BlueTiger™

BlueTiger™ Connected Optical Drive Family

CD-84 and CD-88 PC-Tool and CFLG-Tool

User Manual Version 1.0
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Introduction

PC-Tool

The PC-tool is an application for Windows that can interface to the CD-84 and CD-88 boards through the IFB (InterFace Board), which is part of any dev-kit for these boards.

It interfaces from the PC's USB port to a USB-to-UART converter with an CP2102 bridge IC to the SUOS-Interface board and subsequently to the CD-Module.

It is intended to be used for assisting in the development of ones own control board by:

- Providing detailed information about the communication between the CD-board and the controller.
- Make visible all the features about the diagnostic data stored on or being available in real-time from the CD-Module, which are not shown on the UFB-8X.

It can also be used to read and write the settings on the EEPROM of the CD-module and to reflash the board. For reflashing please refer to the Dev-kit User Manual for the switch and jumper settings on the IFB.

CFLG-Tool

The CFLG tool is combination of a Windows application similar to the PC-tool with the "Whistle", which is a device that extracts the detailed Error-Correction Data from the SPDIF signal of the CD-Module and displays it on the PC. This detailed information can be used to judge the quality of the reflected laser light as seen be the photo detectors in the OPU. It can be used to detect any problematic OPUs - e.g. one that have been touched and have thus a contaminated lens, and can assist in the listening test by giving a much more detailed view of interpolations and uncorrectable errors than would be possible by just by listening.

PC-Tool

Setup

Download the installer file PC-Tool.exe from the SUOS sftp-server and run it to install the PC-tool on the PC.

Download the USB-UART bridge driver from the Silabs website (https://www.silabs.com/developers/usb-to-uart-bridge-vcp-drivers) and install it. If you connect the USB-UART bridge to your PC it should show in the Device Manager as COM port.

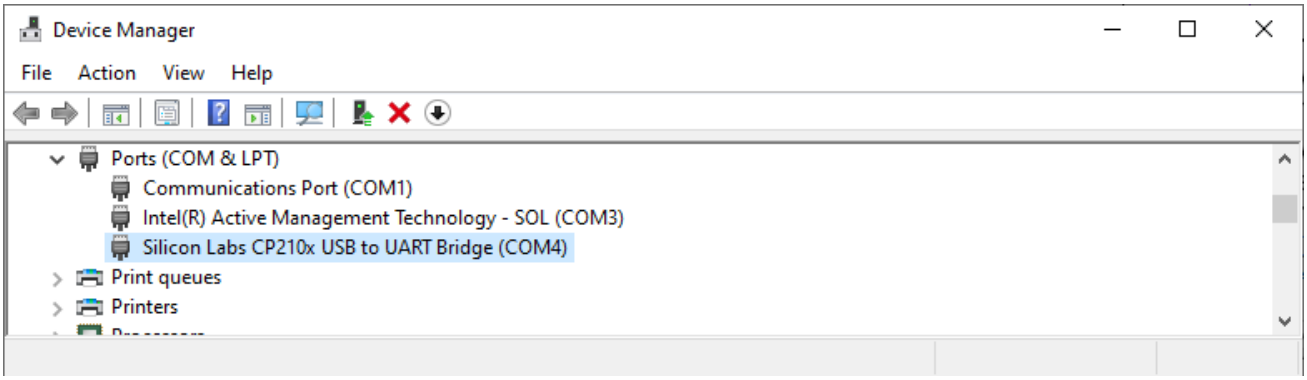


Fig. 1 USB-UART bridge installed

With the UART bridge connected to the PC and dev-kit apply power to the IFB and start the PC-tool.

