FiberLaser Software
Version 0.6.8

User Guide

MenloSystems GmbH

MenloSystems GmbH

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1. Introduction

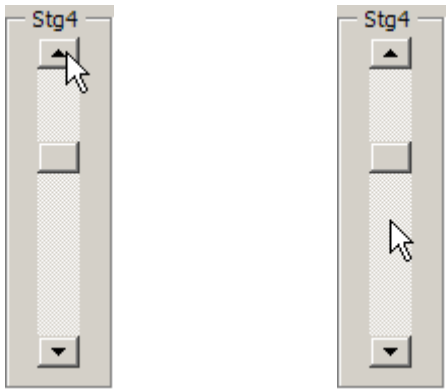
This user guide describes the FiberLaser software. This software is a graphical user interface for remote setup and control of all Menlo Systems GmbH laser systems. It is intended to control the laser, optimize the mode locked state for maximum conversion efficiency of the second harmonic generation (SHG) and the optical spectrum and to control the actuators to change the repetition rate and the offset frequency.
The chapters 13 and 14 describe settings which highly influence the correct functioning of the whole laser system and for everyday operation do not have to be modified.

Note This software is in beta stadium.

Note **A badly set up mode lock detection or scrambler will cause the laser not to mode lock any more. Be careful when changing those settings.**

Scrollbar behavior

The scrollbars comply with standard MS Windows behavior.
Clicking on the arrows at the end of the bar (left picture) changes the value by one point, clicking into the area between the arrow and the slider (right picture) by ten points.
Additionally, the scrollbars can be changed by use of the mouse wheel.



2. Installing and Uninstalling

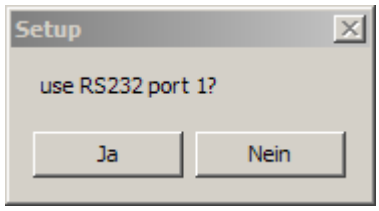
To install the FiberLaser software, double-click the *FiberLaserXX_install.exe*.
The setup program leads you through the installation process.

To uninstall the FiberLaser software, start *FiberLaser vX.X Uninstall* from *Start->Programs->MenloSystems->FiberLaser*.

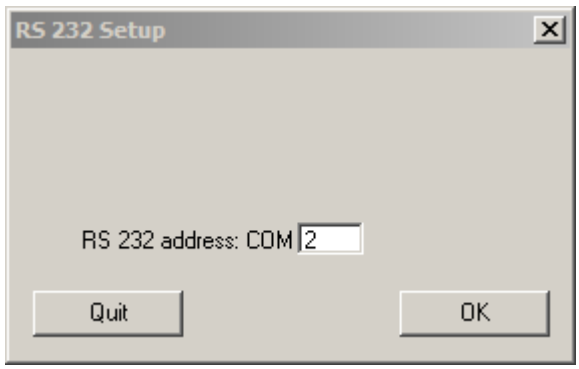
3. Starting the software

The FiberLaser software can be started by double clicking on the *FiberLaser vX.X.exe.*

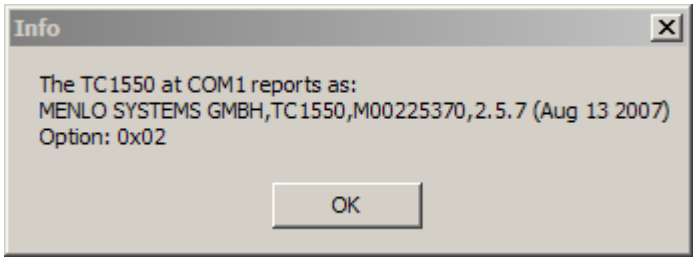
First you need to specify the port the TC1550-ST is connected to:



Clicking *Yes* uses serial port 1, clicking *No* brings up another window which lets you choose the serial port you want to use.



