Motorized Aperture Operating Manual
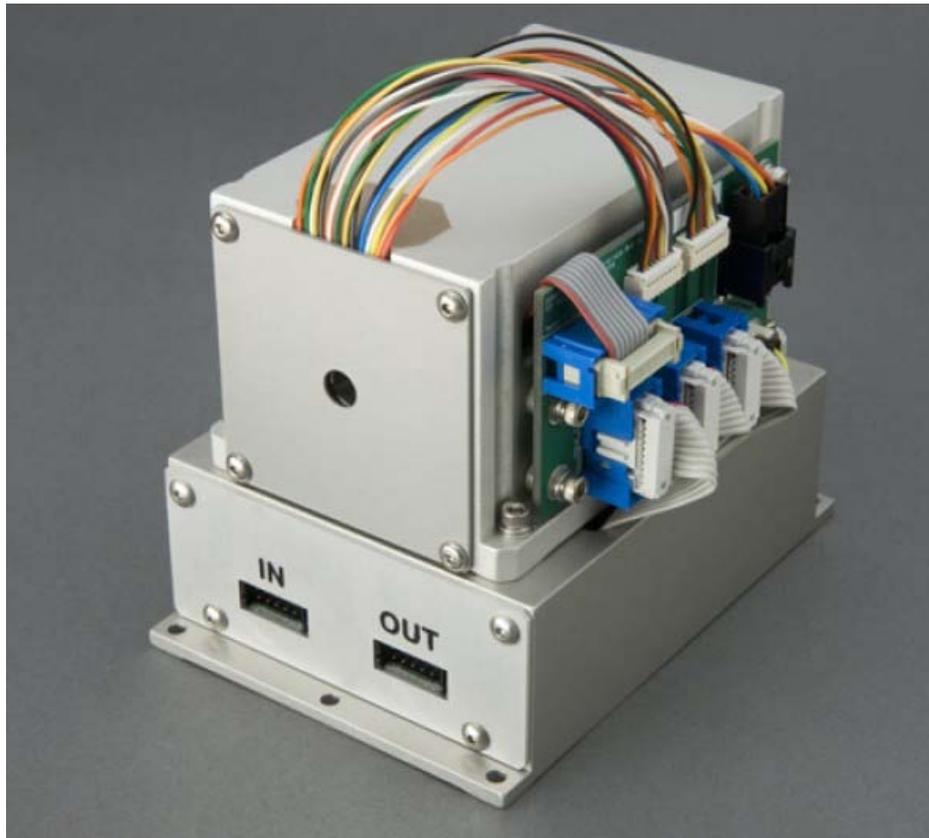
Version 0.4

1 Table of Contents

2 Introduction

The Quantum Composers motorized aperture module provides 3 axis of adjustment for use in imaging systems for precise patterning. It allows for independent control of X, Y and Theta parameters in order to precisely control a beam that is imaged to a sample. An internal calibration and anti-backlash function simplifies setup and control. The module is controlled via a RS232 serial interface that can be daisy chained to other Quantum Composers laser modules.

3 Setup

The motorized aperture should be placed at the image plane of the beam delivery system. The beam should be adjusted by either using an expander or reducer so that the beam size meets the input requirements of the aperture. The beam should also be conditioned so that a uniform and flat profile exists at the aperture plane. This insures that the pattern projected to the sample will be as flat and defined as possible. The beam should also be properly attenuated before the aperture to prevent damage to the aperture blades. See the specifications section for details. Connections to the device for

minimum operation are listed in the electrical connections section. At a minimum, power (5V and 12V) and RS232 (serial) connections are required.

4 Electrical Connections

The motorized aperture module requires two input voltages to be applied for operation:

+5VDC @ 100mA.
+12VDC @ 500mA.

The included power/communications cable includes the minimum connections for operation. Detailed electrical connections are described in the tables below.