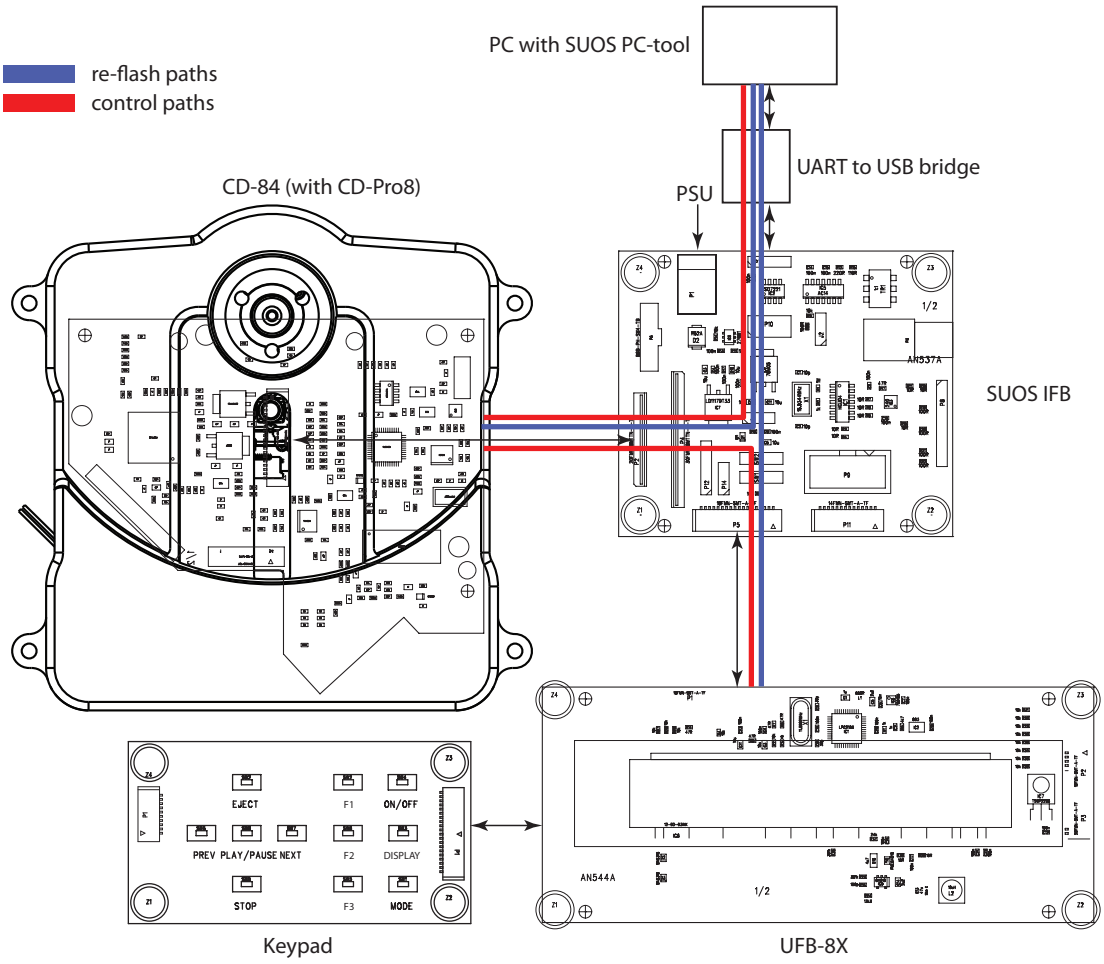


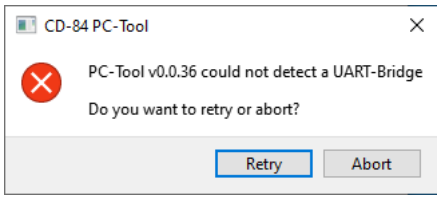
Fig. 2 Dev-kit connection

The PC-Tool should start with this screen.

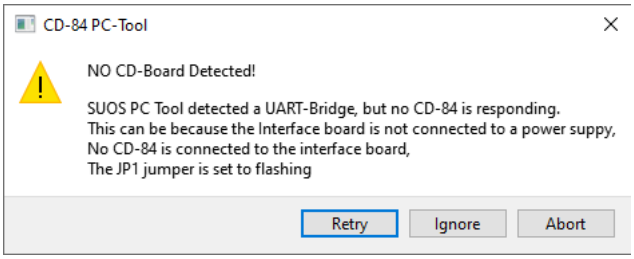
Fig. 3 PC-tool Start-Screen

The top left corner shows the version of the PC-tool, bottom left the loader type as set in the EEPROM and the bottom right COM port, baudrate, FW version and has a toggle buttom to connect and disconnect. Disconnecting and connecting will refresh the info read from the EEPROM.

If the CP2102 bridge is not found this message will appear:



In this case check that the Silab driver is installed and that the USB-UART bridge shows up in the Windows Device Manager as COM port.



If the PC-tool doesn't detect a CD-board make sure that:

- The IFB and CD boards are connected and powered
- The CD-board has already been flashed
- Other reason can be wrong jumper settings or the RESET or FLASH switches are in the wrong positions.
- The board can be flashed with the PC-tool and in this case this message will always show up since the board is in flash mode and cannot operate.

Other Tabs on the PC-tool are:

- The Expert Mode

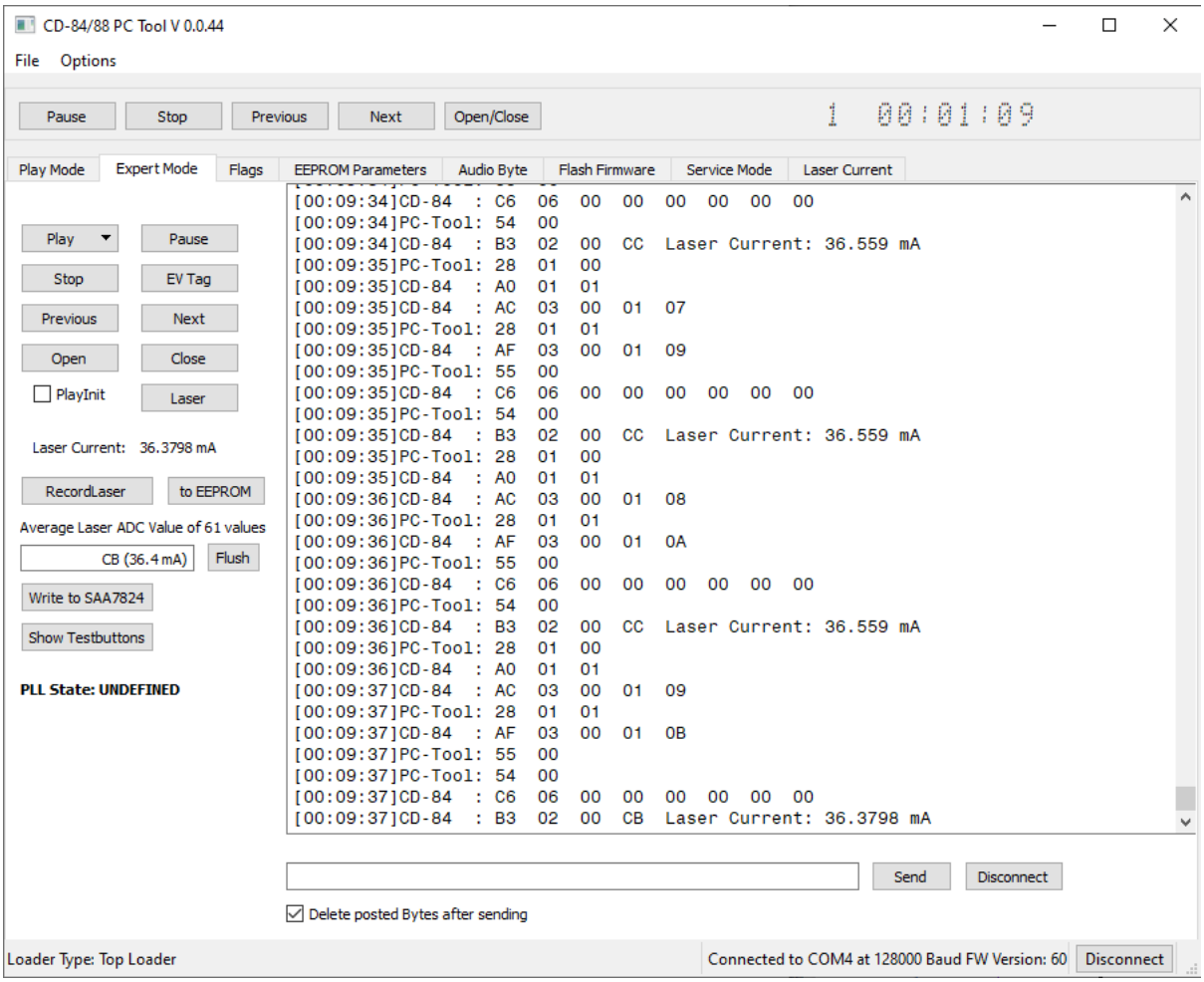


Fig. 4 Expert Mode

The Main Windows shows the communication between the PC-tool and the CD-Module in HEX form. The PC-tool requests once per second the value of the ADC measuring the laser current and displays it not in HEX but in readable form

