Laser Programming Kit (LPK)

OEM Industrial Laser Modules

WORLD LEADERS IN MEASUREMENT TECHNOLOGY

Notes to the following pages.

1. Numerical values need you to Tab out of the box after entry. Either press the TAB key or click into another box to finally accept your value.

2. Some options become unavailable as you make a selection. Either they will dim to show that they no longer apply or a message will appear to show any conflicts to prevent errors and unrealistic requests or parameters being sent to the laser.

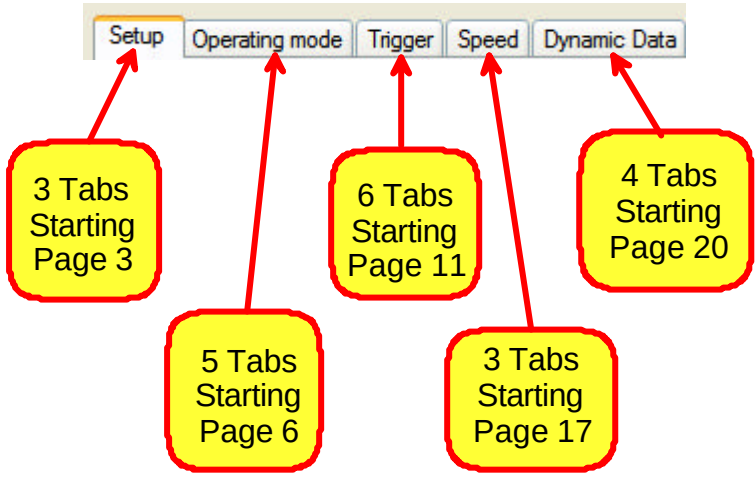
3. Dynamic commands exist to allow a limited number of changes to the laser without being connected to the PC software or the interface board. Commands can be listed by sending 'H' to the laser via its serial port. The latest list is shown at the end of this document for reference.

   On the Dynamic Data tab, some of the buttons have letters in brackets. These show the single letter command which will have the same effect in the laser itself when not connected as the button has on the screen. If a numeric value is needed then the laser will request it via text through the serial connection.

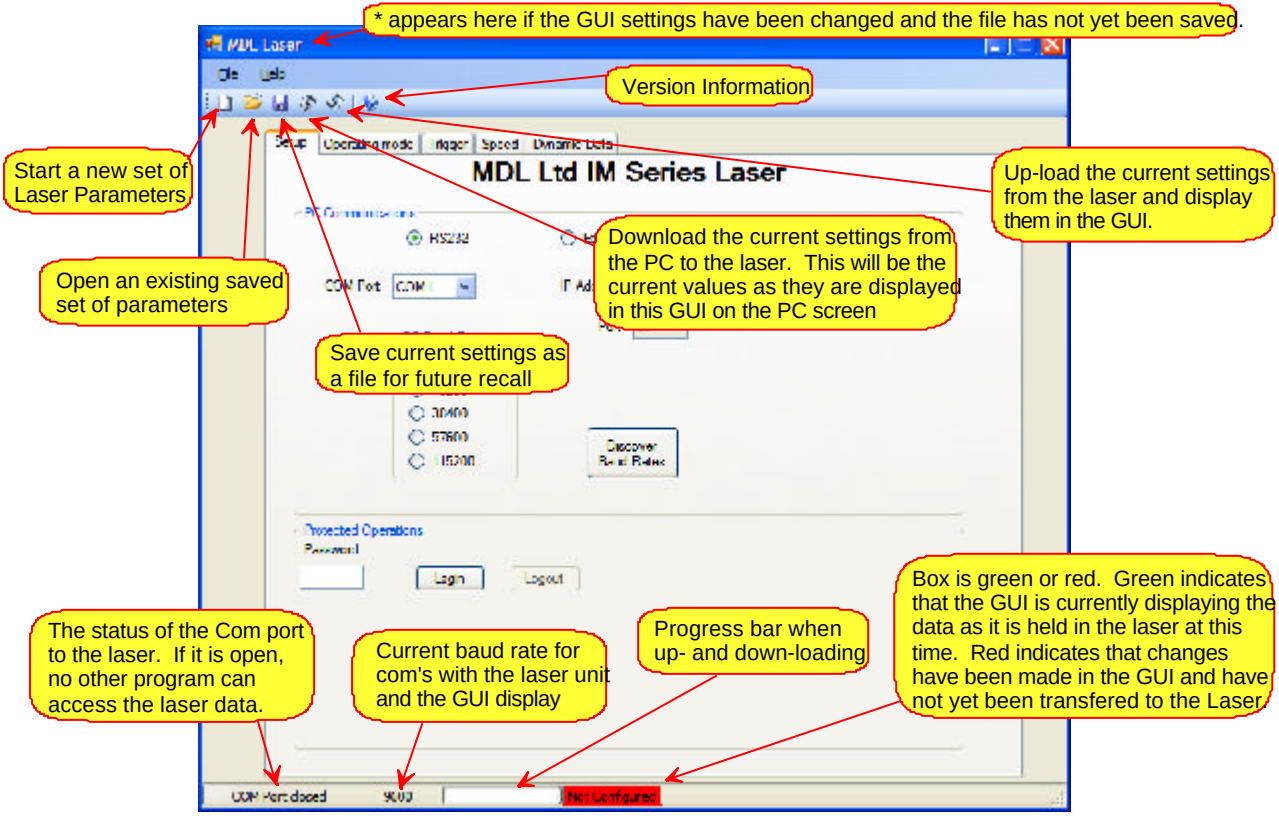
4. Pressing # will display the serial number of the unit and pressing ? Will display the version and date of the firmware which is in the Laser Module.

5. A laser does not need to be connected to the computer to create program/parameter files. These can be created on the GUI even without the laser board.