Input Connector (Connector: Hirose #DF11-12DS-2C, Contacts Hirose #DF11-2428SC)

Pin Number	Type	Description
1	Ground	Power Ground
2	Power input	+5VDC
3	Power input	+12VDC
4	Power input	+12VDC
5	Ground	Power Ground
6	Ground	Power Ground
7	Input	RS232 Receive (from PC or other module)
8	Output	RS232 Transmit (to PC or other module)
9	Input	Analog reserved (do not connect)
10	Ground	RS232 Ground
11	N/C	No connection
12	Input/Output	Bus sense line (connect between modules)

Output Connector (Connector: Hirose #DF11-12DS-2C, Contacts Hirose #DF11-2428SC)

Pin Number	Type	Description
1	Ground	Power Ground
2	Power output	+5VDC
3	Power output	+12VDC
4	Power output	+12VDC
5	Ground	Power Ground
6	Ground	Power Ground
7	Input	RS232 Pass-through Out (to other module)
8	Output	RS232 Pass-through In (from other module)
9	Input	Analog reserved (do not connect)
10	Ground	RS232 Pass-through ground
11	N/C	No connection
12	Input/Output	Bus sense line (connect between modules)

5 Software Operation

A simplified software interface (GUI) is provided to allow for quick setup and operation of the module.
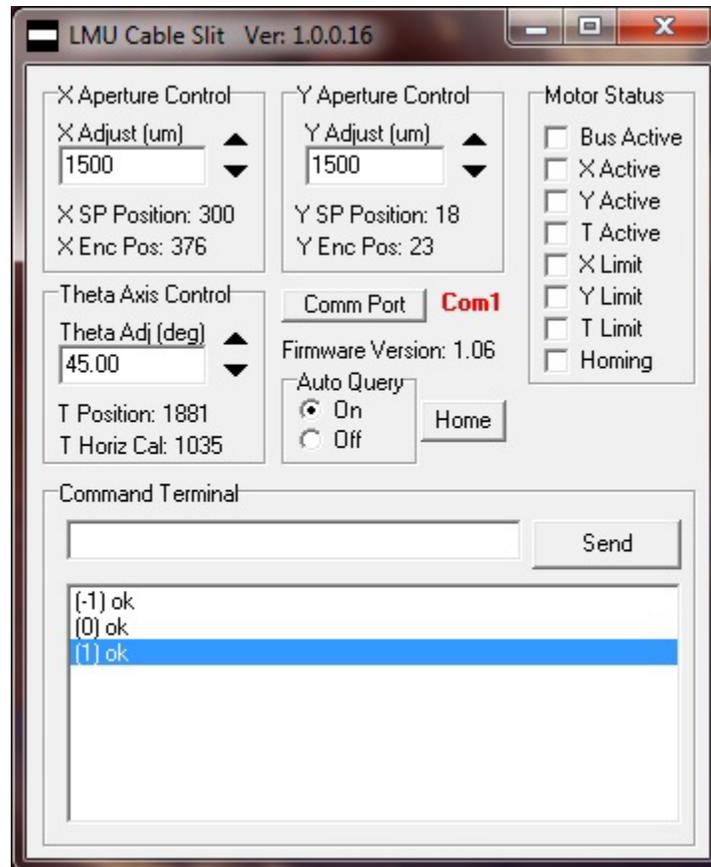
The software will run on any Windows based computer. Before running the software, make sure the module has power applied to it and the RS232 communication port is connected. Once the module is powered and connected, run the software by double clicking on the executable file. When the software first runs, it will ask what serial port the module is attached to. Select the appropriate port. If for any reason, the software cannot detect the module, then an error message will appear. Re-check all connections if this should occur. The software allows for adjustments of the X/Y aperture blades from 0 to 2500um and theta from +/-45 degrees. You can either enter the parameters or use the increment decrement buttons for adjustment.

6 Command Set

The motorized aperture communicates via a standard RS232 connection. The default communication settings are 57,600 baud, 8 data bits, even parity and 1 stop bit (57600, 8, E, 1). A typical serial port pin out is shown below. Only the Rx, Tx and Gnd are used to communicate with the aperture. The included software can be used to operate the unit over the serial port at the default baud rate of 57,600.

Typical PC Serial Port (DB9)

Pin No.	Name	Description
1	DCD	Data Carrier Detect †
2	Rx	RS232 Receive
3	Tx	RS232 Transmit
4	DTR	Data Terminal Ready †
5	Gnd	Ground
6	DSR	Data Set Ready †
7	RTS	Request to Send †
8	CTS	Clear to Send †
9	RI	Ring Indicator †
† denotes signal not used by the module		

Device Command Format

All commands use ASCII characters and are composed of the following fields:

<Prefix><Address><Deliminator><Command String>[Parameters]<Terminator>

Field	Description
Prefix	Single semicolon character ";", must precede all commands. All devices will reset their command input buffer when the prefix is received.
Address	2 ASCII characters. Each device has a unique address which is programmed into its firmware. See the table below for a list of addresses.
Deliminator	Single colon character ":", must follow device address.
Command String	Commands are specific to each device -- see the following sections for the commands that each device supports.
Parameters	(optional field) Some commands may have parameters which immediately follow the command string. Multiple parameters are

separated by commas.