This Tab also allows to write to the CD-module directly from the PC-tool using the field below the communication window and the "Send" button.

The button "to EEPROM" is meant to write the 0-hour laser current to the EEPROM to be able to compare it with the laser current history.

"Show Testbuttons" extends the area and shows predefined commands that may be useful.

- Flags

The functionality of this Tab is not supported any more by newer CD-84 and CD-88 firmware versions. It turned out that due to the RTOS running on the controller this was prone to wrong detection of a sync pattern, resulting in wrong Error-Correction outputs. Instead of the Flags Tab the SUOS-CFLG-tool should be used which is described later in this manual.

- EEPROM

Displays the parameters stored in the EEPROM and can be used to modify write them.

Fig. 5 shows the page on the internal version of the PC-tool and not all fields are enabled in the customers version. For example the serial number, laser runtime and other production info is not supposed to be modified. Modification of this parameter would result in voiding any warranty.

Use this Tab if you want to change the loader type, baudrate (caution: changing the baudrate of the CD-Module requires also a change of the baudrate in the PC-tool before they can communicate again) or Audio Byte.

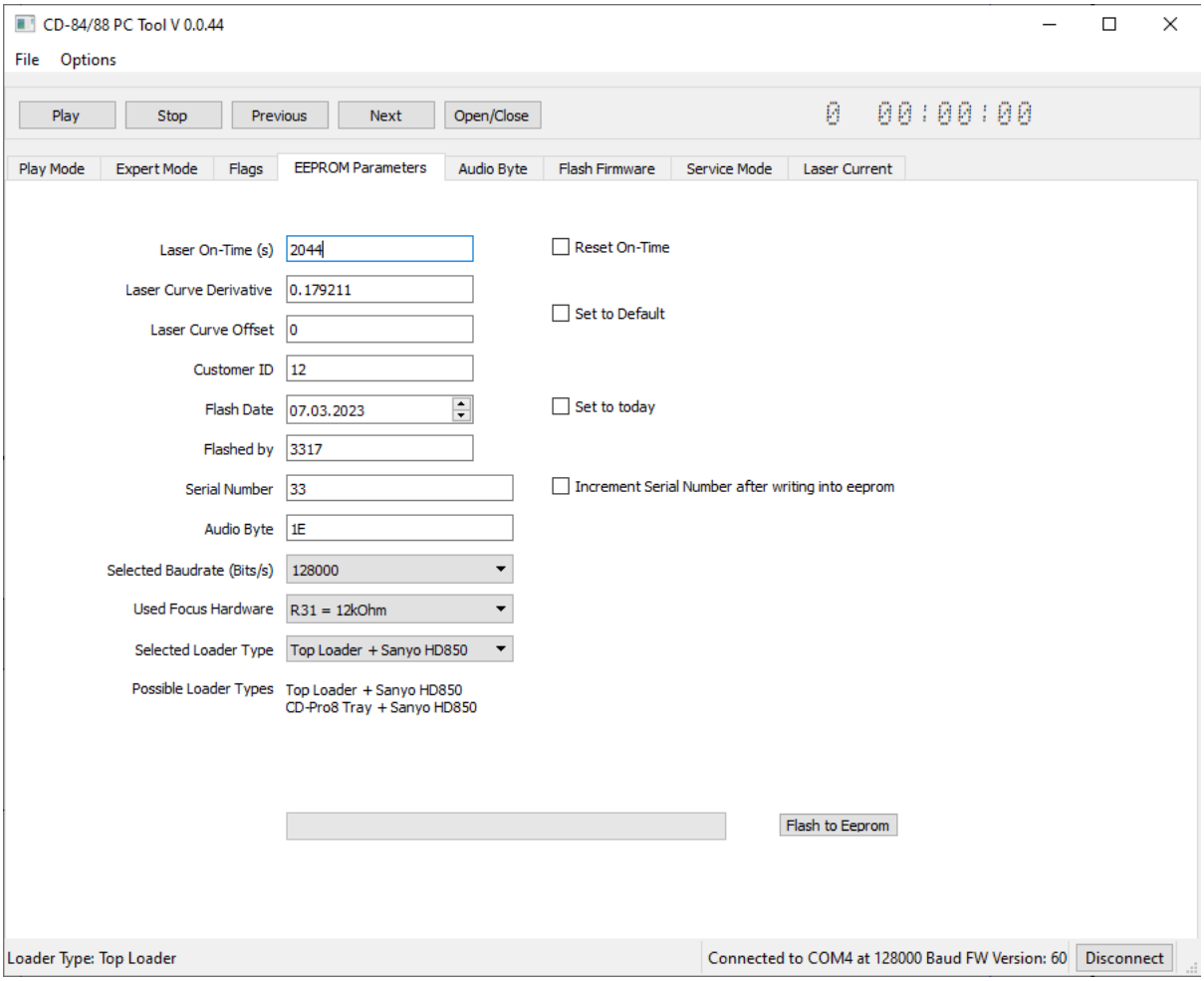


Fig. 5 EEPROM Parameters

The first field shows the laser on time. This variable is a 3 Byte value and is incremented every 7 seconds during Play. So the On Time equals the value returned from the CD-Modul times 7 in seconds. Every 16 x 7 seconds the 8 MSb of the ADC value are written to the EEPROM. 256 Bytes of the EEPROM are reserved for this laser current history, so it covers the last 7 x 16 x 256 seconds, which equals almost 8 hours. This can be useful to cover a burn in test.

