

## LAMBDA-TEST.EXE

This program was written using Microsoft ‘.NET’ frame work so it should run reliably on any Windows platform using .NET Framework 3.5 or greater.

If you do not have .NET Framework 3.5 installed on your machine you can download it here.

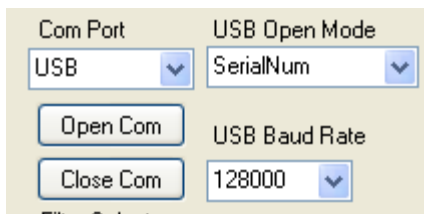
<http://www.microsoft.com/en-us/download/details.aspx?id=21>.

## Communications

The first step when running Lambda-Test.exe is to establish communication with the Lambda series controller. There are two standard options for communications, USB or serial (RS-232) port. All Lambda-series products operate with a default USB data rate of 128k bps (Bits per Second or “baud”), and a default serial port data rate of 9600 bps. The USB data rate applies to both the primary direct USB device driver implementation, as well as the secondary virtual com port (VCP) device driver. If you wish to run either the USB port or the virtual-com-port at an alternate data rate (such as 9600 bps) then it is necessary to match the selected data rate on the Lambda-series controller as well.

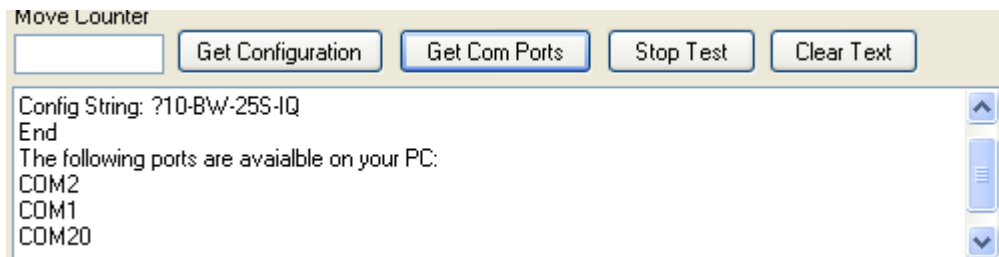
## Changing the Data Rate in the Lambda Series Controller for USB/VCP Communications

1. Lambda 10-3: To change the data rate on the Lambda 10-3, first go to local mode (press <LOCAL>) and then press the <MODE> key twice. This will bring up a special menu where the USB data rate may be selected from a list.
2. Lambda 10-B / Lambda XL: : To change the data rate on the Lambda 10-B (LB10-B/IQ), first go to local mode (press <LOCAL>), press <F1> then <F2> to bring up this list.
3. Lambda SC: This option is not available on the Lambda-SC. There is, however, a firmware solution available for production serial numbers LBSC-2150 and above. This new firmware implements an auto baud detection scheme. Auto baud detection is only valid for 9600 and 128k baud. If you are communicating via 9600 baud it will be necessary to send the open com command (128 (decimal) or EE (hexadecimal)) twice to establish communications.



Once the appropriate device driver is installed on your computer, communications via the USB port can be opened by pressing the ‘Open Com’ button in the Lambda-Test program. This should open the USB port at the specified data rate. To open communications via the serial port, specify the port and press the ‘Open Com’ button. If you are unsure of which port is associated with the device, press the ‘Get Ports’ button which will return a list of available COM ports. Your device should be associated with

COM1, COM2, COM3, or even COM20. To select COM20 enter "COM20" into the 'Com Port' combo box. Remember that the USB data rate in the filter wheel controller must match the USB data rate in the 'USB baud rate' combo box. If the baud rates do not match, you will not be able to establish communications. Once communication has been established, the dialog box below will read "USB: Is Open" followed by the configuration string from the device. In the example below, that would be a "10-B" for the controller, the wheel "W" is a "25" mm filter wheel, and the shutter "S" is a SmartShutter ("IQ").



The above dialog box is very useful for tracking the progress of various commands as they are issued. These commands have been translated into a more user-friendly format. If you wish to see the actual communications, the Com String dialog box is useful.