Terminator   ASCII carriage return character (decimal value 13). The receiving device does not process any commands until the terminator is received.

Device Addresses

Address   Device

SL   Generic motorized (slit) module

Command Types

There are two types of commands -- those that set a value or initiate an actions (control commands), and those that request information (query commands). Each device must respond in the proper manner to each type of command.

Control Commands

A device must always parse a control command and return a response immediately.

- If the command is a recognized command and the parameter is valid, then the device returns an "OK<CR>". (<CR> = ASCII carriage return, decimal value 13).
- If the command is not recognized by the device, then it responds with "?1<CR>
- If the command is recognized, but the parameter value is missing or invalid, then the device responds with a "?2<CR>".
- If the command is recognized, but the parameter is out of range, then the device responds with a "?3<CR>".

If a control command is received while the device is in the midst of executing a previous command, and the commands are mutually exclusive (cannot be executed in parallel), then the previous command is aborted and the new one executed. It is up to the host controller (the PC) to poll the device and make sure the previous command is finished, if that is the needed.

Query Commands

Query commands return a value to the PC as soon as the command is parsed and executed. The value returned will depend on the command. The response is always terminated with a <CR>. If a query command is not recognized by the device, then a "?0" is returned.

Common Commands

All devices are required to support some common commands as part of their command set. Those commands are:

Command	Description
VN	Return firmware version number
RS	Reset, return to power-up defaults.

Global Commands

By using a special prefix (the * character), it is possible to send a command to all the devices at once. When a global command is sent, no device will send a response.

Command	Description
*RS	Reset, return to power-up defaults. All devices

Command Set

CT?	Theta Calibration. Returns the currently stored horizontal position in encoder counts. See the ST command for usage of this value.
CX?	X Calibration Value. Returns the 2.5mm calibration opening value in encoder counts.
CY?	Y Calibration Value. Returns the 2.5mm calibration opening value.
HM	Home Motor. Moves motors to limits, then returns to default position.
RS	Resets all motors, returns to power up defaults and homes the motors
SC?	Step Count. Returns the current X and Y raw encoder count.
SP #### ####	Set Spot Size. First parameter = 4-digit hex value for size of opening in x direction in millimeters *200, Second parameter = 4-digit hex value for size of opening in y direction in millimeters * 200. Range is 0000h to 01F4hex (0 to 500). For a slit 1.5mm x 1.5mm the command would be ;SL:SP 012C,012C (012Ch = 300).
SS?	System Status. Returns status of system as 2-digit ASCII hex value. Note that M (modules) Busy indicates that some module on the serial bus is busy. This allows one poll to determine if any of the modules are busy.

7	6	5	4	3	2	1	0
Homing	Theta Limit	Y Limit	X Limit	Theta Busy	Y Busy	X Busy	M Busy

ST ####   Set Theta. . Parameter = 4-digit hex value for rotation in motor steps. Horizontal is the value returned by the CT? command. +45 and -45 are +/-845 (h034D) steps from the horizontal value (A "?" returns the current position.

VN   Version Number. Returns the firmware revision number as a 4-digits in the format "m.nn", where m = major version, n = minor version.

7 Specifications

Input

Beam Height   60mm (other configurations upon request)

Fluence   10 J/cm^2 max

Diameter   3.6mm min (beam must fill maximum slit)

Output

X, Y

Range   0 – 2.5mm

Resolution   1.0% (25um resolution with a 100x objective)

Accuracy   +/-(25um + .01 * position)

Speed   < 1.0s full range of travel

Theta

Range   +/– 45 degrees from horizontal

Resolution   1.1% (.50 degrees)

Accuracy	+/- (1 degree + .01*theta)
Speed	< 1.0s full range of travel

Controller

Comm	RS232, w/ bypass output which allows multiply units to be daisy chained on the same serial port.
Baud Rate	57,600, 8, E, 1 (other speeds available on request)
Tact Time	< 1s, full range motion, for all three parameters

Mechanical

Please contact the factory for details and drawings.