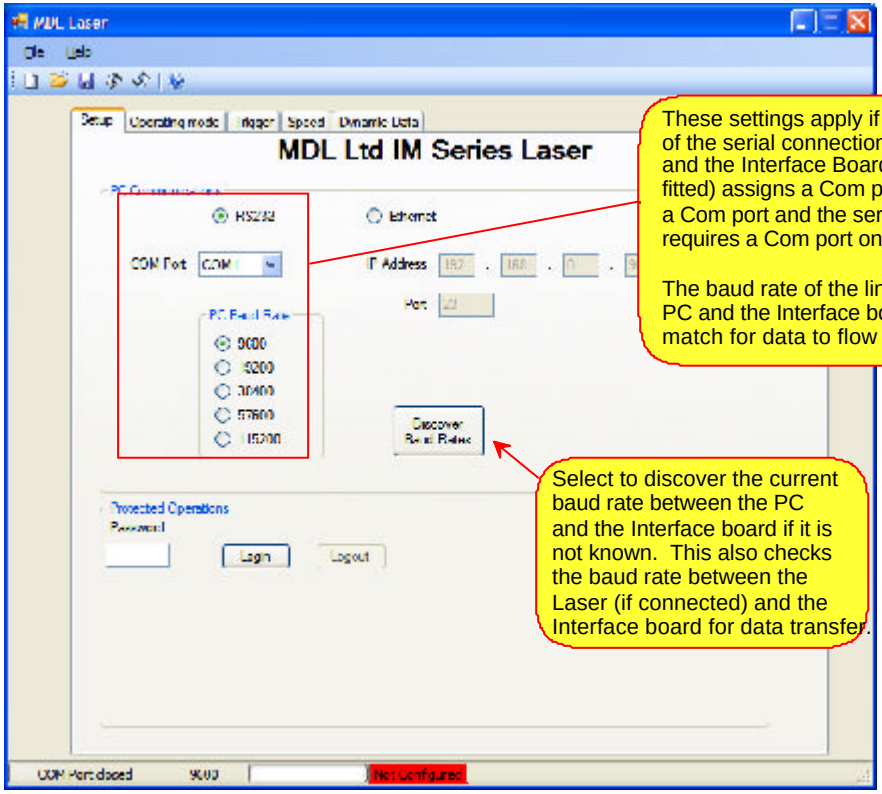
Tab Sections



Setup Tab 1 of 3



Setup Tab 2 of 3

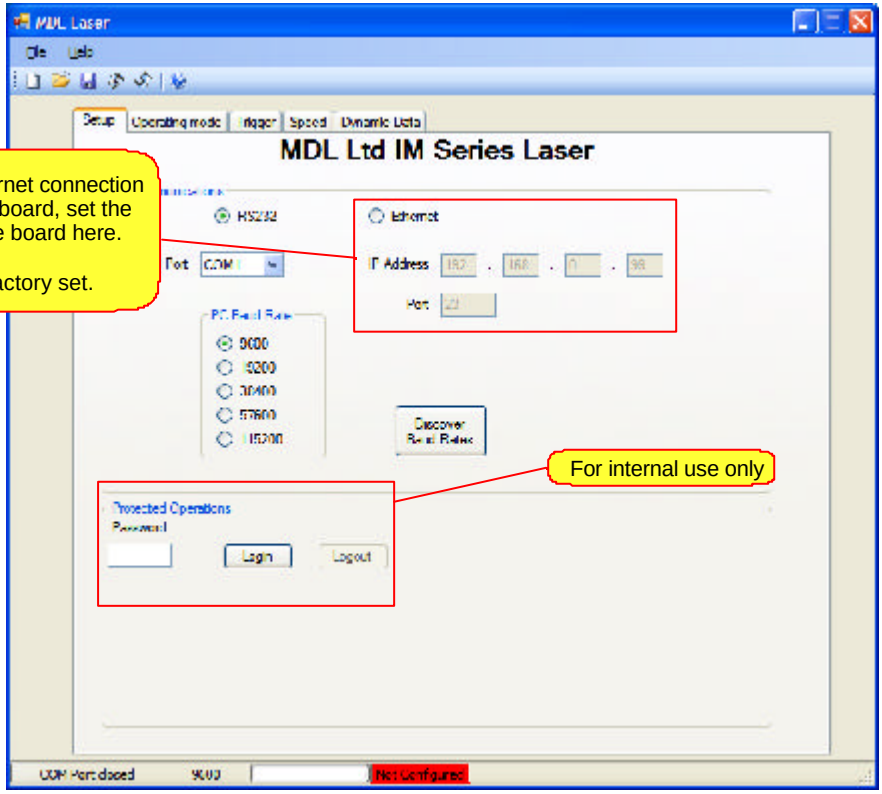


These settings apply if you are using any of the serial connections between the PC and the Interface Board. BlueTooth (when fitted) assigns a Com port, USB assigns a Com port and the serial connection requires a Com port on the computer.

The baud rate of the link between the PC and the Interface board needs to match for data to flow correctly.

Select to discover the current baud rate between the PC and the Interface board if it is not known. This also checks the baud rate between the Laser (if connected) and the Interface board for data transfer.

Setup Tab 3 of 3

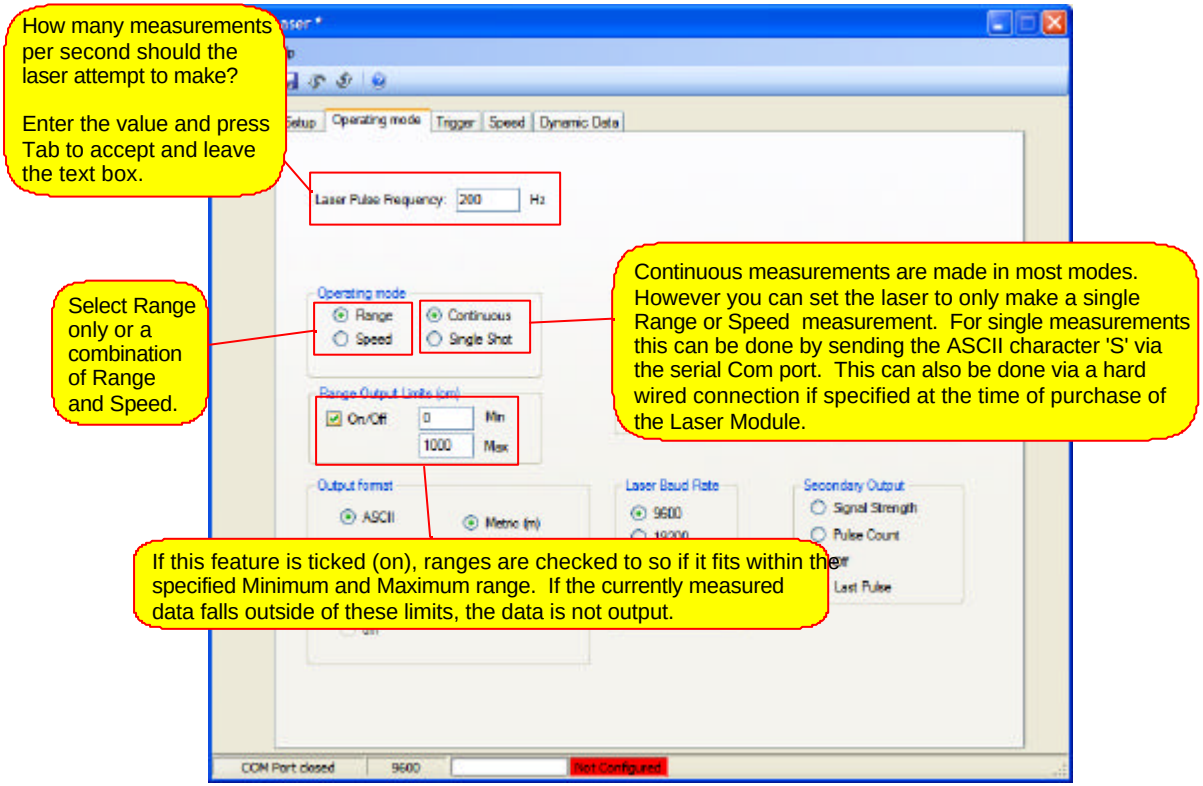


If using the Ethernet connection on the Interface board, set the IP address of the board here.

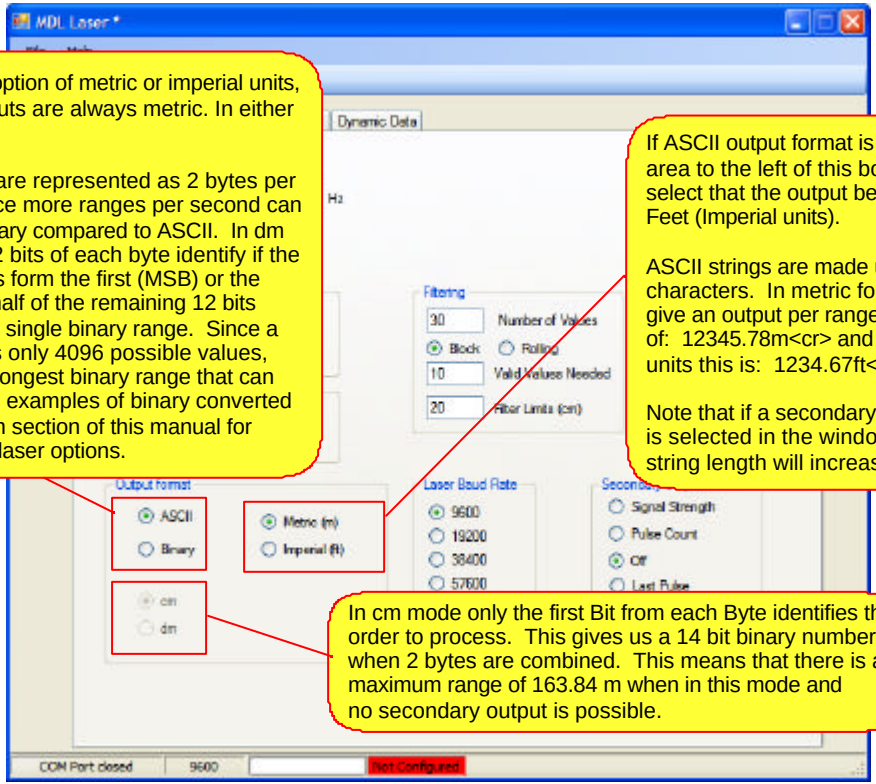
This is usually factory set.