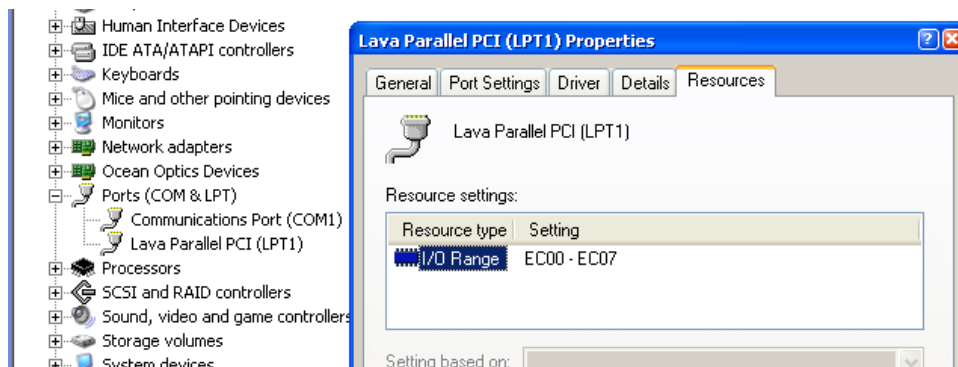
**\*\*Neither the Lambda 10-2 or the Lambda DG-4 / DG-5 (including DG-4Plus & DG-5Plus) support the 'Get Status' command, nor do they echo a response after the 'Go Online' command. As a consequence, if the program fails to get a response it will default to the presence of the LB10-2. If you see the dialog box indicating that the device is a LB10-2, when you know the device is actually a LB10-3 or LB10-B, then open the COM port again to establish communications. If you still get the response 'LB10-2' then serial communications has not been established.**

## Parallel Port Communications

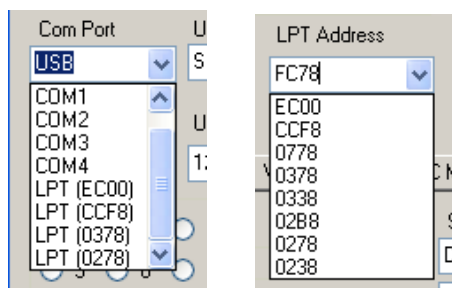
The parallel port is primarily useful for the Lambda 10-2 and DG-4/5 series. The parallel port is available for optional use in later versions of the Lambda 10-3. Support for the parallel port exists in the Lambda-Test program primarily for diagnosing parallel port issues. To use the Lambda-Test program with the parallel port, the device driver 'INPOUT32' must first be installed. To install this driver, copy the file 'inpout32.dll' into the Win32 System directory. This file can be found in the 'Release' folder. Simply copy and paste it to Win32 System directory so that Windows can find it. Information on how to use inpout can be found at the following web address:

<http://www.codeproject.com/Articles/15020/Reading-from-Parallel-Port-using-Inpout32-dll>

Once the driver is installed accessing the parallel port is achieved by its address, not its name. The port labeled LPT-1 for instance could be addressed 0238 to E000. To find the address of your parallel port you will have to go to the device manager and look at the resource tab on the device driver. The address for the device listed below is EC00.



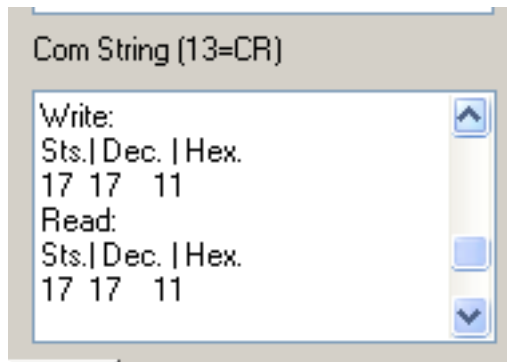
Once we have established the address of the device installed on the computer we will use that information to open communications. The communications drop down has common addresses. If the address is listed there just select it and press the open com button. If it is not available there is another drop down which has more values available. This other drop down will also accept user defined hexadecimal addresses.



If you have established communications the LB10-3 and DG-4 will reregister 'PARALLEL' on the front panel. In the case of the LB10-2 you will have to either open the shutter or move the filter wheel to verify communications.

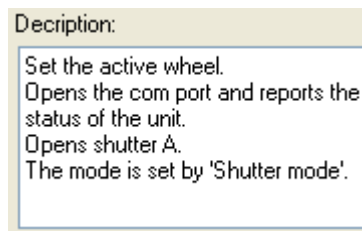
## Tracking Your Communications

All data being transmitted to, and received from, the connected Lambda-series device is logged and displayed in the scroll panel shown below.



Lines beginning with “W” indicate data that was written out or transmitted to the device. All return data (received from the connected device) are on lines that begin with an “R”. All commands are echoed back. In the above example the ‘Open Shutter A in Fast Mode’ routine was called. This routine consisted of the following commands:

220 =Set Fast Mode <CR>1= Shutter 1 (A) <CR> 170= Open Shutter <CR>. This tracking panel can be very useful as to what is being transmitted and what is being received, diagnosing problems, and even for developing your own command routines to control the Lambda-series device...



