions of the manuals is provided.

6 Calibration requirements

The Laser does not require any regular calibration in order to function correctly. If calibration traceability according to i.e. ISO 9001 standard is required, an approved laboratory shall calibrate the instrument for Frequency accuracy and output power.

Please see the data sheet for guaranteed accuracy of parameters if a check of calibration is performed.

7 Remote Control

The CoBrite series operates using SCPI standard style commands which are ASCII based and allow easy communication and interpretation with the instrument. Refer to chapter “Interfaces” on how to establish communication to the ports available at the instrument. More detailed information on SCPI syntax can be found here: http://www.ivifoundation.org/docs/SCPI-99.PDF

7.1 Operating multiple Interface Ports

CoBrite mainframes support parallel usage of al remote-control ports available but not multiple connections to the same port. Note that responses to commands issued are only returned to the according port from where the command was issued.

Commands are generally executed in order of time wise arrival to the controller and buffered into a FIFO stack. If a stack overflow occurs, an error is issued.

Note that there is not control exclusivity is given to any laser port for a specific interface or user. Thus, commands issued to the same port by different instances might lead to inconsistencies. It is recommended to poll current parameter status to ensure integrity of set vs. actual parameters.

7.2 Syntax conventions for commands

7.2.1 Long and short form

The key words feature a long form and a short form. Either the short form or the long form can be entered, other abbreviations are not permissible.

Example: STATus:QUEStionable:ENABle 1= STAT:QUES:ENAB 1

Note: The short form is marked by upper-case letters; the long form corresponds to the complete word. Upper-case and lower-case notation only serve the above purpose, the instrument itself does not make any difference between upper-case and lowercase letters.

Note: All commands are case insensitive.

7.2.2 Query commands

Most commands serve a double function that allows either setting or executing a query on a parameter.

Note: Query commands are terminated by a “?” character.

7.2.3 Parameter

Parameters must be separated from the header by a "white space". If several parameters are specified in a command they are separated by a comma ",".

7.2.4 Colon Character

A leading colon character `: ' instructs the instrument to interpret the command starting at the root (highest level) of the command tree. Since the Instrument also starts at the root each time you send it a new command, the leading colon is not required (although the instrument will accept it if you send it). You can send multiple commands to the Instrument in a single message. You separate the commands with a semi-colon character `;'. When the Instrument encounters a command following a semi-colon, it attempts to interpret the command starting at the level of the previous command, unless you precede the second command with a colon.

7.2.5 Command Termination character

Each command must be terminated either by a ";" character or a carriage return (ASCII #13) to signal completion of the command telegram to the controller

7.2.6 Wild card character

A special wild card character "*" is used to address several ports at a time. This can be used for both set commands and query commands

Example: `SOUR:WAV 1,2,* 1555.1234;` will set all Lasers of slot 2 in chassis 1 to 1555.1234nm.

If a query is executed using a wildcard character, the parameter will be preceded a location identifier. Parameters returned for each port are separated by a „\n" (=ASCII Code #10) for easier readability.

Example: `SOUR:WAV? 1,2,*;`

Will query current wavelength of all lasers of slot 2 in chassis 1 and will return:

```
1,2,1,nnnn.nnnn\n
1,2,2,nnnn.nnnn\n
1,2,3,nnnn.nnnn\n
1,2,4,nnnn.nnnn;\n
```

7.2.7 Acknowledgement of executed commands

The mainframe controller will always acknowledge successful execution of commands by a ";" character. If the echo option is set (for details, see command list), the accordingly sent command is returned first.

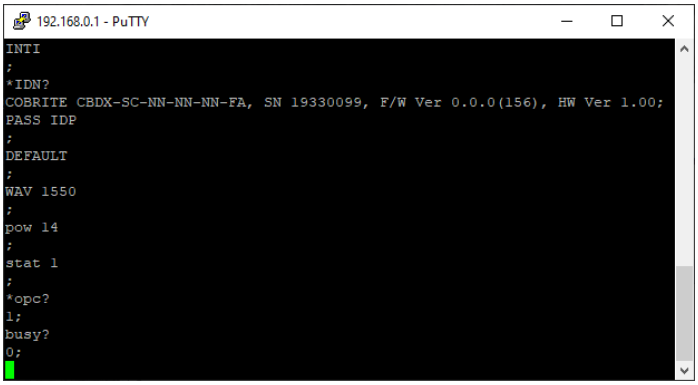
7.2.8 Basic script example

The following commands can be a minimal script to perform a basic set up of the unit and read the data

Command	Comment

`*IDN?;`
`WAV 1550;`
`pow 14;`
`stat 1;`
`busy?;`
	Query idn string of unit
	Sets Laser 1-1-1 Wavelength to 1550nm
	Sets output Power of laser 1-1-1 to 14 dBm
	Enables Laser 1-1-1 output
	Queries if the laser port has finished tuning and has settled on target settings that were set before

Screenshot of script example result using Putty as a terminal Program:



<ENTER> was used to execute the command. Alternatively, use ";".