For internal use only

Operating Mode Tab 1 of 5



Operating Mode Tab 2 of 5



ASCII has the option of metric or imperial units, but binary outputs are always metric. In either dm or cm units.

Binary ranges are represented as 2 bytes per range and hence more ranges per second can be output in binary compared to ASCII. In dm mode the first 2 bits of each byte identify if the remaining 6 bits form the first (MSB) or the second (LSB) half of the remaining 12 bits used to make a single binary range. Since a 12 bit word has only 4096 possible values, 409.5 m is the longest binary range that can be output. See examples of binary converted data in the main section of this manual for HR and T type laser options.

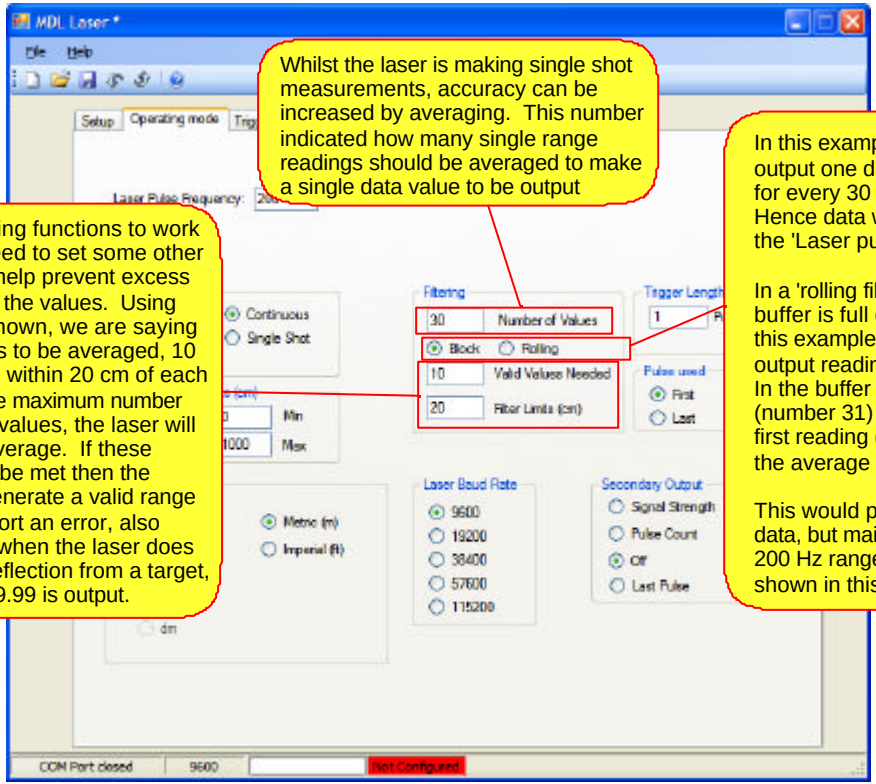
If ASCII output format is selected in the area to the left of this box, then you can select that the output be in metres or Feet (Imperial units).

ASCII strings are made up of 10 characters. In metric format this will give an output per range measurement of: 12345.78m<cr> and in imperial units this is: 1234.67ft<cr>

Note that if a secondary output option is selected in the window below, the string length will increase further.

In cm mode only the first Bit from each Byte identifies the order to process. This gives us a 14 bit binary number when 2 bytes are combined. This means that there is a maximum range of 163.84 m when in this mode and no secondary output is possible.

Operating Mode Tab 3 of 5



Whilst the laser is making single shot measurements, accuracy can be increased by averaging. This number indicated how many single range readings should be averaged to make a single data value to be output

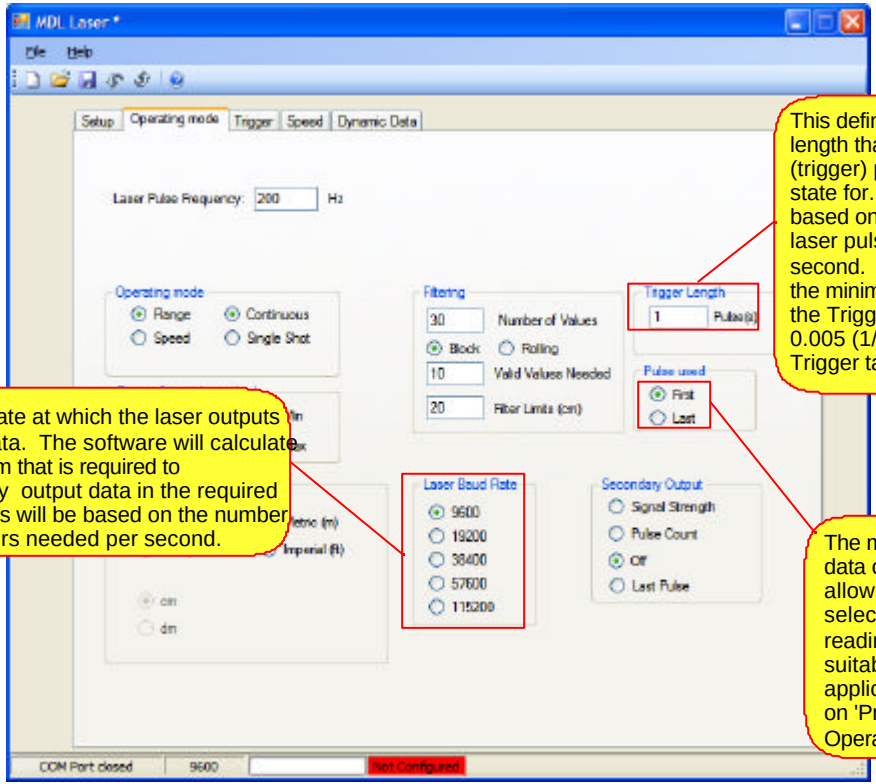
For the averaging functions to work correctly we need to set some other parameters to help prevent excess noise distorting the values. Using the numbers shown, we are saying of the 30 values to be averaged, 10 values must be within 20 cm of each other. Using the maximum number of 'acceptable' values, the laser will calculate the average. If these criteria can not be met then the laser will not generate a valid range but instead report an error, also used for times when the laser does not receive a reflection from a target, the value 99999.99 is output.

In this example, the laser would output one data value (range) for every 30 measurements. Hence data would be 1/30 th of the 'Laser pulse Frequency'

In a 'rolling filter', once the buffer is full of 30 values (in this example) an averaged output reading is produced. In the buffer the next reading (number 31) replaces the first reading (number 1) and the average is re-calculated.

This would provide averaged data, but maintain the full 200 Hz range readings shown in this example.

Operating Mode Tab 4 of 5



This defines the minimum length that the digital output (trigger) pulse can change state for. Its duration is based on the number of laser pulses being fired per second. So in this example the minimum duration for the Trigger pulse would be: 0.005 (1/200) seconds (see Trigger tab for more options).

The baud rate at which the laser outputs its serial data. The software will calculate the minimum that is required to successfully output data in the required format. This will be based on the number or characters needed per second.

The main measuring data on the laser. It allows the user to select which range reading is the most suitable for the current application (see section on 'Principles of Operation' in manual).