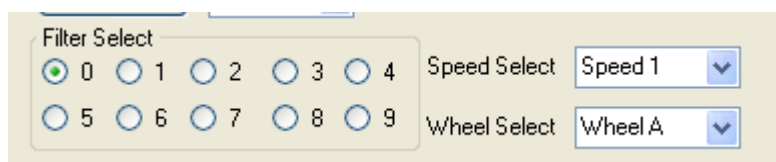
Another useful dialog box is the “Description” dialog box. Many of the text boxes and buttons will display their function when the cursor “hovers” over them. This can be very useful for a quick reference to the various functions.

## Front Panel

Once communications have been established you can send commands to the connected Lambda-series controller. The device connected to the controller will be one or more peripherals, such filter wheel(s), shutter(s), and etc. Each type of peripheral has control regions on the Front Panel, these controls are designed specifically for that type of peripheral.

### Filter Wheel Control

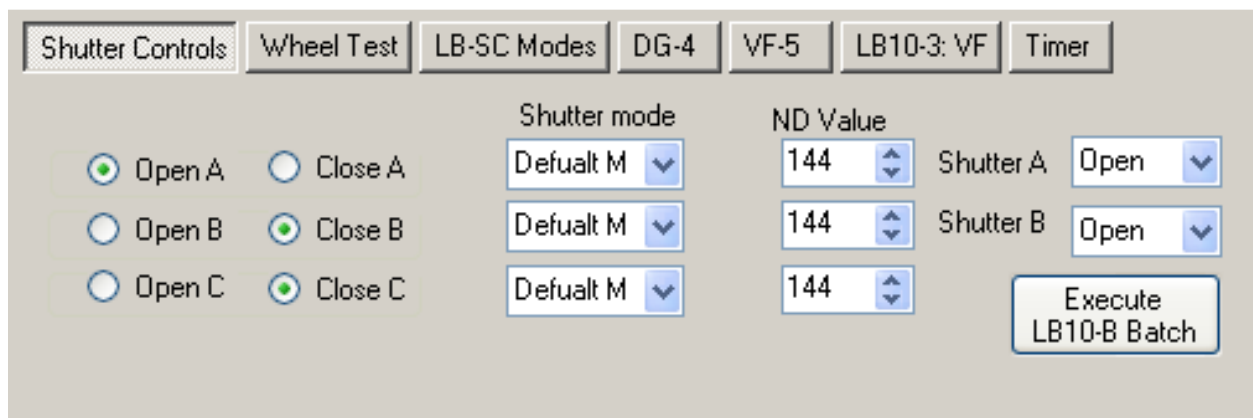
The most straight forward way to test the movement of a filter wheel is to simply click one of the “Filter Select” radio buttons.



The home position of the Lambda filter wheel is Filter 0. So by default this radio button is selected. The filter wheel will not move unless you select another filter position. The combo boxes above will dictate the speed of the filter move as well as the selected wheel (A, B, or C).

## Shutter Controls Tab

To open one of the shutters simply click on the appropriate open / close radio buttons. The Shutter Mode applies to SmartShutter's only. The mode can be Fast, Soft, or Neutral Density, with fast being the default. Neutral Density Mode has a neutral density setting that ranges from 0 to 144 micro-steps. It should be noted that when the SmartShutter is installed in the light source, there is approximately 20 micro-steps on either end of travel so you can expect values of 20 through 120 to produce results with the greatest change in light output.



The screenshot shows the 'Shutter Controls' tab of a software interface. At the top, there are seven tabs: 'Shutter Controls' (selected), 'Wheel Test', 'LB-SC Modes', 'DG-4', 'VF-5', 'LB10-3: VF', and 'Timer'. Below the tabs, the interface is organized into several sections. On the left, there are three rows of radio buttons for controlling shutters A, B, and C. Each row has an 'Open' button (with a green dot) and a 'Close' button (with a blue dot). In the center, there is a 'Shutter mode' section with three dropdown menus, all currently set to 'Default M'. To the right of the mode dropdowns is an 'ND Value' section with three numeric input fields, each set to '144' and featuring up/down arrow buttons. Further right, there are two 'Shutter' sections, one for 'Shutter A' and one for 'Shutter B', each with a dropdown menu set to 'Open'. At the bottom right, there is a large button labeled 'Execute LB10-B Batch'.

You will also notice a special "Test Button" to the right. This button is useful for testing the stability of the shutter running a certain number of cycles per second (Hertz).