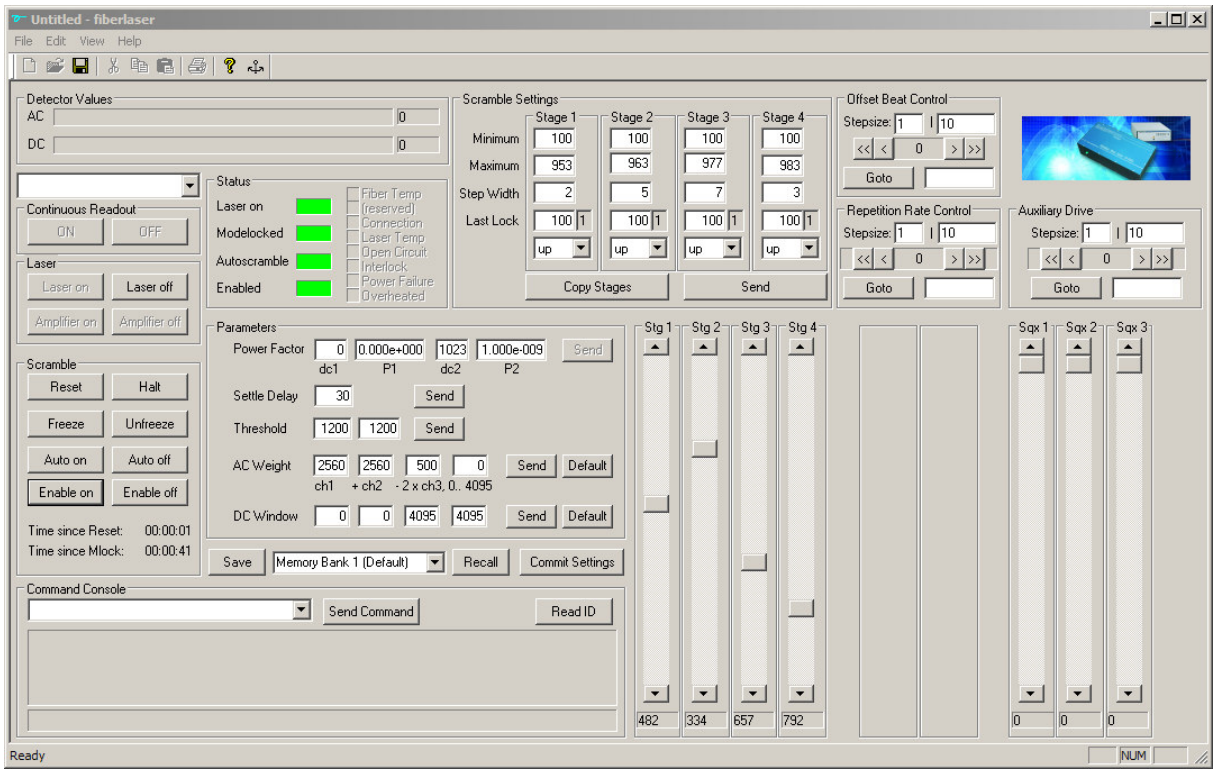
After entering the correct port and clicking *OK*, the program continues with a message box, containing the identification string and options setup of the control unit.



Pressing *Enter* takes you to the main window.

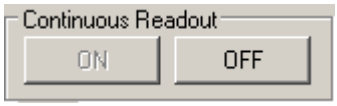
4. The main window

The main window is shown in the screenshot below.



5. Acquiring data

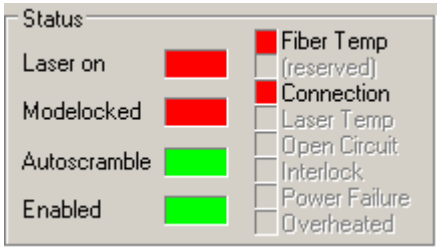
As soon as the *Continuous Readout* button is switched *ON*, the software starts acquiring data continuously.



It retrieves the AC and DC detector values, the status of the laser (*off/on* and *unlocked/locked*), scrambler unit (*disabled/enabled*) and auto scrambler (*disabled/enabled*), and the voltages for the four scrambler stages. The data is indicated in the areas *Detector values*, *Status* and the scrollbars *Stg1-4*.

6. Identifying errors

The software displays the control units' status register in the *Status* area.



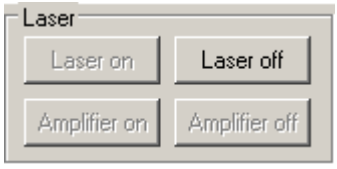
The description of the eight status bits is self explanatory. The most common errors are:

- *Fiber Temp* and *Connection*: Check the head control cable.
- *Laser Temp* and *Connection*: Check the laser pump control cable.
- *Interlock*: Check the interlock connection at the back panel.

The state of these status bits is information you need to enclose in your service request to Menlo Systems GmbH in case of any malfunction.