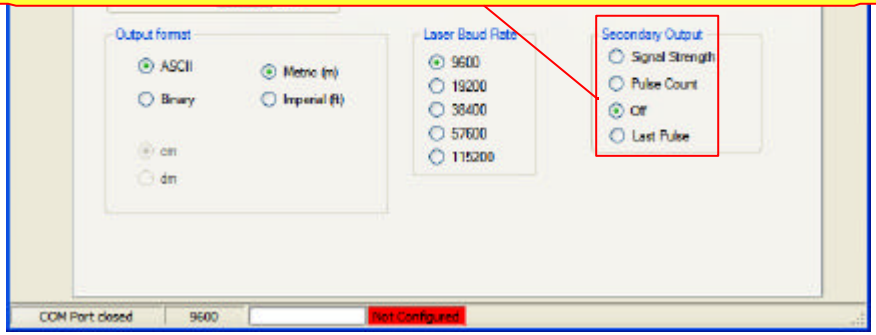
Operating Mode Tab 5 of 5

In addition to the primary range data, it is also possible to output additional data for each range measured.

- Signal Strength is an indication of the reflectivity of the target. Larger values represent stronger reflection signals.
- Pulse Count is a simple counter that increments with pulses emitted from the laser. This cycles round a 4096 maximum.
- Off, turns of any secondary output to leave just the primary measurement.
- Last Pulse data can also be output if the 'Pulse Used' section is set to First. If it is set to Last then this option will not be available.

In Binary mode these values are output by an additional 2 bytes of data. In ASCII mode the additional output is a more basic number which does not have decimal points or units shown. The primary units are followed by a comma and the additional characters prior to the <cr>. E.g:

12345.78m,12345<cr>

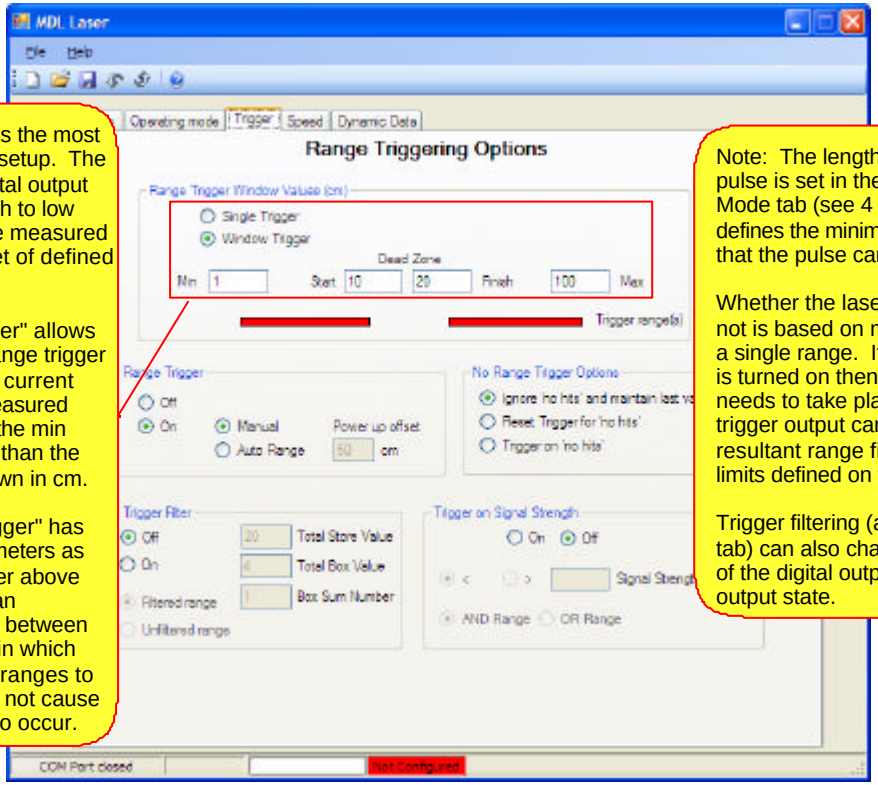


Trigger Tab 1 of 6

Range Trigger is the most popular trigger setup. The state of the digital output moves from high to low when the range measured falls within a set of defined values.

A "Single Trigger" allows the laser to change trigger state when the current range being measured is greater than the min range and less than the max range shown in cm.

A "Window Trigger" has the same parameters as the single trigger above but it also has an additional zone between the max and min which allows a set of ranges to be ignored and not cause a trigger state to occur.

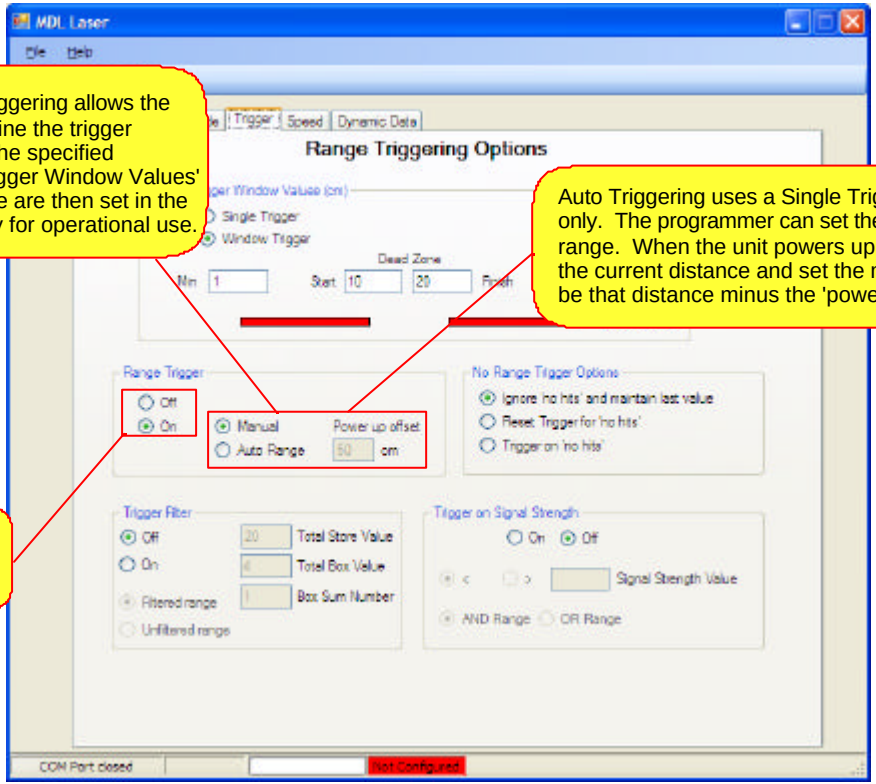


Note: The length of the trigger pulse is set in the Operating Mode tab (see 4 of 5) and this defines the minimum length that the pulse can be.

Whether the laser triggers or not is based on more than just a single range. If range filtering is turned on then the averaging needs to take place before the trigger output can decide if the resultant range fits within the limits defined on the left.

Trigger filtering (also on this tab) can also change the ability of the digital output to change output state.

Trigger Tab 2 of 6



Manual Triggering allows the user to define the trigger ranges in the specified 'Range Trigger Window Values' box. These are then set in the laser ready for operational use.

Auto Triggering uses a Single Trigger Window only. The programmer can set the minimum range. When the unit powers up it will measure the current distance and set the max range to be that distance minus the 'power up offset'.