<ENTER> was used to execute the command. Alternatively, use ";". If both is used, it is interpreted as 2 commands of which the second one is empty so that the first command is executed but the second produces an error since empty.

7.3 Laser port addressing scheme

Laser ports are addressed by a three-level port identifier that allows easy identification of the port and are issued as parameters with according commands. Each level parameter is separated by a "," character.

If not laser port address is added to the command, Laser port 1,1,1 is addressed automatically, i.e. SOUR:WAV? Queries the wavelength setting of laser port 1.

Identifier	Description

<C>	Chassis identifier 1: Always 1 for CBDX1 device
<S>	Slot identifier. Range: 1 : Always 1 for CBDX1 chassis
<D>	Device identifier for Laser port on each card. Range: 1 : Always 1 for CBDX1 chassis

Example: SOUR:WAV? 1,4,2; queries the current wavelength of Port 1 on card 4 in chassis 2.

7.4 Notation of Syntax for command definition

Syntax and Type	Description
[ ]	Optional command level that can be omitted. Example: Definition [:SOURce:]WAVelength/? <C>,<S>,<D>,/<P> Allows sending the command: WAV? 1,2,3
< >	Denotes a parameter. Placeholder is replaced with parameter value defined for according command. Definition [:SOURce:]WAVelength/? <C>,<S>,<D>,/<P> Allows setting the parameters: WAV 2,5,2,1552
/?	Denotes the optional character "?" that is used if the command can also be used as a query. Example: Definition [:SOURce:]WAVelength/? <C>,<S>,<D>,/<P> "?" is used to query current wavelength of device 2,5,2: WAV? 2,5,2
/	Denotes a parameter is omitted in case of a query. Example: Definition [:SOURce:]WAVelength/? <C>,<S>,<D>,/<P> The parameter <P> is omitted if a query is sent: WAV? 2,5,2
:	Usage of Colon see 7.2.4

7.5 Commands on system level

<table>
<tr><th>Syntax and Type</th><th>Description</th></tr>
<tr><td>[:SYStem:]ECHO/?
/<P></td><td>Set or query echo of commands sent to controller
Example write: SYS:ECHO 1;
Example read: ECHO?;
Answer: 1
If echo is enabled, any sent command and ASCII 10 is returned by controller before answer is sent.
Note: For DX4 mainframes, ECHO must always be on.
Example:
Command: :SOUR:WAV?;
Answer: SOUR:WAV?\n
1555.1234;</td></tr>
<tr><td>[:SYStem:]LAYout?</td><td>Query configuration of attached system.
Format of response:
SYSTEM <Master chassis type>, <slave chassis type>,<slave chassis type>\n
<Slot Address>,<card type>\n
…
<Slot Address>,<card type>;\n

Slot Address is to be used as defined, i.e. 1,3,

Possible chassis types:
<table>
<tr><th>Response</th><th>Meaning</th></tr>
<tr><td>CBMA48</td><td>Master chassis 12 slots</td></tr>
<tr><td>CBMA24</td><td>Master chassis 6 slots</td></tr>
<tr><td>CBSL56</td><td>Slave chassis, 14slots</td></tr>
<tr><td>CBDX4</td><td>CoBriteDX4 chassis</td></tr>
<tr><td>CBDX1</td><td>CoBriteDX1 chassis</td></tr>
<tr><td>CBPX</td><td>CoBritePX slide in card</td></tr>
</table>
Possible card types in slot
<table>
<tr><th>Response</th><th>Meaning</th></tr>
<tr><td>EMP</td><td>Empty slot</td></tr>
<tr><td>TLS<n></td><td>Tunable laser with <n> Lasers equipped</td></tr>
</table>
Example write: LAY?;
Response for a system with maximum number of slots:
SYSTEM CBMA48,CBSL56,PMUX,PMUX\n
1,1,TLS4\n
1,2,TLS4\n
1,3,TLS2\n
1,4,EMP\n
1,5,TLS2\n
…
1,12,TLS2\n
2,1,TLS4\n
2,2,EMP\n
2,3,TLS3\n
2,4,TLS1\n
…
2,14,EMP;</td></tr>
<tr><td>[:SYStem:]INTLock?</td><td>Query the status of the system interlock.
The system interlock is a system hardware line which is connected to all cards.</td></tr>
</table>