- Audio Byte

The Audio Byte allows to select the format and oversampling rate of the serial audio data to be output to the DAC. It also contains info about the clock accuracy indicated in the SPDIF signal, wheter the Error-correction status is coded into an ancilliary bit (bit-24 = LSB if the SPDIF data is read as 24-bit) and if the deemphasis should be done in the decoder or not. Note that deemphasis is only done on the serial data and not on the SPDIF signal.

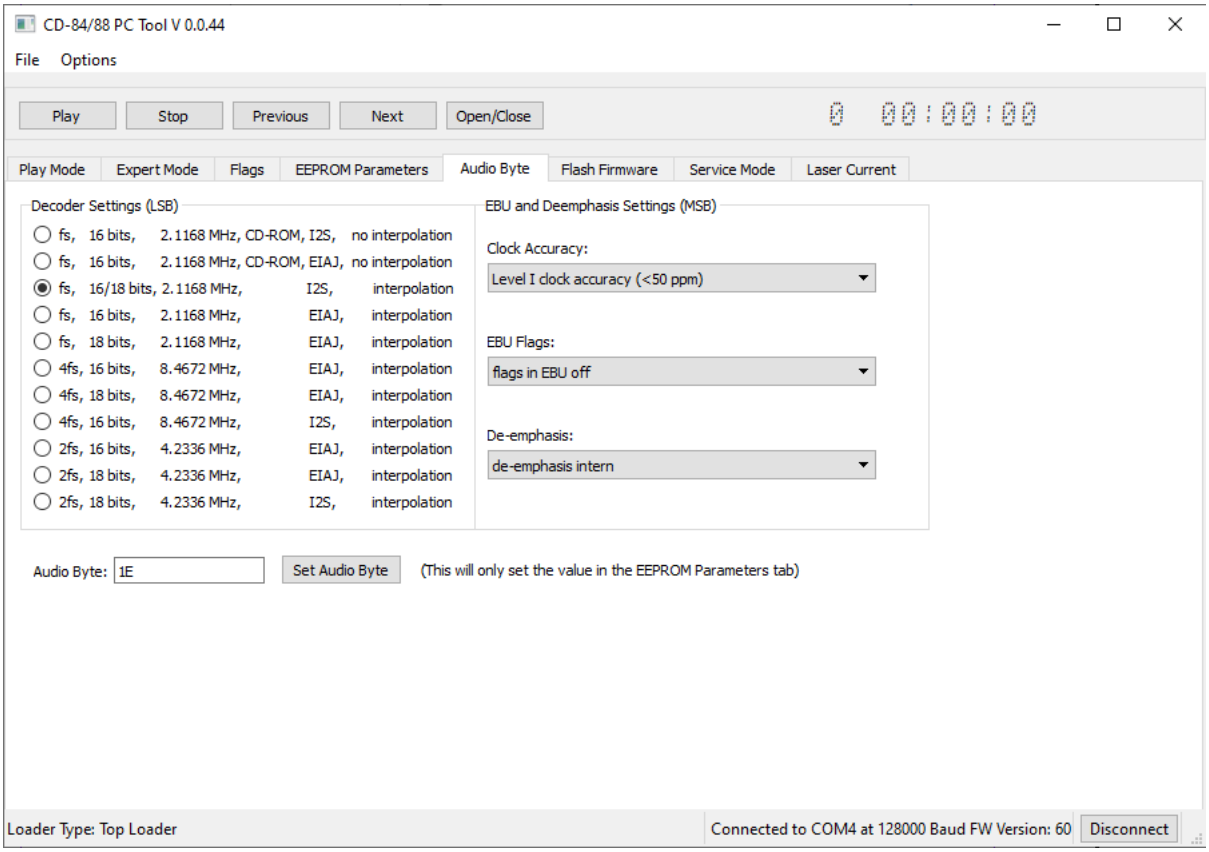


Fig. 6 Audio Byte

This Tab only calculates the value of the Audio Byte depending on the settings chosen and copies it to the field on the EEPROM Tab. It needs then to be written to the EEPROM to be effective.

- Flash Firmware

With the respective jumper settings on the IFB this Tab can be used to re-flash the CD-Module or the UFB-8X firmware. For jumper setting refer to the “Dev-Kit User Manual”.

- Service Mode

Is intended for diagnosing faulty modules. If the laser diode is damaged so badly that a disc cannot be played the actual laser current reading is not available since it is only read in play mode (when the disc can actually be read). The first step of the service mode turns on the laser regardless if a disc is present and a reading of the laser current can be taken on the Expert Mode Tab.

Other steps operate the motors (to check for faulty connections or motors) then searching for focus and eventually playing a disc.