Turn on/off the Trigger feature on the laser

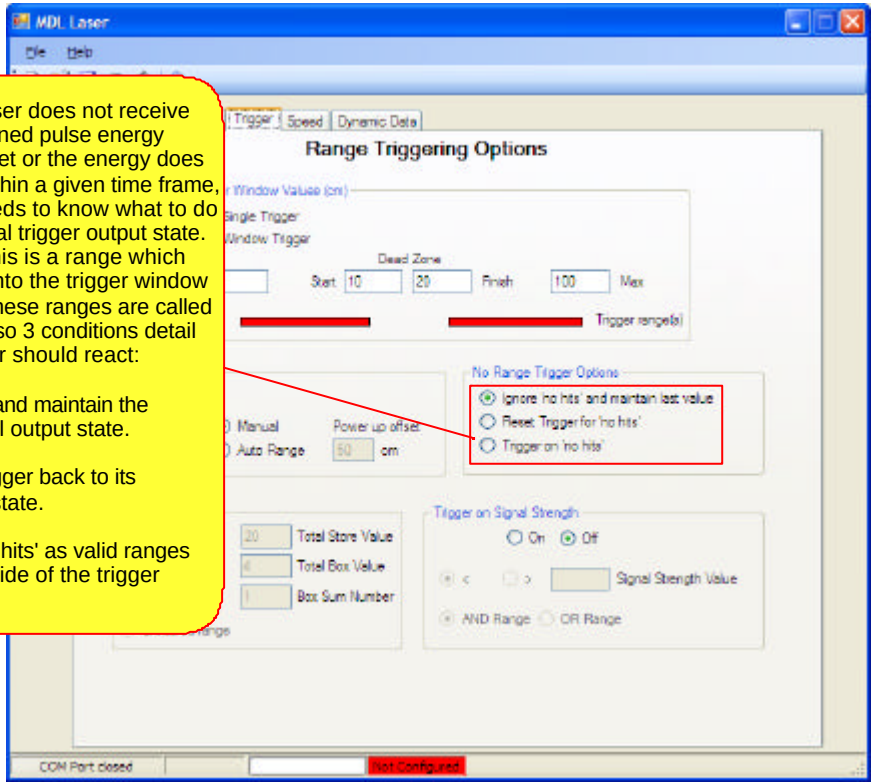
Trigger Tab 3 of 6

When the laser does not receive enough returned pulse energy from the target or the energy does not return within a given time frame, the laser needs to know what to do with the digital trigger output state. Effectively this is a range which does not fit into the trigger window definition. These ranges are called 'no hits' and so 3 conditions detail how the laser should react:

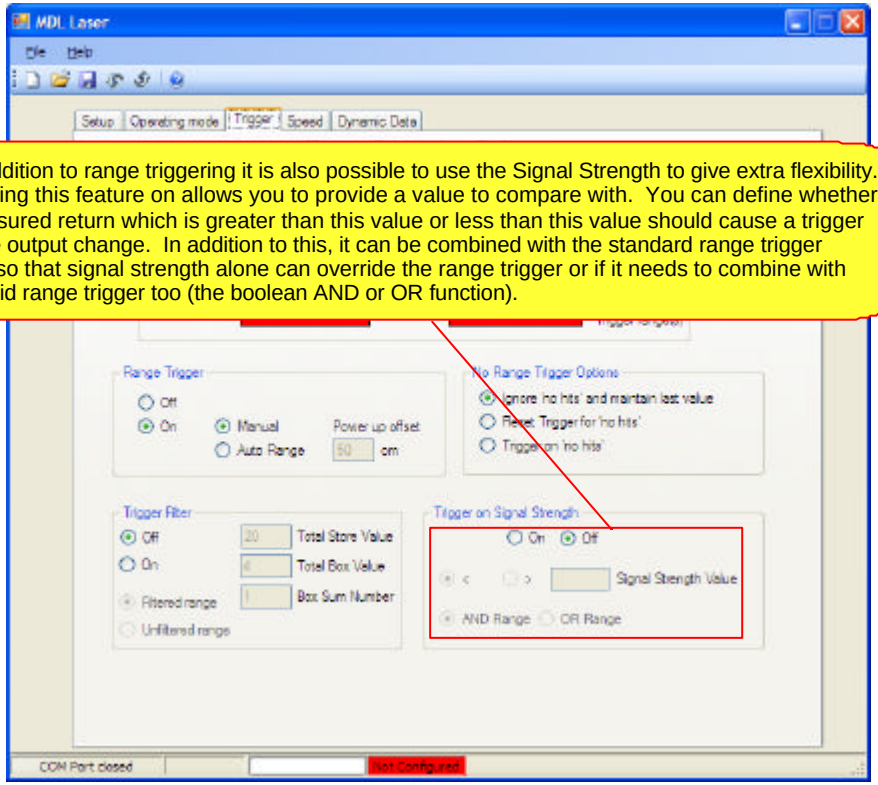
Ignore them and maintain the current digital output state.

Reset the trigger back to its untriggered state.

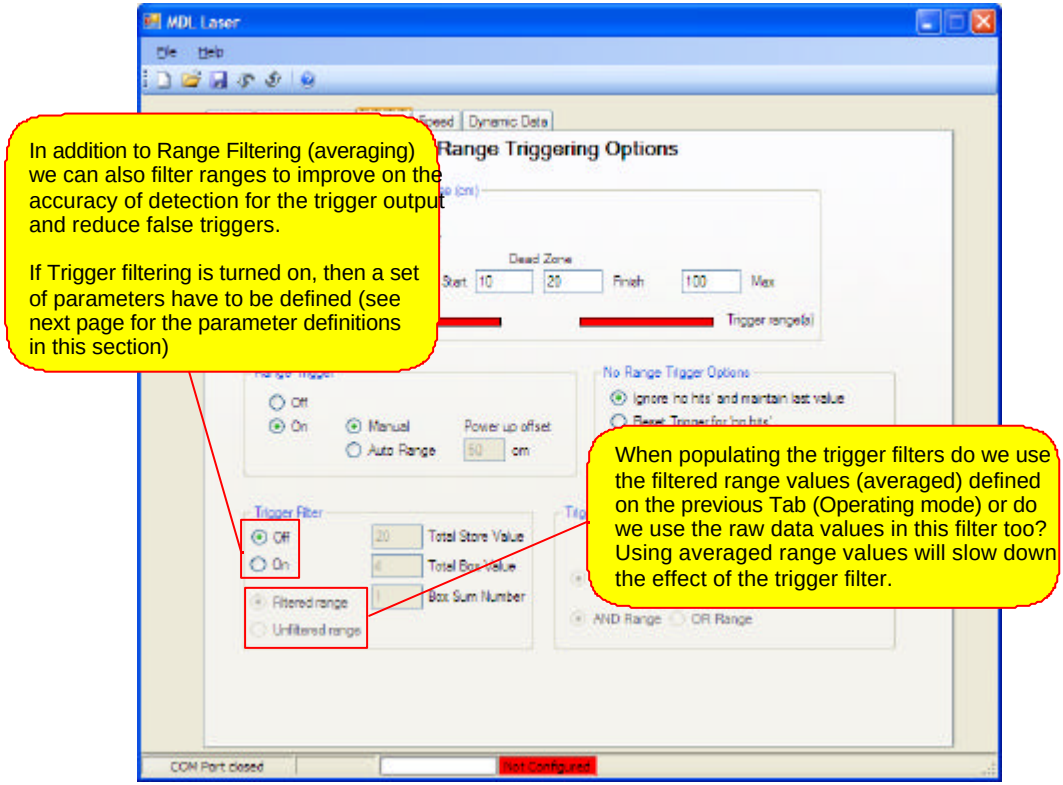
Treat the 'no hits' as valid ranges which fall inside of the trigger window.



Trigger Tab 4 of 6



Trigger Tab 5 of 6



Trigger Tab 6 of 6

With the Trigger Filter turned on, the laser is looking at the distance measurements which come back from the target and if the value is between RTmin and RTmax (Range Trigger single window values), it is rounded to the nearest 10 cm and divided by 10. In memory the laser creates a virtual box with all of the possible values that could be generated between the two RT values. Each virtual location is stamped with the distance measurement that it represents. As the laser makes distance measurements it starts a log of how many readings are in each box. So for example if the laser makes the following 6 measurements (cm): 156, 160, 167, 164, 152, 160

Then the converted values would become: 16, 16, 17, 16, 15, 16

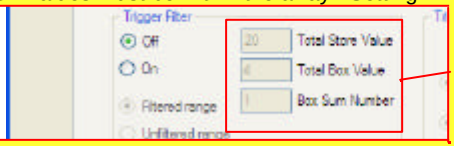
This would mean that for these 6 readings, the virtual box values would be:

..... 0, 0, 0, 1, 4, 1, 0, 0 .... Where the first 1 is in the 15's box and the 4 is the 16 box and the final 1 in the 17 box. We have to tell the laser how many values to store in the boxes, so in this case we have said that we want to store 6 values called the 'Total Store Value' which is shown as 20 on this screen shot. The value must be less than 32.