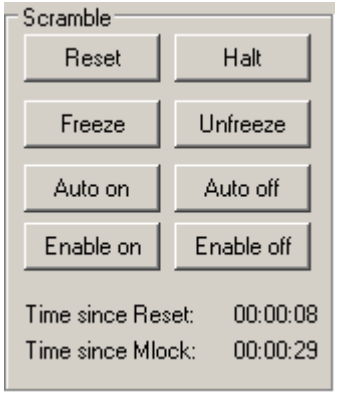
7. Controlling the laser

The four buttons *Laser on/off* and *Amplifier on/off* switch on/off the laser and the amplifier. If no amplifier is installed, the buttons for amplifier control are disabled.



8. Controlling the scrambler unit

The buttons to control the scrambler unit are arranged in the *Scramble* area.



Reset

Clicking *Reset* discards the current mode locked state and starts searching for the next one.

Halt

Clicking *Halt* disables the scrambler unit and the auto scrambling. The search is immediately stopped and all stages hold their current position.

Freeze/Unfreeze

Clicking *Freeze* sets the step width of stage one and two to zero, *Unfreeze* reenters the old values.

Note Unfreeze stores the old step widths of stage one and two in memory. Therefore this information is lost when the FiberLaser software is terminated.

Auto on/off

With auto scramble turned off, the scrambler unit remains at its position if the mode locked state is lost. The search for the next mode locked state has to be initiated by clicking *Reset*.
In turn, if auto scramble is turned on, the control unit **automatically starts searching** the next mode locked state **every time the lock is lost**.

Enable on/off

This button enables/disables the scrambler unit.

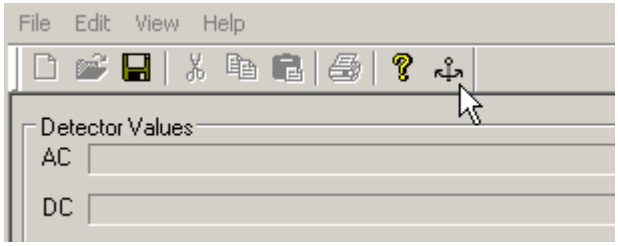
Timers

The software features two timers which count the time since the laser is searching a new mode locked state and since the laser has found a new mode locked state.

9. Controlling auxiliary drives

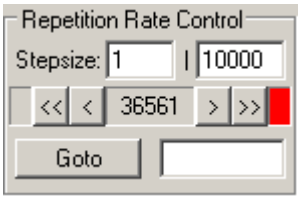
Depending on your purchased laser system, different auxiliary drives are installed to control e.g. the output intensity and/or polarization, the repetition rate, the offset frequency or a piezo squeezer. Your system might also support an additional, external drive, e.g. a motorized wave plate. The software automatically recognizes the built-in hardware options and shows/enables the corresponding controls.

To inhibit accidental movement of the scrambler stages while optimizing for example a piezo squeezer, you can lock the scrollbars for *Stg1-4* with the anchor button in the toolbar.



Repetition rate control

The controls to change the repetition rate are arranged in the *Repetition Rate Control* area.



Pressing the arrow buttons moves the motor in the respective direction. The *<* and *>* buttons move the motor by the number of steps entered in the left *Stepsize* field, the *<<* and *>>* buttons by the number of steps entered in the right *Stepsize* field. By pressing the *Goto* button, the motor moves to the absolute position entered in the field next to the button.
A red field (as shown in the screenshot) indicates that the motor has reached its left or right limit. The motor can not be moved in the same direction any further.

Offset beat control

The controls to change the offset frequency are arranged in the *Offset Beat Control* area.

Pressing the arrow buttons moves the motor in the respective direction. The *<* and *>* buttons move the motor by the number of steps entered in the left *Stepsize* field, the *<<* and *>>* buttons by the number of steps entered in the right *Stepsize* field. By pressing the *Goto* button, the motor moves to the absolute position entered in the field next to the button.

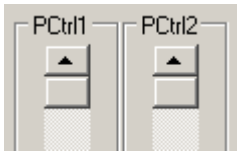
Auxiliary drive control

The auxiliary drive control is used to move an additional and/or external drive, e.g. a motorized wave plate.

Pressing the arrow buttons moves the motor in the respective direction. The *<* and *>* buttons move the motor by the number of steps entered in the left *Stepsize* field, the *<<* and *>>* buttons by the number of steps entered in the right *Stepsize* field. By pressing the *Goto* button, the motor moves to the absolute position entered in the field next to the button.