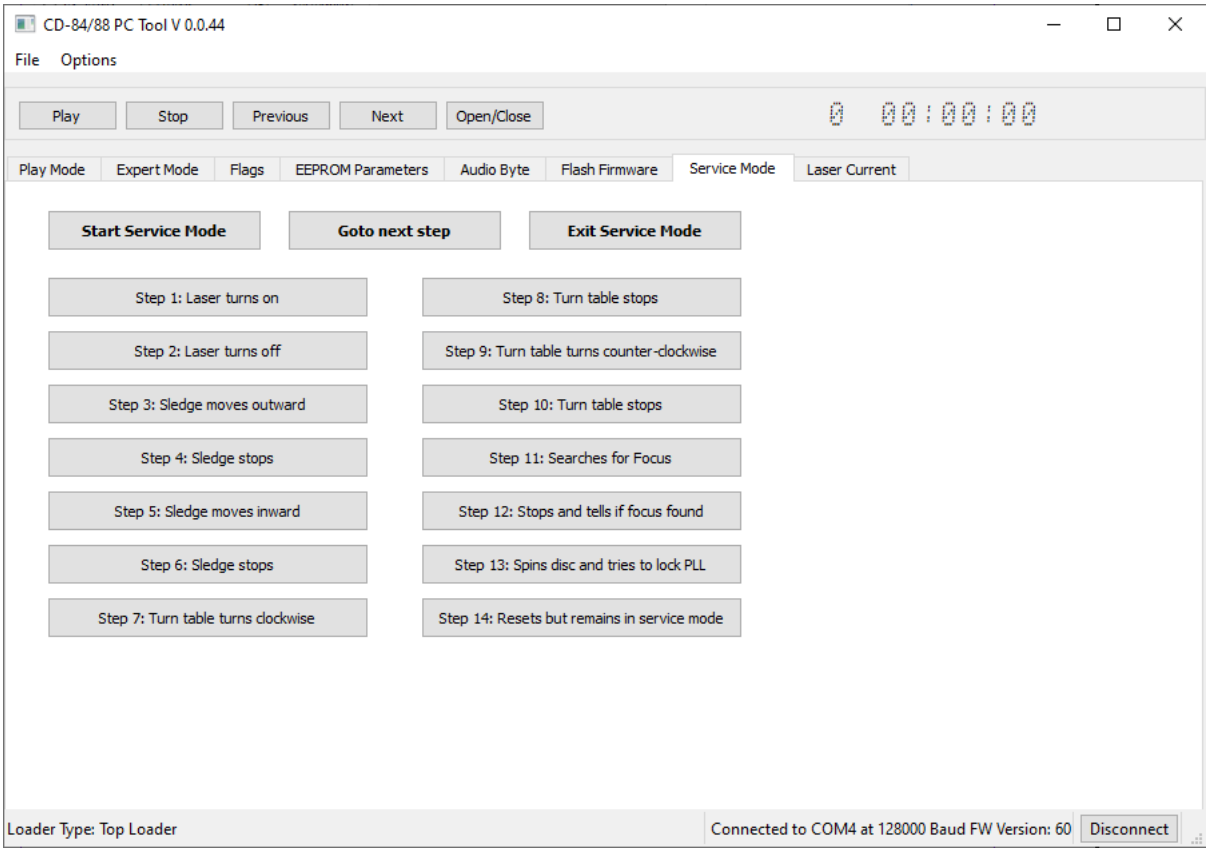


Fig. 7 Service Mode

For the other functionality to work normally, the service mode must be excited or the CD-Module reset.

- Laser current

This Tab only works in Stop Mode. It displays the values of the laser current of up to the last 8 hours and the 0-hour current if it has been set. For CD-Pro8 Modules the 0-hour current is written by SUOS during the test phase.

The 0-hour value is displayed in blue and the history in red.

The laser current is measured by an ADC on the CD-board. The laser current runs through a 1 Ohm resistor and the voltage drop on this resistor is amplified by a factor 18 and referenced to GND with an OPAMP.

A typical laser current is in the range of 40mA, so the output voltage of the OPAMP would be

0.04*18 = 0.72V

The ADC outputs full scale at 3.3V with 10 bits, so the range of values is from 0~1023.

0.72V = 21.82% of 3.3V so the ADC value would be 223 decimal or 0x00DF.

To convert an ADC value from the *AC_Get_Laser_Current* command use the following formula:

I_{laser}[mA] = ADC_value * 1000/1023*3.3/18; 1000=mA/A, 1023=10-bit value, 3.3V=ADC supply; 18=OPAMP gain

I_{laser}[mA] = ADC_value * 0.179211 OR

I_{laser}[mA] = ADC_value * 367 / 2048

Where the division can be replaced by bit-shifting

For values from the EEPROM only 8 bits are stored so the value from above formula needs an extra multiplication by a factor of 4.