Using the above example, if the next measurement is 154, this would be converted to 15 and so the array would become:

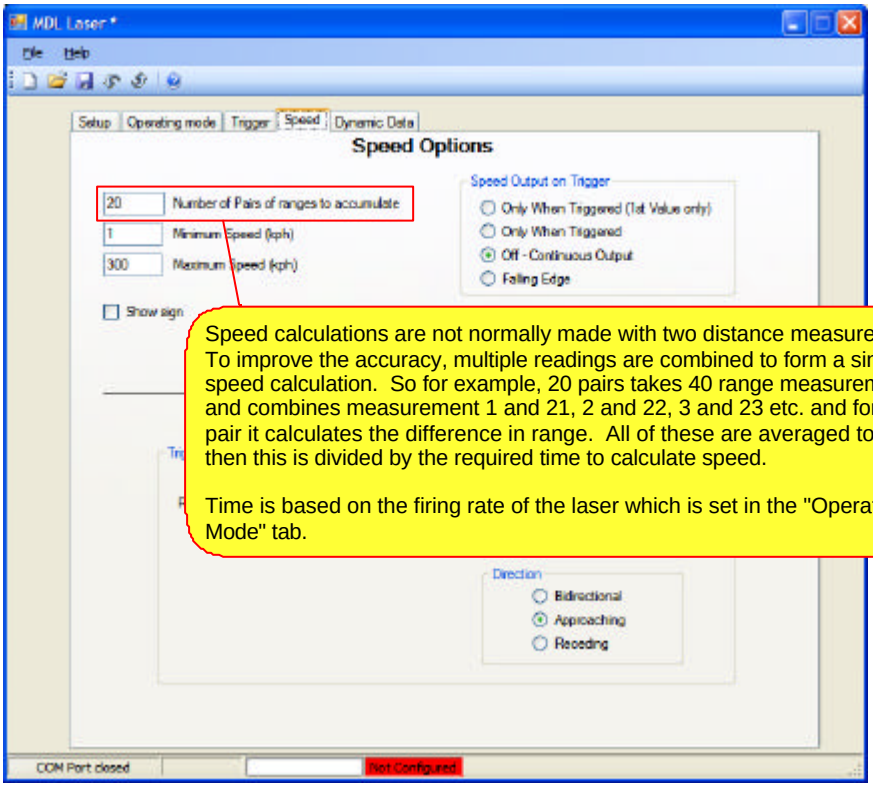
..... 0, 0, 0, 2, 3, 1, 0, 0 .... the first 16 would be lost from the list as it is the oldest and the new 15 would be added to the end. The boxes will only hold the last 6 values in memory.

For the laser output to trigger there must be at least "Total Box Value" in one box. This is a value which we define to indicate how many of the TSV values must be within the array. Setting "TBV" to 1, means that the laser will always be triggering as if the filter were turned off. If we set "TBV" to be 3 in the above example, then we will trigger when one of the boxes gets 3 or more in it. If we set TBV to 4, it will cause a trigger in the first string, but not when the reading is replaced in the second.



To increase the efficiency further we have "Box Sum Number" which tells the laser how many boxes can be added together (next to each other) to get the TBV value that we need. So for example if we set BSN value to 3, then the software would read the array (from above) ..... 0, 0, 0, 1, 4, 1, 0, 0 .... as 0, 1, 5, 6, 5, 1 etc. This is just adding the 3 boxes which are next to each other. This is effectively the same as re-defining boxes to be 30 cm wide rather than 10 cm without giving specific boundaries.

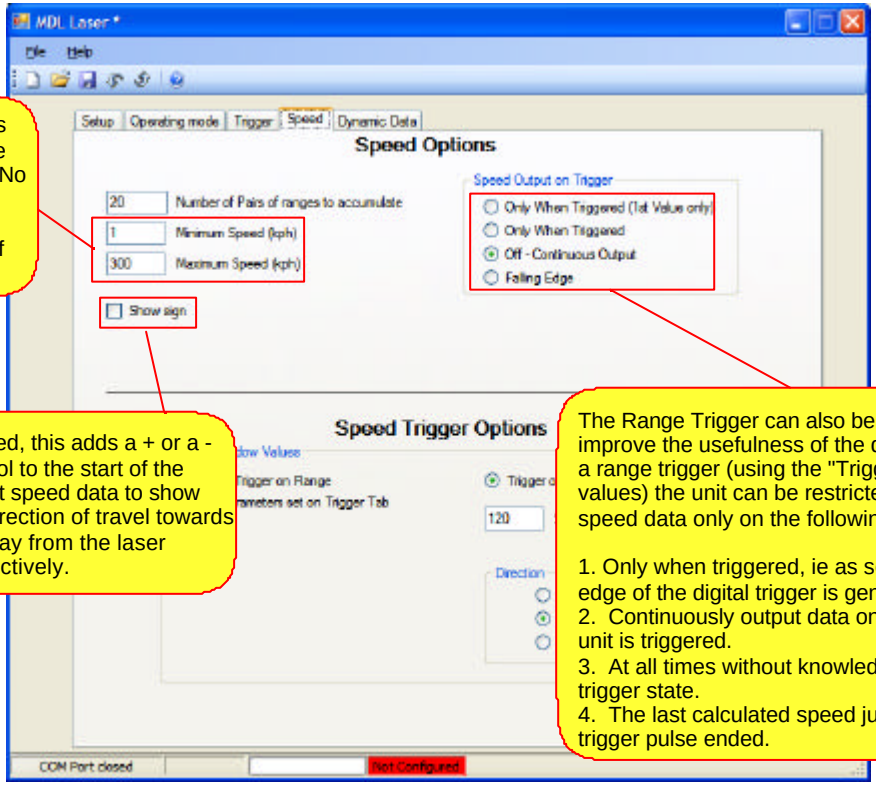
Speed Tab 1 of 3



Speed calculations are not normally made with two distance measurements. To improve the accuracy, multiple readings are combined to form a single speed calculation. So for example, 20 pairs takes 40 range measurements and combines measurement 1 and 21, 2 and 22, 3 and 23 etc. and for each pair it calculates the difference in range. All of these are averaged together then this is divided by the required time to calculate speed.

Time is based on the firing rate of the laser which is set in the "Operating Mode" tab.