Output polarization control

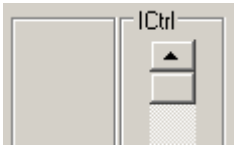
The output polarization control consists of the two scrollbars *PCtrl1* and *PCtrl2*.



By moving both scrollbars you can achieve any polarization state of the output light.

Output intensity control

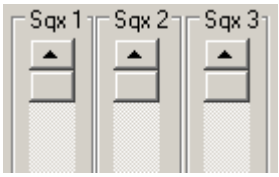
The output intensity control consists of the *ICtrl* scrollbar.



Moving the scrollbar gives you the possibility to adjust the output intensity to values below the specified output power.

Piezo squeezer control

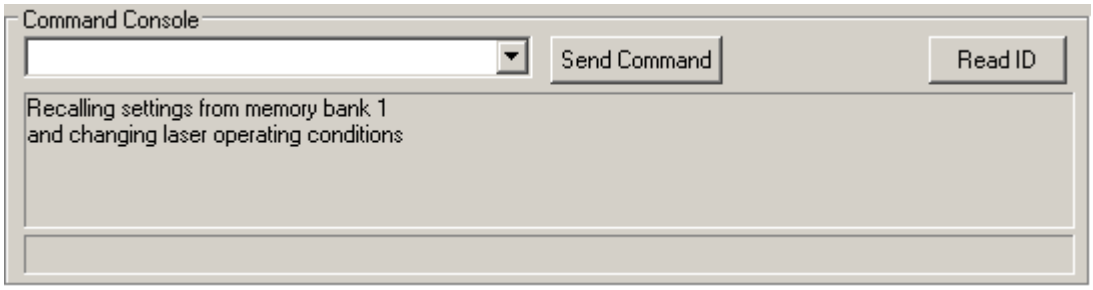
The amplifier squeezer control consists of the four scrollbars *Sqx1-4*.



Changing the values in the scrollbars let you adjust e.g. the input polarization of an EDFA system and this way enables you to optimize the output spectrum and/or the signal-to-noise ratio of an offset beat.

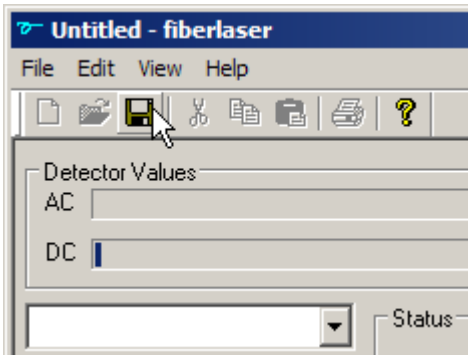
10. Submitting commands

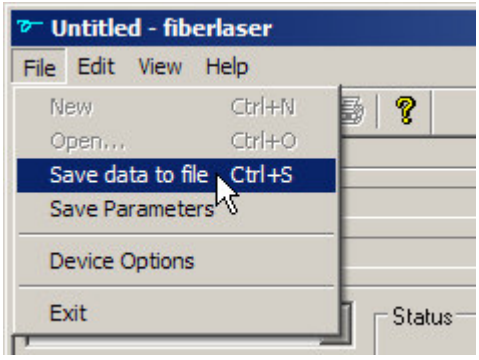
The *Command Console* area includes an input field where commands to the control unit can be submitted manually upon clicking *Send Command*. The response is shown in the status field below.
Clicking on *Read ID* retrieves the control units' identification string.



11. Logging to file

By clicking the *Save* icon in the toolbar or selecting the *Save to file* menu command it is possible to log the detector and scramble values to a file.

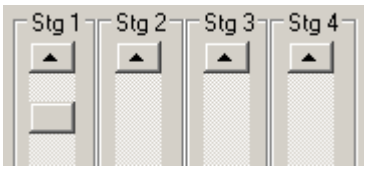




To stop the logging, disable *Continuous Readout*.

12. Optimizing the laser output

Since the laser output in the mode locked state is controlled by the scrambler values it's possible to optimize the output. Slightly changing the values may result in higher output power, broader optical spectrum or higher SHG conversion efficiency.
To optimize the scrambler values first let the software find a mode locked state automatically. Now you can change the value of each scrambler stage by moving the corresponding scrollbars *Stg1-4*.



