Litron Plasma Laser Control Software

Litron Lasers Ltd
V1.01

System Operation

Interlocks

The system is hardware protected against certain failure modes. If a failure is detected, the laser is shut down into a safe mode and the error condition is reported. The interlocks are described below:

Laser Head	The cover on the laser head is not fitted.
Driver 1 Temperature	Diode Driver 1 is overheating
Driver 2 Temperature	Diode Driver 2 is overheating
Water Temperature	The internal cooling water is too hot.
Water Level	There is not enough internal cooling water.
Water Flow	There is not enough internal cooling water flow from the Cooler Unit
Water Head Flow	At least one Diode Podule is not receiving enough cooling
Shutter Out Of Position	The beam shutter has not reached its commanded position in time.
Over Volts 1	Diode Driver 1 voltage is too high
Over Volts 2	Diode Driver 2 voltage is too high
Supply Rails 1	Diode Driver 1 supply is out of range
Supply Rails 2	Diode Driver 2 supply is out of range
External	The hardware link on the back of the power supply is open circuit.

When any interlock causes the system to shut down, the state of all interlocks at the time of failure is latched. This is to catch transitory / momentary failures and aid diagnostics. The system will continue to report this latched interlock state until it receives a command to restart the system. It will then update all the interlocks to their live state, report this state and attempt to restart the system (if the new interlock state allows).

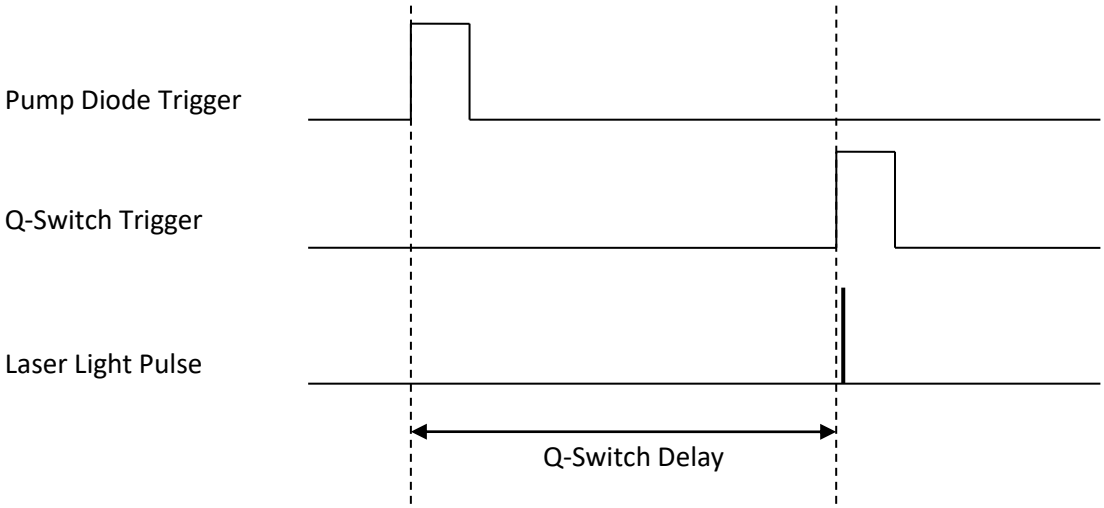
Some of these faults are not critical. They do not stop the laser. They are for information only.

System Timings

Q-Switch Delay

It is important for the Oscillator to fire its Q-Switch a specific time after its Pump Diode. This is known as the Q-Switch Delay. The optimum value can be found in the laser test sheets (in the laser manual). This value is different for each laser.

The laser light pulse will be synchronised to the Q-Switch trigger.



Repetition Rate

The rep rate is the frequency at which the laser fires. It is defined in Hz and most lasers can operate within a defined range of frequencies. This range will be found in the laser manual.

System Parameter Overview

Laser Energy Adjustment

The Attenuator (if fitted) is the usually best way of adjusting the energy output of the laser. This can be adjusted from 0 – 100%, but the relationship is not linear. A table in the laser test sheets shows the relationship between attenuator position and laser output. At very low attenuator values (low pulse energies), the beam shape may be affected. Consider increasing the Q-Switch delay in combination with the Attenuator.

Changing the Pump Energy of the Oscillator and Amplifier will also affect the laser pulse energy, but can have unwanted effects on the beam quality and stability. Increasing the Amplifier Pump Energy slightly over time to compensate for Diode aging is acceptable.

Increasing the Q-Switch delay will also decrease the laser pulse energy. This may be used to drastically reduce the output energy with less effect on beam quality. However, Pulse Stability may be reduced at large values.

Enable Signals

The internal trigger generators used to generate the pump diode and q-switch trigger signals can be enabled / disabled independently as required.

Trigger Sources

Triggers for the pump diodes and q-switches can either be generated internally, or fed in from an external source.

Shot Counter

An internal Shot Counter keeps track of the number of times the pump diodes have been triggered.