## Wheel Test Tab

The next tab, "Wheel Test", has many useful test routines related to filter wheel testing. The first of the tests is "Test Wheel", which is the production test. This test will run through the speeds defined by "Top Speed" and "Last Speed". The default top speed of the filter wheel is Speed 1. Speed 0 should not be used without a lightened wheel, such as the 4 position wheel or a wheel loaded with Semrock's thin filters. There are two factors to produce error-free filter moves:

1. The speed of the filter wheel
2. The delay between the filter moves

There are constructive and destructive harmonics in the movement of the filter wheel. These harmonics are dependent upon the load of the filter wheel which **changes with the number of filters installed**. This delay may be increased by a "Delay Multiplier" for the speeds marked in the check box, for instance in the example below the delay at speed 1 would be 120msec. At Speed 2, the delay multiplier would kick in and the new delay would be 120msec X 5= 600msec. This can be useful for determining a good speed to move your filter wheel.

Shutter Controls | Wheel Test | LB-SC Modes | DG-4 | VF-5

Increase delay on speeds- Delay multiplier. Steps Pos 1 Pos 2

☐ 0 ☐ 1 ☒ 2 ☒ 3 5 1000 0 1

☒ 4 ☐ 5 ☐ 6 ☐ 7 Delay time in mili-sec Test Mode

120 Wheel A HS 4 Test

Top Speed Last Speed

Speed 1 Speed 7 Test Wheel 2 Filter test Evaluate Wheel

The production test employs a random position algorithm. If you are primarily interested in 2-filter moves, such as between position 1 and 2, then the “2 Filter Test” is recommended. The “HS 4 Test” is a special version of the 2-position test that names two specific filters on which to perform this test. There is also the “Evaluate Wheel” test that performs a random position test at increasing delays and at increasing speeds. The random test can be useful in determining what speeds will work for you. The “Test Mode” combo box allows you to choose the wheel on which to run the tests. When testing in “Batch Mode” (Lambda 10-2 and 10-3 only), follow-up testing is automatically performed if a wheel movement error occurs so that the wheel causing the error can be determined.

## LB-SC Modes Tab

The LB-SC Modes tab contains controls for testing the special features that are unique to the Lambda SC.

Shutter Controls | Wheel Test | LB-SC Modes | DG-4 | VF-5 | LB10-3: VF | Timer

Trigger Mode Delay / Exposure time

TTL High Min. Sec's Free Run On:

Sync Out Options 0 0 Command

High on Open Milli-Sec's 100 us Run Cycles

0 0 1 Set Auto Run Reset Config.

Set TTL Modes Set Exposure Set Delay Stop Auto Run Reset Defaults

Get Home Power Down Power Up

**Trigger Mode (TTL IN):** The trigger mode corresponds to the TTL IN signal. The default setting is “TTL High”, which causes the shutter to open once the signal on TTL IN is high. The Trigger Mode can also be set to “TTL Low” (open shutter when TTL signal is low (grounded)). In addition to TTL High and TTL Low, high and low transitions are also supported. By opening on a transition, the TTL can cause the shutter to open and close in toggle mode. For instance, if you change the shutter state only on a high transition, the shutter will open on the low-to-high transition and close on the next transition.

**Sync out Options (TTL OUT):** The options for the sync out pulse are high on shutter open, low on shutter open, or disabled.

For both Trigger Mode and Synch out options, press the “Set TTL Modes” button to save the changes to the controller as the power-on defaults.

**Free Run Mode:** The second set of important features to be found on this tab involves the “Free Run Mode”. In the “Free Run Mode” there are three parameters that can be set, exposure, delay, and repeat cycles. If you want to set the shutter to open for 20ms after a delay of 60ms, you would first enter 20ms into the timer counters and then press “Set Exposure”. Next, you would enter 60ms into the timer counters and then press “Set Delay”. When either the Set Delay or Set Exposure button is pressed, the Free Run Mode, the number of Run Cycles is set to 1 (single cycle). Repeated cycles can be set by increasing the number of Run Cycles. Note that any number of cycles above 65,000 places the Free Run mode into continuous mode (infinite cycles).

**NOTE:** Once the Lambda SC is set in Free Run mode, it will not respond to any commands until either the “Stop Run” button or the “Reset LB-SC Defaults” is pressed (or the equivalent commands are sent from another application). Stopping the auto run without subsequently pressing “Set Auto Run” causes the controller to revert back to the original auto run mode when it is powered on the next time.

**Re-aligning a Shutter:** The button, “Get Home”, is a tool that is required to re-align the SmartShutter. There are subtleties to correctly setting up the shutter, so if you need to perform this procedure, call Sutter and speak to a Technician.