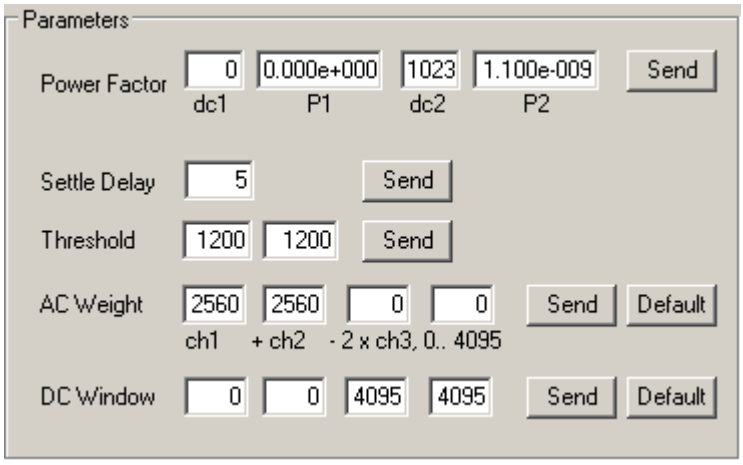
If you want to save the optimized state, click the *Copy Stages* button in the *Scramble Settings* area and *Save* the changed lock position to the desired memory bank of the control unit.

Note Without pressing *Copy Stages* and *Save*, the scrambler unit restores the values stored in the lock position setting after switching the laser off and on again.

Note The optimized state might not be self-starting.

13. Setting up mode lock detection

All the parameters to set up the mode lock detection are arranged in area *Parameters*.



Each setting is submitted to the control unit by clicking the corresponding *Send* button. Clicking the *Default* button for *AC Weight* or *DC Window* resets the value to factory setting.

Note Be aware of the fact that a faulty setup is most likely resulting in a not mode locking laser. Modifying these settings is not recommended.

Note Depending on the set up of the mode lock detection, the control unit might indicate a mode locked state while the laser actually is not mode locked. In turn, actually mode locked laser states might not be recognized and be swept over by the control unit.

Power factor

The control unit features a linear two point conversion from DC detector value to power. Therefore two DC values and their corresponding output powers are needed. The input fields are arranged in the order *point1 DC, point1 power, point2 DC, point2 power*. The power values are entered in Watts.

Note Adjusting this setting is disabled in this version of FiberLaser.

Settle delay

This setting gives the time in seconds which a mode locked state must persist before it is recognized and indicated by the control unit.
If this time is to short, the unit may indicate unstable mode locked states.

AC threshold

Whether the laser is mode locked or not is determined by the *AC value.* In mode locked state, the AC values are noticeably higher than in unlocked states. As soon as the AC value excesses an upper threshold, the control unit stops the scrambler unit and, after the settle delay time has elapsed, sets the mode locked flag. Should the AC value fall below a lower threshold the unlocked flag is set and if auto scramble is turned on the control unit starts to search the next mode locked state.
The left input field contains the lower threshold, the right one the upper threshold.

AC weight

The AC value is built of the power values at four different frequencies. The first two channels frequencies are located at the repetition rate and one of its harmonics. The third channel is measured between two successive harmonics and is used to detect noise in the RF spectra. The fourth channel is not used.
The four input fields contain the weights for the four channels, starting with channel 1.

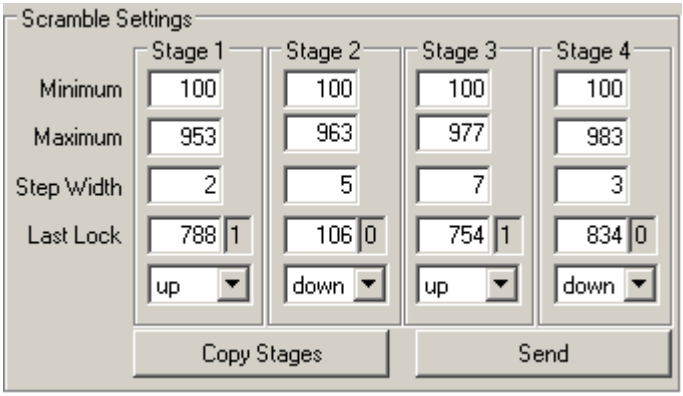
Note The settings for channels 1, 2 and 4 should not be changed. If you get a lot of noisy RF spectra, increase the weight of channel 3 (e.g. in steps of 100). Keep in mind that changing any weight affects the range of AC values you will get. It's likely you have to adjust the threshold afterwards, too.

DC window

It is possible to define a window the DC values must lie in. Both window borders feature a hysteresis, similar to the AC threshold. The order of the input fields is *bottom border low threshold, bottom border high threshold, top border low threshold, top border high threshold*.