Speed Tab 2 of 3



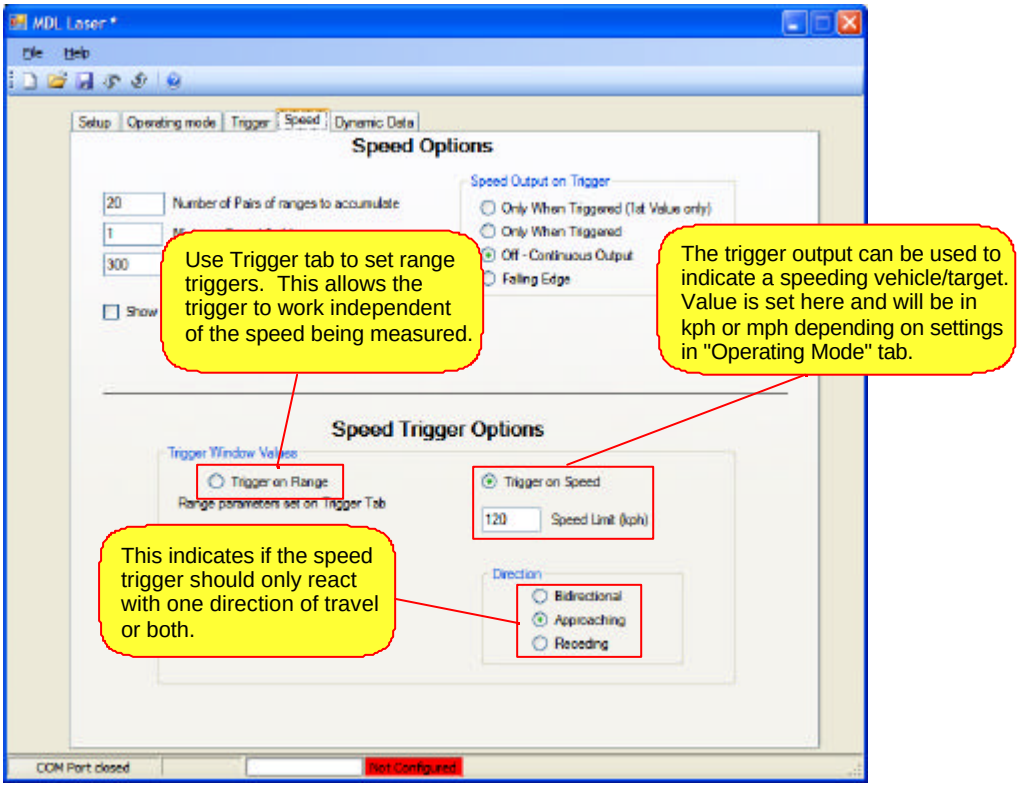
These are the limits that will restrict the output of the unit. No data will be output if the calculated speed is outside of these limits.

If ticked, this adds a + or a - symbol to the start of the output speed data to show the direction of travel towards or away from the laser respectively.

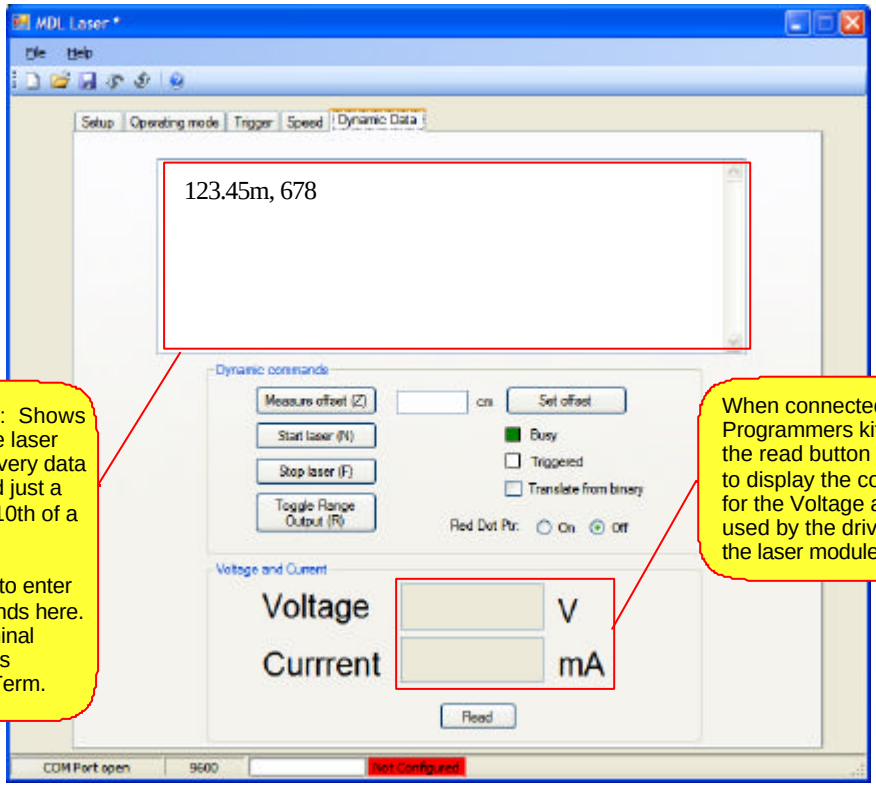
The Range Trigger can also be used to help improve the usefulness of the data. By setting a range trigger (using the "Trigger" tab to set values) the unit can be restricted to output speed data only on the following 4 conditions.

1. Only when triggered, ie as soon as the rising edge of the digital trigger is generated.
2. Continuously output data only when the unit is triggered.
3. At all times without knowledge of the trigger state.
4. The last calculated speed just before the trigger pulse ended.

Speed Tab 3 of 3



Dynamic Data Tab 1 of 4

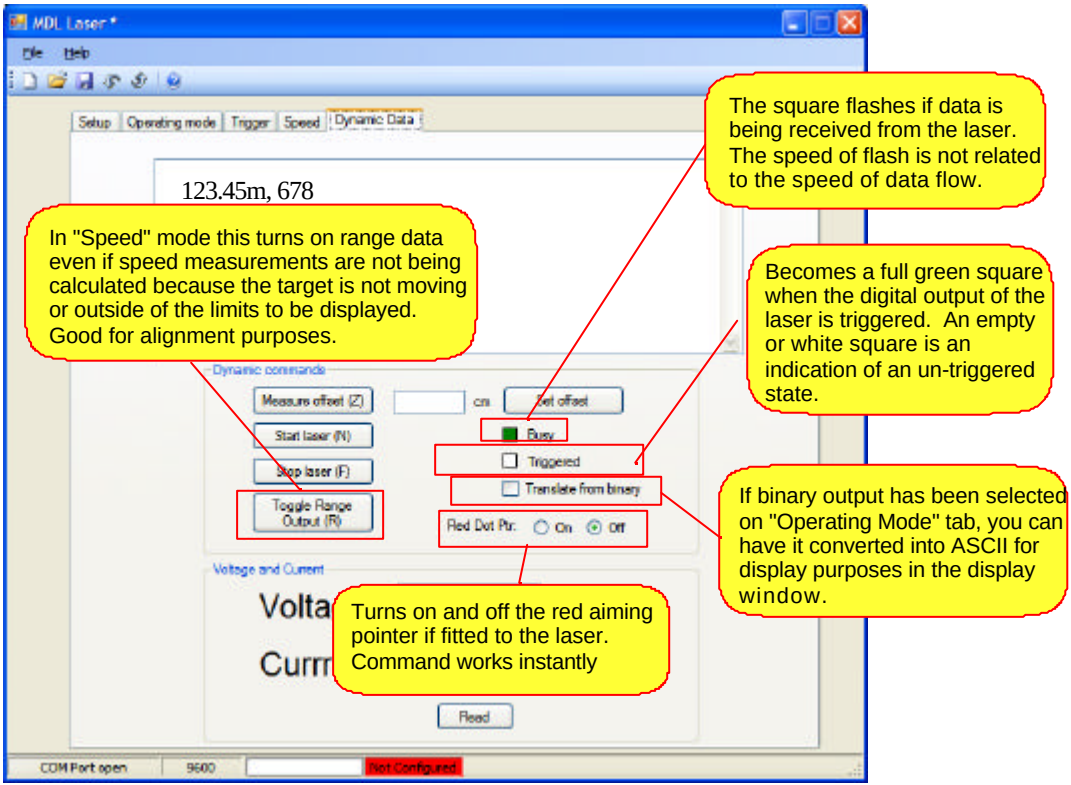


Display WIndow: Shows live data from the laser unit. Note, not every data point is displayed just a sample every 1/10th of a second.