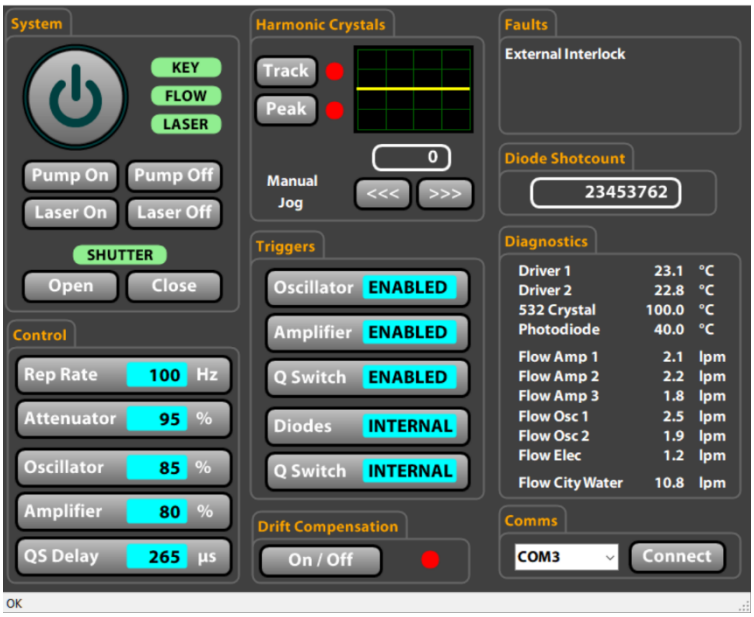
Control Interface

Installation

The Control Software is supplied on a Memory Stick found in the Laser Manual. It will run on any PC running Windows XP or later.

To install, simply run the MSI file.

If an existing copy of the software is already installed on the PC, this must be removed first using the Windows Control Panel.



Serial Port

The Laser system is controlled via an RS232 Serial Port. The software will detect any serial ports available to the PC. These may be internal, or USB-Serial Converters.

If the software has run successfully in the past, it will automatically try to find the laser on the last port used and selection will not be needed.

If the software cannot find the laser automatically, the user must select the correct port from the list, then press the Connect Button.

You will know if the laser has connected as the temperatures in the Diagnostic window will start updating.

Main Control Screen

Start Laser

The laser is started by pressing the circular Power button.

This will take the laser through a start sequence which may last up to 20 seconds.

The Power button will flash during the start up sequence. It will change to steady blue once the laser successfully starts.

Pressing the Power button again will turn the laser off.

Alternatively, the laser may be started by pressing Pump On, waiting 7 seconds for flow to establish, then pressing Laser On.

The laser may be turned off by pressing the Circular Power Button or the Laser Off Button.

NB. The Plasma Laser will not allow the Pump to start until there is External Water flowing through the Cooler Unit.

The Key on the PSU/Cooler unit must be turned to the ON position for the laser to start.

Shutter

The laser has an internal safety shutter which prevents the laser emitting light whilst closed.

Use the Open and Close buttons to control laser output once the laser has been running for about 10 seconds.

The SHUTTER indicator is green when the shutter is open, red when closed.

Interlocks

The laser is protected by a number of interlocks.

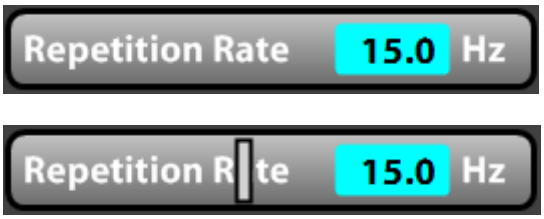
Any Alarms or Interlocks will appear in this window:

If an interlock fault occurs whilst the laser is running, the laser takes a snapshot of the interlocks and shows the interlock state at the moment of failure. If this occurs, the window title will show that the interlocks are LATCHED rather than live.

To exit the latched state, press the **Close Shutter** button or the **Power** button (if you want to try to restart the laser).

Slider Controls

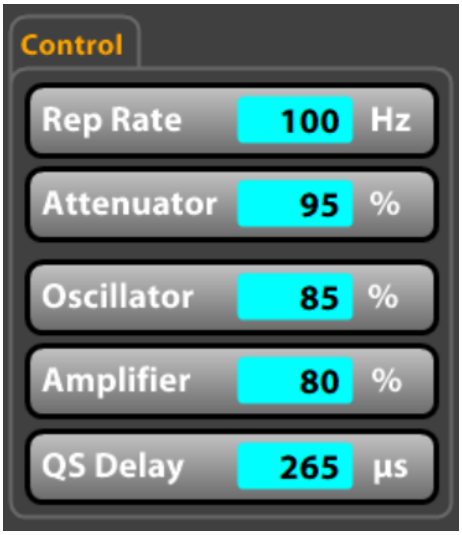
Controls with values on a blue background can be adjusted by clicking in the blue area. The user then types a new number and presses the ENTER / RETURN key. The edit can be aborted by pressing ESC instead.



Some controls can also be adjusted by moving the mouse to the left of the blue area. A slider will appear which can be dragged left and right to change the value. Releasing the mouse button enters the new value.

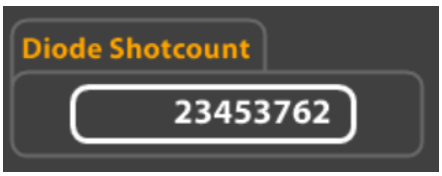
Repetition Rate & Delays

These values adjust the System Timings as described in the earlier section of this document.



Shotcount

The laser keeps a record of how many times the pump diodes have fired.

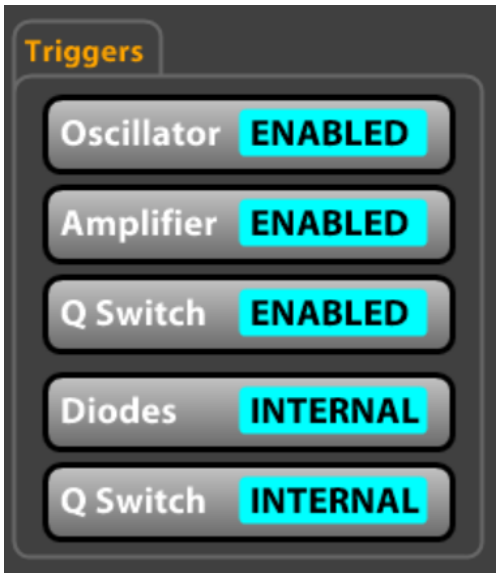


Trigger Control

The pump diodes and q-switch can be triggered by either internal trigger generators, or by user supplied triggers.

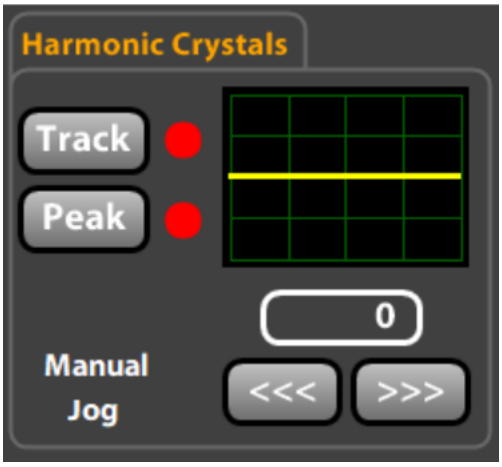
The trigger source for each component can be toggled between Internal and External by pressing the relevant button.

The internal trigger sources can also be toggled on and off by pressing the relevant Enable Button.



Harmonic Conversion Crystal

The angle of this crystal is critical for optimum output energy. Several options are offered to ensure the angle is correct.



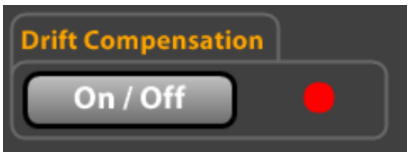
The crystal angle may be manually adjusted by jogging the angle using the <<< and >>> buttons. A Photodiode measures the laser output energy and displays the value below the graph. Adjust the angle to achieve the highest value.

The Peak button will perform a routine in which the crystal is scanned over its full range. The best position is found and the crystal set to that angle. This routine takes about 30 seconds.

The Track button will continuously dither the crystal angle back and forth, looking for the best energy. When this mode is active, the short-term stability will not be as good, but the long-term drift may be improved.

Drift Compensation

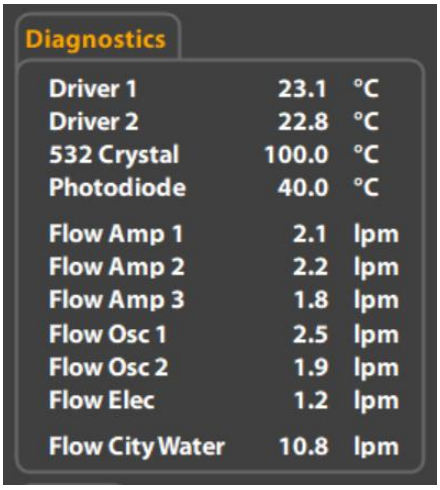
When the Drift Compensation button is pressed, the system looks at the energy value measured by the internal Photodiode and tries to maintain that value by adjusting the Amplifier Drive. This can help to combat any long-term drift.



The Indicator will be green if Drift Compensation is turned on.

System Diagnostics

The laser head and PSU contain several sensors to monitor the overall well-being of the system. These can be seen in this window:



The System should not be operated until the Crystal Temperature is up to 100°C.
The System cannot be started unless the City Water Flow is > 5 litres/min.
These values are periodically logged to the PCs hard disk and can be found in the directory \\LitronDataLogs\
The log files will import into Excel as CSVs, delimited by commas.