Syntax and Type	Description
	When activated, it forces all interlocked devices in the system to be immediately disabled. When the interlock is deactivated a three-second delay is observed prior the re-enabling interlocked devices. When the system interlock is activated, the interlock LED on the master local interface will be lit in the red color, when the system interlock is disabled, this LED will be green in color. Control of the interlock line is achieved via a key on the master local interface. Example: `intl?;`
`[:SYStem:]` `AUTOSTArt /<P>`	<P> may be {0,1} Allows to en- or disable automatic setting of stored EEPROM parameters after Laser power up. If invalid data is stored in the EEPROM, the laser state is not recovered after reset.

7.6 Commands on card level

Syntax and Type	Description
[:SOURce:]WAVelength/? <C>,<S>,<D>,/<P>	Set or query Wavelength of Laser in location C-S-D in Nanometers Wavelength Format : nnnn.nnnn Example write: WAV 1,2,3,1555.1234; Example read: WAV? 1,2,3; Answer: 1555.1234;
[:SOURce:]WAVelength:LIMit? <C>,<S>,<D>	Read Wavelength limits of Laser. Format: nnnn.nnnnn Example: WAV:LIM? 1,2,3; Answer: 1530.12345,1560.12345;
[:SOURce:]FREQuency/? <C>,<S>,<D>,/<P>	Set or query Frequency of Laser in location C-S-D in Terahertz Frequency Format : nnn.nnnn Example: SOUR:FREQ 1,2,3,194.1234;
[:SOURce:]FREQuency:LIMit? <C>,<S>,<D>	Query Frequency limits of Laser. Format: nnn.nnnn Example: FREQ:LIM? 1,2,3; Answer: 192.1234,196.12345;
[:SOURce:]OFFset/? <C>,<S>,<D>,/<P>	Set or query Fine tuning of Laser (=Offset) in location C-S-D in Gigahertz Parameter Format : nn.nnn Example:OFF 1,2,3,11.1234;
[:SOURce:]OFFset:LIMit? <C>,<S>,<D>	Query Offset limits of Laser. Format: nn.n Example: OFF:LIM? 1,2,3; Answer: 12.5;
[:SOURce:]POWer/? <C>,<S>,<D>,/<P>	Set or query Power of Laser in location C-S-D in dBm Format : nn.nn Example:POW 1,2,3,15.12;
[:SOURce:]POWer:LIMit? <C>,<S>,<D>	Query Power setting limits of Laser. Format: nn.nn Example:POW:LIM? 1,2,3; Answer: 6,15.12;
[:SOURce:]STATe/? <C>,<S>,<D>,/<P>	Set or query on/off output Laser in location C-S-D Off: 0 On: 1 Example: :STAT 1,2,3,1;
[:SOURce:]LIMit? <C>,<S>,<D>	Query maximum tuning Parameters of Laser in location C-S-D in csv format. Minimum Frequency Maximum Frequency Fine tuning Range Minimum Power Maximum Power Example:LIM? 1,2,3; returns 191.1,194.1,12.5,6,16;
[:SOURce:]CONFiguration/? <C>,<S>,<D>,/<P>	Set or Query current configuration of Laser in location C-S-D in csv format: Frequency Fine tuning Value Output Power Output state (0/1)

Syntax and Type	Description
	Busy state (0/1), (only for query, if set is used, this parameter is omitted) Dither state (will be ignored if Laser does not support this option). If queried, "-1" is reported if not supported Example read:`CONF? 1,2,3` returns `191.42,10.134,6.12,0,1,1;` The laser is set to 191.42THz, 10.134GHz FTF, 6.12dBm, output on (1) , not busy tuning (0), dither on(1) Example write:`CONF 1,1,1,193,1,7,1,1;` will set the to 193THz, Fine tuning 1GHz, 7dBm output power, 1: laser on, 1: dither on

`[:SOURce:]BUSY? <C>,<S>,<D>`	Query state of a device. If 1, the laser is currently tuning and not settled.
	Response: <state>, 0/1
	Example 1: `BUSY? 1,2,3;`
	Returns
	`1`
	Example for Query of multiple Lasers:
	Example 2: `BUSY? 1,2,*;`
	Returns
	`1,2,1,1\n`
	`1,2,2,1\n`
	`1,2,3,0\n`
	`1,2,4,1;`

`*opc?`	Operation complete query (available for Firmware 2.1.17 or later). This will check tuning status of all installed lasers and respond with 1 if all lasers are settled or 0 if any port is still in tuning mode. It is identical to query `BUSY? *,*,*;` Example: `*opc?;` Returns `1,1`
`[:SOURce:]MONitor? <C>,<S>,<D>`	Query monitor readings from laser. Response: <LD chip Temperature>, format nn.nn, unit °C <LD base Temperature>, format nnnn.n, unit mA <LD chip current>, format nnnn.n, unit mA <TEC current>, format nnnn.n, unit mA Example 1: `MON 1,2,3;` Returns `29.23,25.12,125.1,1043.2`
`[:SOURce:]DITher/? <C>,<S>,<D>,/<P>`	Set or query dither tone enable/disable of laser in location C-S-D -1: Not available 0: Off 1: On Example: `DIT 1,2,3,1;` Note that this is supported only by special versions of the laser.
`[:SOURce:]SBS:STATus/? <C>,<S>,<D>,/<P>`	Set or query status of SBS suppression (enabled "1" or disabled "0") Example: `SBS:STAT 0.5;`

Syntax and Type	Description
[:SOURce:]SBS:FREQuency/? /<P>	Set or query SBS suppression amplitude in GHz in 100MHz increments, valid values: 0, 0.1, …, 1 Value is set system wide for all lasers Example: SBS:FREQ 0.5;
CARD:INFOrmation <C>,<S>?	Retrieves Information about Firmware and Hardware Version of chassis if used without parameters. For MX system, information of installed card can be retrieved using the according Chassis and Slot ID Example: CARD:INFO?; Response: CBMA24,SN: 11180002,FW 1.5.13,HW 2.0.0; Note: Some devices do not allow querying the Serial number of the device, Serial Number will be "NA"
*idn?	Retrieves Information about Firmware and Hardware Version of chassis (available for Firmware 2.1.17 or later). It is identical to CARD:INFO?; without Example: *idn; Response: CBMA24,SN: 11180002,FW 1.5.13,HW 2.0.0;
[:SOURce:]SaveCurrSTATe <C>,<S>,<D>	Permanently saves the current laser port state which will be loaded again after a power on/off cycle or reset. Note that parameter [:SYStem:]AUTOSTArt must be set to "1" to enable this feature. Example: SCSTAT 1,1,1; will save the current laser state for port 1,1,1.
[:SYStem:] AUTOSTArt/? /<P>	Set or query autostart behavior of laser: 0: saved Laser settings are not loaded upon powerup 1: saved Laser settings are set upon powerup Example: AUTOSTA 1; will save the current laser state
[:SOURce:]FastFREQuency/? <C>,<S>,<D>,/<P>	This command is available in Firmware 2.1.32 or later Query: Indicates if feature is installed (1) or not (0) Set: Triggers a fast frequency jump to the target frequency <P>. See separate section for a detailed description of the feature Example: ffrequ? 1,1,1; Returns 1; ffrequ 1,1,1,194.345; Note that dither must be off to enable this feature
[:SOURce:]SWEEP/? <C>,<S>,<D>,/<P>	This command is available in Firmware 2.1.33 or later and lasers that have the feature installed Parameters are: <sweep range [GHz]>, <sweep speed [MHz/s]>, <Trigger Interval [MHz/s]>, <sweep on/off {1, 0}> Query: Returns current setting of parameters. Note that speed readout is currently not supported so

Syntax and Type	Description

	that always 0 is returned. An error will be returned of the feature is not supported on your laser
	Set: Enables or Disables the Sweep feature of a laser port and defines parameters. If sweep is disabled, the other parameters are ignored.
	See details for parameter range in general section of this manual.
	Set example:
	`sweep 1,1,1,60,5000,5000,1;`
	Enables a 60GHz sweep with a rate of 5GHz/s and a trigger interval of 5GHz (=1Hz repetition rate).
	Read Example:
	`sweep? 1,1,1;`
	Returns
	`60,0,5000,1;`

7.7 Error code definition

Error code	Description
1	Execution error
4	Timeout communication to laser
5	Command was sent to laser several times but not accepted
6	Command transmission error
100	Command error
101	Syntax error
102	Illegal Parameter error
103	Too much data, buffer overflow
104	Device not ready
105	Command execution error
106	Limit exceeded
110	No valid Port

8 Uninstalling CoBrite Software

Software may be uninstalled by either using the well-known central Windows built-in “Add/remove Programs” function or by running “setup.exe” from installation medium again.

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