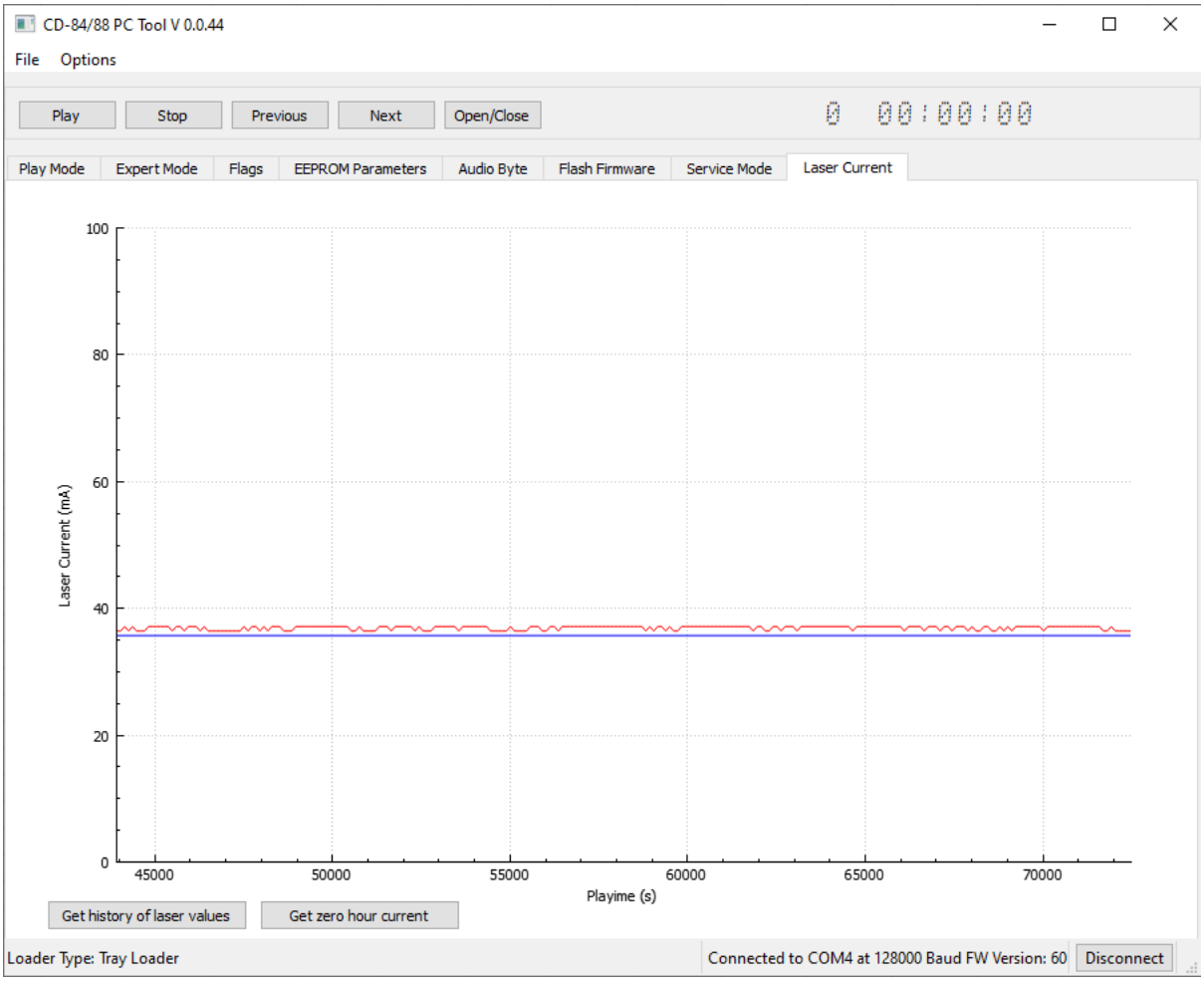


Fig. 8 Laser Current

CFLG-Tool

Setup

Download the installer file CFLG-Tool.exe from the SUOS sftp-server and run it to install the CFLG-tool on the PC.

The CFLG-tool does have a CP2102 USB-UART bridge inside and powered by the USB connection, so it also requires the Silab driver to be installed.

- Hardware

The CFLG hardware - called the Whistle - contains an SPDIF to I2S converter which sends the Error-correction data to a µC. The "Flags in EBU" must be set to ON either in the EEPROM or the command AC_Set_Audio_Byte

- CD-Module version

The CFLG command is supported from CD-84 and CD-88 version 58 onwards. Earlier versions do not require the CFLG-tool but display the ERCO data in the Flags Tab of the PC-tool. Due to the use of an RTOS on the CD-Modules µC, which disables interrupts from time to time, the Data in the PC-tool Flag Tab may trigger to wrong sync patterns whereas the data in the CFLG-tool is 100% correct.

- Connections

Besides the USB-C connector there are inputs for cinch and toslink. Only one input for the digital signal may be present at a time.

- Start-up sequence

Both the PC-tool and the CFLG-tool look for the CP2102 bridge, therefore first connect only the USB-connection for the PC-tool and then start the PC-Tool. Afterwards connect the USB-connection of the Whistle and start the CFLG-Tool.

- Operation

Make sure that Flags in EBU is either set to ON in the EEPROM settings of the CD-Module or send the command AC_Set_Audio_Byte. Sending the command can only be done in STOP Mode and not during Play or Pause.

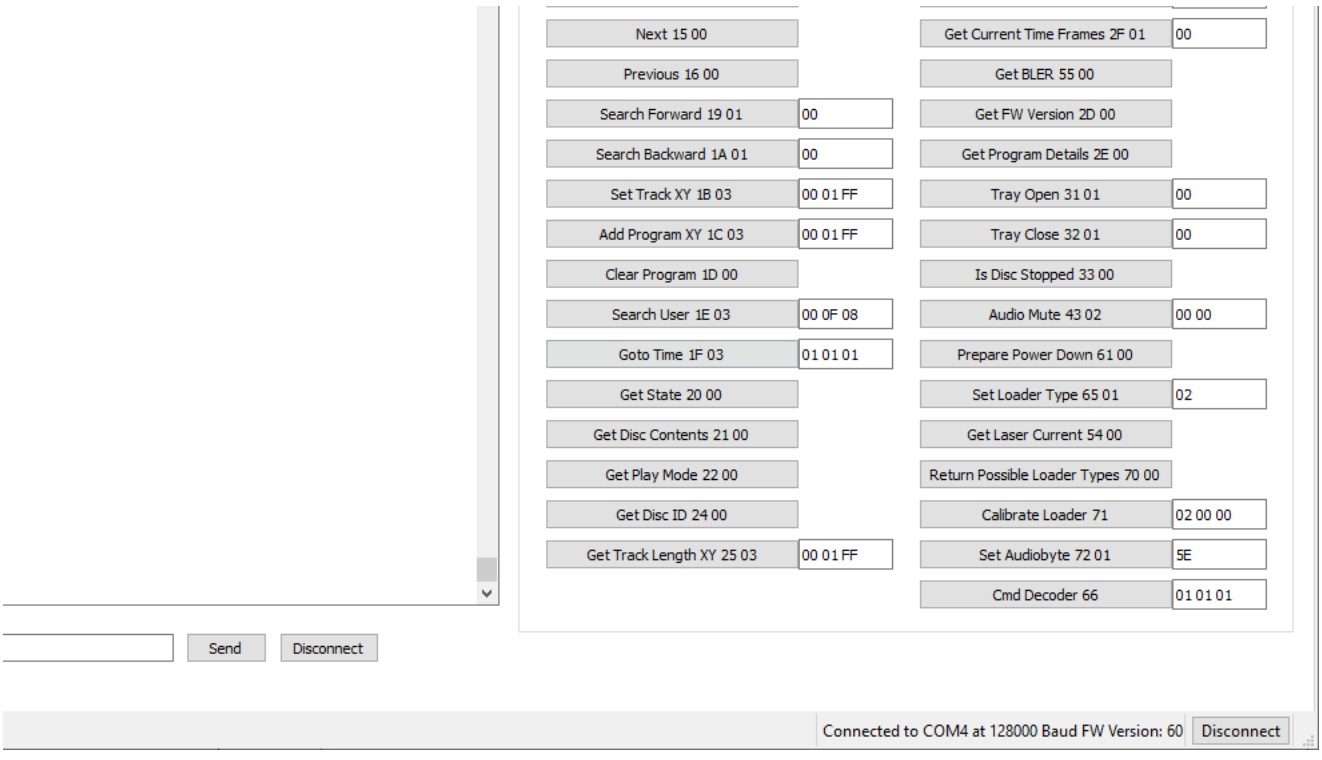


Fig. 9 Set Audio Byte with the PC-tool

The value of the Audio Byte can be calculated in the Audio Byte Tab of the PC-tool. In the picture above the value is 0x5E in the second to last control of the second column.