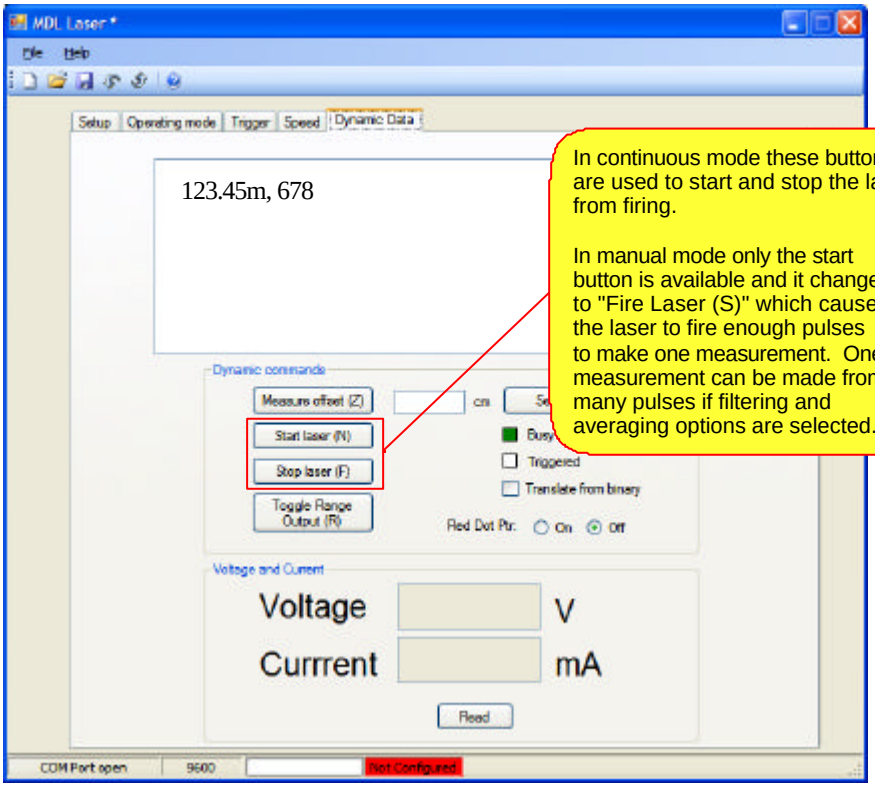
It is not possible to enter dynamic commands here. This is not a terminal emulation such as Windows HyperTerm.

When connected to the Programmers kit interface board, the read button allows the user to display the correct settings for the Voltage and Current used by the driver board and the laser module at that moment.

Dynamic Data Tab 2 of 4



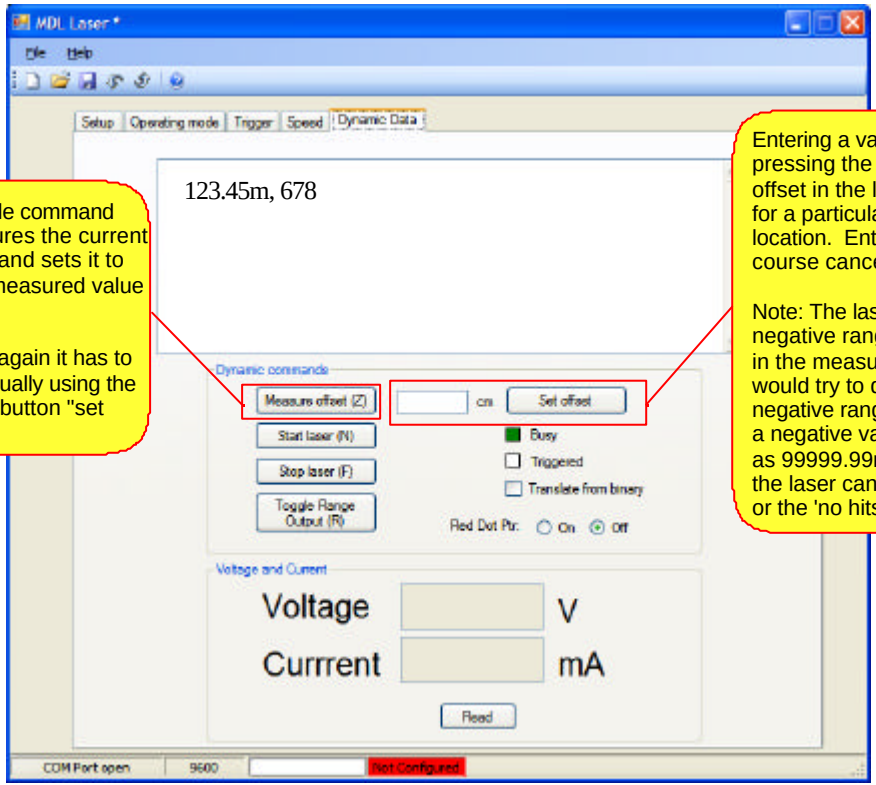
Dynamic Data Tab 3 of 4



In continuous mode these buttons are used to start and stop the laser from firing.

In manual mode only the start button is available and it changes to "Fire Laser (S)" which causes the laser to fire enough pulses to make one measurement. One measurement can be made from many pulses if filtering and averaging options are selected.

Dynamic Data Tab 4 of 4



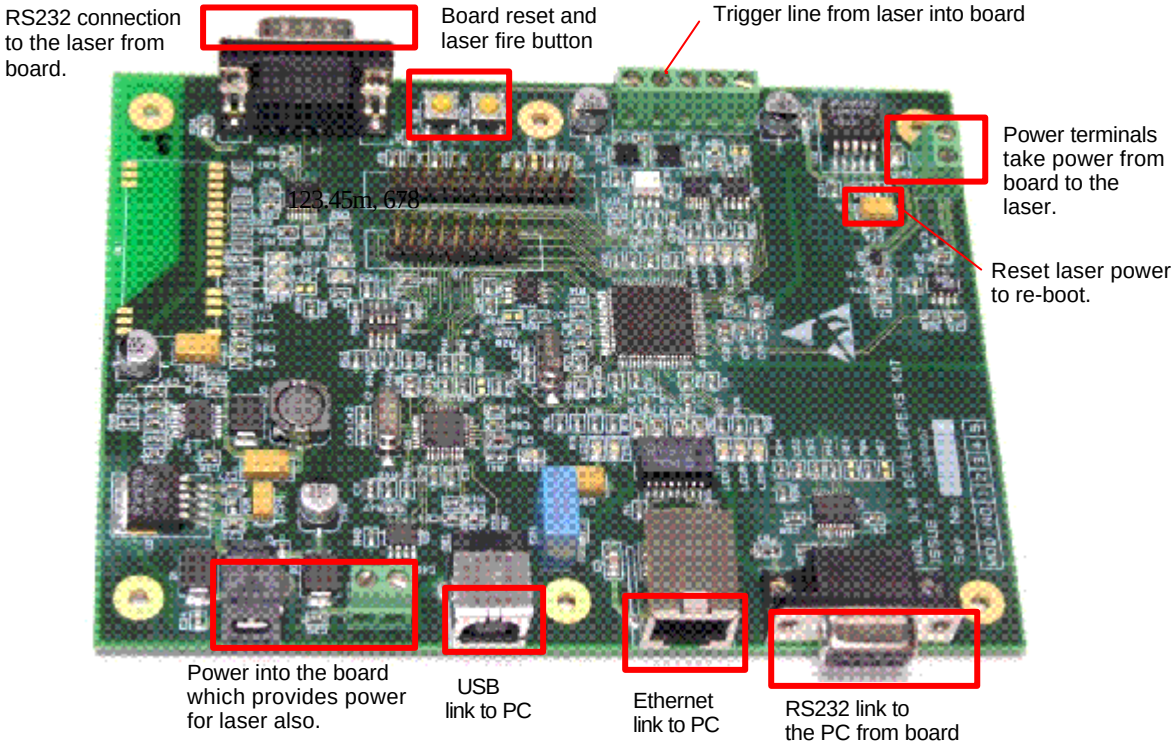
This is a single command which measures the current range offset and sets it to this current measured value in the laser.

To clear this again it has to be done manually using the text box and button "set offset".

Entering a value in here and pressing the button will set an offset in the laser to compensate for a particular mounting location. Entering '0' will of course cancel the offset value.

Note: The laser does not display negative ranges, so any noise in the measured range which would try to display a small negative range value. Instead a negative value is displayed as 99999.99m as it does when the laser can not detect a range or the 'no hits' value.

Connections to the board



Dynamic commands and their meanings: