

## COM Commands – OptoTIRF

### *The Basics*

Inside the OptoTIRF there is an Arduino microcontroller that communicates through a USB virtual COM port. You must install the Arduino drivers prior to communication. The quickest method is to follow the advice from the Arduino website and install the Arduino environment: <http://arduino.cc/en/Guide/Windows>.

The program communicates at a baud rate of 57600. All the commands follow a general format of; **COMMAND**, space character, **ARGUMENT**, space character, and one or two **NUMBER(s)** separated by a comma character.  
E.g;

**SET XY 500,500**

Depending on the command it may not have an argument or number. If a command is not recognised by the program it will flush it's serial buffer and respond with an error message.

E.g;

**ERROR!: Command not recognised**

After a successful command the unit will reply with a relevant phrase, it's position, or repeat the command.

E.g;

**Set XY 500,500**

If the program fails to respond, or to perform the requested action, some common causes for this are; an incorrect baud rate or faulty connection, or not using the correct COM port assigned to your Arduino. If all else fails, turn off the unit and remove the USB cable. Wait 10 seconds and then re-insert the USB cable and turn the system back on. After it has finished calibrating you should be able to resume control via COM commands.

### *Getting Started*

On start up, each motor will re-calibrate. This may take up to 20 seconds. The unit should then return to it's last know preset position saved by the user. At this point the program will reply with;

**\*\* Program: OptoTIRF\_MainUnit\_V1.7 \*\***

From there COM commands will be obeyed. Multiple commands can be given at once, but they must be separated with a semicolon character. A space character after the semicolon is optional.

E.g;

**SET XY 150,150; SET B 0; SET Z 9999**

### *General Use*

The program is loosely based around changing these 5 variables;

Variable	Description
X	Steering of the beam in the X-axis
Y	Steering of the beam in the Y-axis
Z	Focusing of the tube lens
F	Positioning of the bypass mirror
L	Toggling of the Laser TTL Out (rear of unit)

Each variable has a current position or state which can be controlled using SET (absolute movement) and JOG (relative movement).

E.g;

**JOG F -300**

These unique positions can then be saved as preset positions using the SAVE P command. Once a variable is changed from it's saved preset position, the unit reports its preset position as NONE. Up to 8 preset positions can be stored and are retained after switch off. One special case is the preset bypass position, SET B command. This is a factory set X, Y, Z, F and L position that will switch off the laser, and bring in the bypass port. By default the X, Y, and Z are set to midpoints. These positions can be changed and the bypass preset altered, on the condition that the F position is greater that 1470 (such that the laser input is obscured).

### Table of Commands

Command	Argument	Num.	Description
SET	XY	$\alpha, \beta$	Moves the beam to <b>X and Y</b> position by $\alpha$ and $\beta$ respectively.
	X	$\alpha$	Moves the beam to <b>X</b> position $\alpha$ .
	Y	$\alpha$	Moves the beam to <b>Y</b> position $\alpha$ .
	Z	$\alpha$	Moves the focus, <b>Z</b> , of the beam to position $\alpha$ .
	F	$\alpha$	Moves the bypass mirror, <b>F</b> , to position $\alpha$ , where $\alpha = 1800$ is approximately the bypass position.
	L	$\alpha$	Turns the laser, <b>L</b> , on or off, where $\alpha$ can be either 0 = off, or 1 = on.
	P	$\alpha$	Moves to preset, <b>P</b> , position $\alpha$ , where $\alpha$ can be a number from 1 to 8.
	B	$\alpha$	Moves to preset bypass, <b>B</b> , in or out. $\alpha$ can be either 0 = off, or 1 = on.
	S	$\alpha$	Changes the speed, <b>S</b> , of the XY movement. $\alpha$ can be number from 5 to 500.
JOG	XY	$\alpha, \beta$	Relative move of the <b>X and Y</b> position by $\alpha$ and $\beta$ respectively.
	X	$\alpha$	Relative move of the <b>X</b> position by $\alpha$ .
	Y	$\alpha$	Relative move of the <b>Y</b> position by $\alpha$ .
	Z	$\alpha$	Relative move of the <b>Z</b> position by $\alpha$ .
	F	$\alpha$	Relative move of the <b>F</b> position by $\alpha$ . Positive values increase the swing angle.
GET	XY		Returns the current position of <b>X and Y</b> .
	X		Returns the current position of <b>X</b>
	Y		Returns the current position of <b>Y</b> .
	Z		Returns the current position of <b>Z</b> .
	B		Returns the current state of <b>B</b> . 0 = off, or 1 = on.
	L		Returns the state of <b>L</b> . 0 = off, or 1 = on.
	P		Returns the current <b>P</b> position.
	S		Returns the current <b>S</b> of XY movement.

Command	Argument	Num.	Description
SAVE	P	$\alpha$	Saves the current setting for <b>X, Y, Z, F</b> and <b>L</b> to preset, <b>P</b> , position $\alpha$ . Where $\alpha$ can be a number from 1 to 8.
	XY		Saves the current position for <b>X and Y</b> for all preset positions including bypass. Useful for globally centring your unit.
	Z		Saves the current focus, <b>Z</b> , for all preset positions including bypass. Useful for globally focusing your unit.
	B		Saves the current setting for <b>X, Y, Z, F</b> and <b>L</b> to the bypass preset. Note bypass mirror must be in the path.
RESET			Restores unit to factory settings and wipes any saved presets.
CALI			Forces the unit to re-calibrate all it's motors and then returns to it's previous position.
CYCLE		$\alpha, \beta$	Cycle through the preset positions from 1 to $\alpha$ . Where $\alpha$ can be a number from 2 to 8. The number of cycles is governed by $\beta$ . Where $\beta$ can be a number from 0 to 99. $\beta = 0$ is a special case where the cycle runs continuously until another command is received. Note, the remote is disabled during this feature.
REPORT	P	$\alpha$	Returns the saved setting for <b>X, Y, Z, F and L</b> for the preset, <b>P</b> , position $\alpha$ . Where $\alpha$ can be a number from 0 to 9. Number 9 will report the current settings whether the unit is currently at a saved preset position or not.
	B		Returns the saved setting for <b>X, Y, Z, F and L</b> for the preset bypass, <b>B</b> , position.
	POT	$\alpha$	Returns internal analogue absolute readings of the current <b>X and Y</b> positions. $\alpha$ is optional, and adjusts the number of readings given.
	IN	$\alpha$	Returns the state of all the <b>inputs</b> . $\alpha$ is optional, and adjusts the number of readings given.
	OUT	$\alpha$	Returns the state of all the <b>outputs</b> . $\alpha$ is optional, and adjusts the number of readings given.
	BYPASS		Returns the approximate speed of moving the bypass mirror, <b>B</b> .

The Arduino project is an open-source electronics platform. If you would like a copy of the program to modify or archive please contact our support team at [tech@cairn-research.co.uk](mailto:tech@cairn-research.co.uk).