Fig. 9 shows the Expert Mode Tab of the PC-tool after pressing the Show Testbuttons control.

The lower left corner of the CFLG-Tool shows the status.

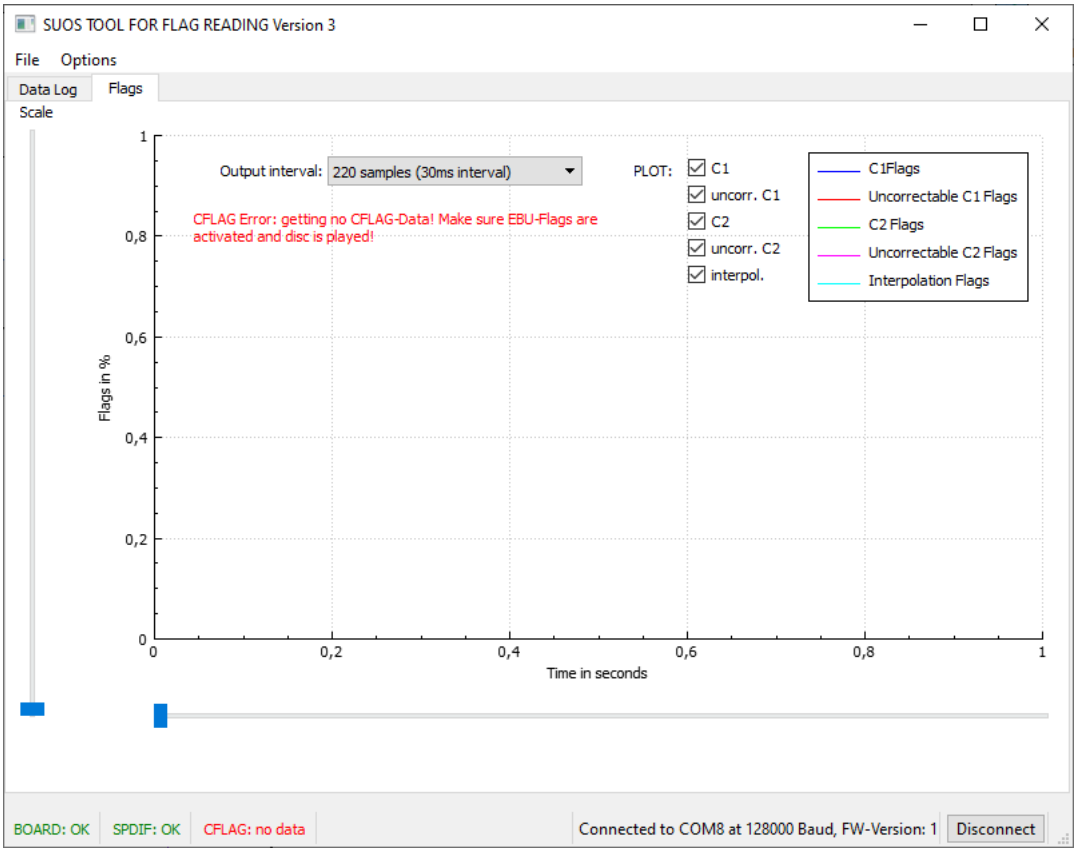


Fig. 10 Status of the Whistle

Fig. 10 shows that the CFLG-Tool detects that the Whistle and an SPDIF signal are present. However there is no ERCO Data since it was not enabled in the Audio Byte