14. Setting up the scrambler unit

The settings for the scrambler unit are located in area *Scrambler settings*.



The settings for all four stages are submitted to the control unit by clicking *Send*.

Stage settings

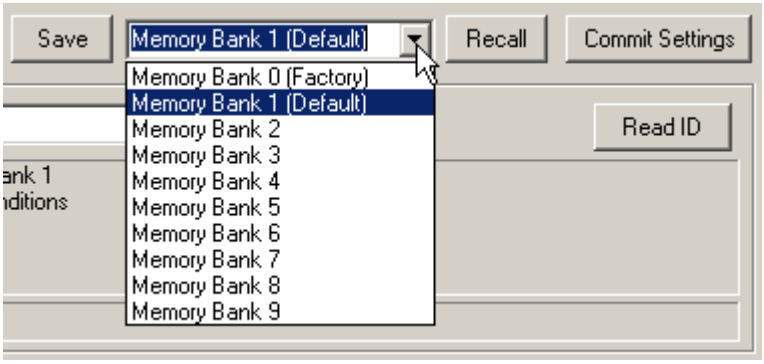
The settings contain the minimum and maximum values, step width, last lock position and direction the last lock was approached for each scrambler stage.

Note It is not recommended to change *Minimum*, *Maximum* and *Step Width*. This will most likely result in a not mode locking laser. Entering own values into the *Last Lock* field may cause the laser not to mode lock after restart.

15. Saving/restoring mode-locked state settings

All control units leave Menlo Systems GmbH with four different mode-locked states saved to memory banks 1 to 4. Memory bank 0 (factory setting) contains the same mode-locked state as memory bank 1 and cannot be overwritten by the user.
The remaining memory banks 5 to 9 may contain corrupt settings which lead to a not mode-locking laser.

Note When the control unit is operated in local mode (no connection to the software) memory bank 1 is used



Saving

Clicking the *Save* button located in the *Command Console* area saves the following settings into the selected memory bank of the control units:

- AC threshold
- DC window
- AC weight
- Last lock position
- Status of auto scrambler
- Settle delay

Note Without saving to memory bank 1, all changes you made are lost when you exit the FiberLaser software.

Restoring

There are two different ways to restore a previously saved mode-locked state.

The *Recall* button restores the settings from the selected memory bank but does not move the scrambler stages *Stg1-4*. To move the scrambler stages to the recalled mode-locked state, you have to switch off the laser. Closing the software without restarting the laser will discard the changes.

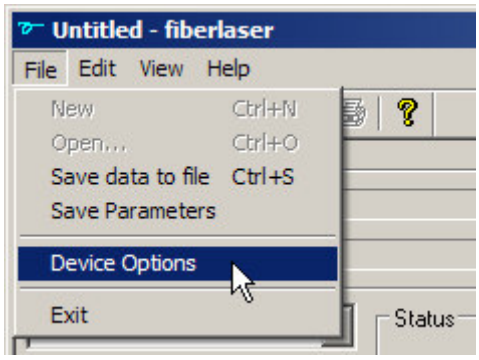
The *Commit Settings* button restores the settings from the selected memory bank and moves the scrambler stages *Stg1-4*. Therefore, the recalled mode-locked state is approached immediately.

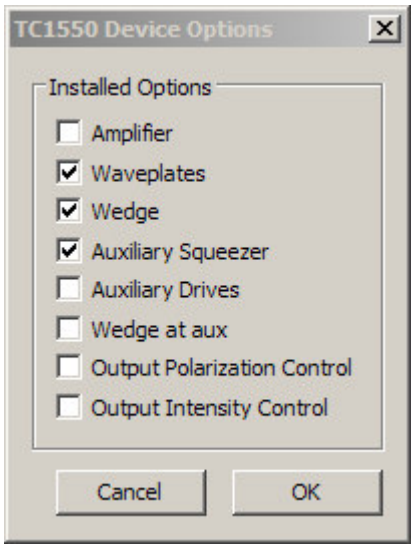
Note Even if you use the *Recall* button the laser may loose its mode-locked state. The changed settings for thresholds, weights, windows and auto-scrambling take effect immediately.

Note If you want to use the recalled mode-locked state in local operation mode of the control unit (without connection to the software), you have to save the recalled settings into memory bank 1 before closing the software.

16. Displaying installed hardware options

Selecting the *Device Options* entry in the File menu brings up a list of all possible hardware options. The ones built into you laser system are checked.





Note It is not possible to change the device options with this software.