## DG-4 Tab

The functions specific to the DG-4/5 and DG-4/5 Plus can be found on the DG-4 tab panel. In a DG-series system, the shutter is closed upon power up. Since the shuttering is controlled by the internal mirrors, a movement to any position opens the shutter.

The screenshot displays the DG-4 tab interface with several control panels:

- Filter Select:** A grid of 15 radio buttons arranged in three rows and five columns, labeled 1 through 15. A checkbox labeled "Triggered move?" is located below the grid.
- Turbo Blanking:** Two radio buttons labeled "On" and "Off", with "Off" selected.
- Shutter:** Two radio buttons labeled "Open" and "Close", with "Close" selected.
- TTL Control:** Two radio buttons labeled "Off" and "Strobe", with "Off" selected.
- Ring buffer:** A section containing a "Filter #" spinner set to 0, a "Sequence#" spinner set to 0, and buttons for "Add", "Load Buffer", "Save File", "Get File", "Clear Buffer", "Ring Buffer Enable", and "Ring Buffer Disable".
- Enter File #:** A text input field containing the word "value" and a "Get File" button.

The first set of controls on the left moves the DG series system to the programmed filter position. The factory defaults for the DG-series are: Filter values 1-4 are filters 1-4 at 100% intensity, values 5-8 are positions 1-4 at 50% intensity, and lastly values 9-12 are filters 1-4 at 33% intensity. The values programmed into the DG-5 follow a similar pattern where values 1-5 are at 100% intensity, 6-10 are at 50%, and 11-15 are at 33% intensity. By default these moves are performed once a radio button is selected.

By default, the turbo blanking mode is off. What this means is that both internal switching mirrors will switch simultaneously for the fastest switching time. This may produce a brief pulse of unfiltered light. To avoid this occurrence turbo blanking can be switched on, and one mirror will shutter the other during movement producing a 'clean' filter switch.

**Ring Buffer:** To achieve the absolute fastest filter switching, the filter values are preloaded into a buffer. This buffer sequence can then be triggered using the strobe input. Each strobe pulse will increment through the ring buffer sequentially. The ring buffer can be programmed into the DG-series using this utility. In addition, the ring buffer sequence can be saved or retrieved from a file. Lastly, the ring buffer can be enabled, disabled, and cleared from this tab panel.

## VF-5 Tab

The last tab, "VF-5", is for the new Lambda VF-5 tunable filter wheel. The VF-5 employs 5 Versachrome filters with an average bandpass of 15nm and has the ability to tune over a range of 60nm to 100nm (filter dependant). The Versachrome filters are tunable by changing the tilt of the filters from 0° to 60°. The initial or base value of the filter is at 0°.

The screenshot displays the VF-5 control interface with the following elements:

- Tab Navigation:** Shutter Controls, Wheel Test, LB-SC Modes, DG-4, **VF-5**, LB10-3: VF, Timer.
- Filter Settings:** A table for 5 filters with columns for Base nM, Range nM, Speed, and Wavelength.
 

	Base nM:	Range nM:	Speed	Wavelength
Filter 1	<input type="text"/>	<input type="text"/>	3 <input type="button" value="▲"/> <input type="button" value="▼"/>	614 <input type="button" value="▲"/> <input type="button" value="▼"/>
Filter 2	<input type="text"/>	<input type="text"/>		
Filter 3	<input type="text"/>	<input type="text"/>		
Filter 4	<input type="text"/>	<input type="text"/>		
Filter 5	<input type="text"/>	<input type="text"/>		
- Speed and Position:** Pos: 0   Step#: 0  . Includes a "Move NM" button.
- Sweep Range:** Radio buttons for 380, 440, 490, 550, 620, 700, 800.
- Buttons:** "Get Wavelength", "Move Pos.", "Sweep", "Step 5", "Step All", "User defined", "Current WL" (display), "Get WL", "Home Pos", "Get Home".

## Filter

To determine which filters are in place, it is first necessary to store the value into the VF-5. In most cases, the VF-5 will come preprogrammed with the correct values at the factory. To get the setup using this utility, press the Get Wavelength button. This will populate the filter fields with the base value of the filter. The range is calculated based upon the specifications of the filter. The VF-5 will resolve these discrepancies internally and move to the optimal filter and angle for the wavelength.

To move to the desired wavelength, enter the wavelength (in nanometers) and the Tilt Speed and press the "Move NM" button. You can also opt to move to a specific position and angle using the "Move Pos." button. The Lambda VF-5 has a look-up table stored internally that indicates the expected wavelength based upon the filter base value and angular tilt. Lastly, there are some built-in routines that sweep



through a filter in single wavelength increments, or you may opt to step through all 5 filters one wavelength at a time.