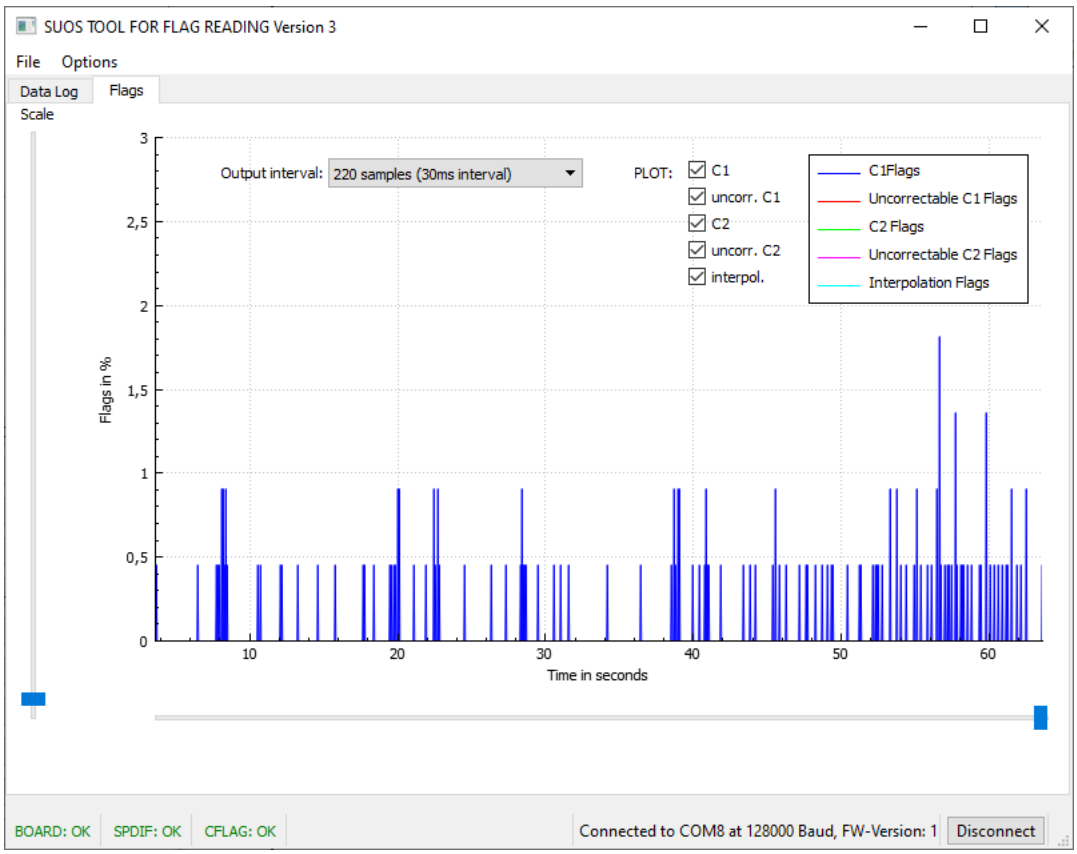


Fig. 11 CFLG-Graph of a good disc

Fig. 11 shows the CFLG-Data of a good disc. There are only C1 Flags on a low level and no uncorrectable C2 Flags. That means the data is 100% correct.

If the Audio Byte has been set by the Command AC-Set_Audio_Byte and not in the EEPROM the CD-Module will start taking the Audio Byte from the EEPROM after a reset or power cycle. By using the Command rather than the EEPROM value this allows for finished goods to be checked with the CFLG-tool during testing if the set software allows this comand to be sent with "hidden" key combination or RC-command. The accuracy and resolution of the CFLG-tool is far better than anything possible by listening only.

The CDFL-tool allows 3 different integration times:

1 second (7350 frames); this is the only integration time provided by the PC-tool Flags Tab.

170 ms (1250 frames)

30 ms (220 frames); with this resolution errors that are concentrated on one part of the disc - like a black dor or wedge - can be made visible and checked for uncorrectable C2 errors, interpolations and holds.

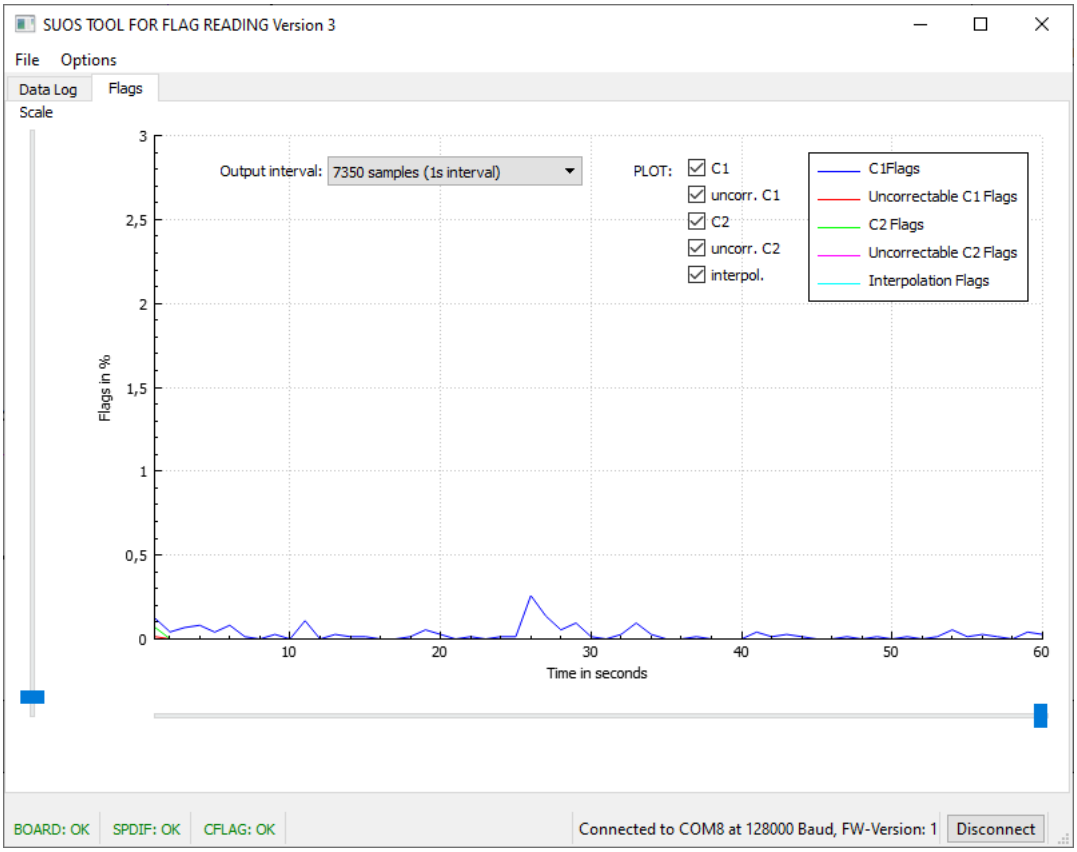


Fig. 12 Good Disc with 1 second integration time

Fig. 12 is with same disc as Fig. 11 but a with a higher integration time. Again there are no C2 correctables or interpolations and the level of the C1 flags is around 0.2%. The Red Book specifies that the C1 flags averaged over 10 s shall be less than 3%.

- Interpretation

The 2 most important lines are for C1 Flags (blue) and Uncorrectable C2 Flags (purple).

- C1 Flags

The C1 Flags are an indication of how good the signal from the laser pi-up is. It can be used to detect if there is anything wrong with the OPU. Since this is also depending on the disc - if there are many little scratches or other defects - it is recommended to use a part - typically the beginning of track - with a very low C1 error rate. If the OPU has been compomised - by being touched or by improper cleaning - the C1 rate will be significantly higher than with a good OPU.

- Uncorrectable C2 Flags

If there are uncorrectable C2 Flags, it means that the audio signal is not 100% correct. In such case

it can be seen on the graph long before it can be detected by listening, since the decoder will interpolate such uncorrectable by taking the average of the previous and following good sample.

The presence of uncorrectable C1 Flags is not important on it's own. Due to interleaved nature of the code, the C2 corrector can still regenerate the data 100% in many cases.