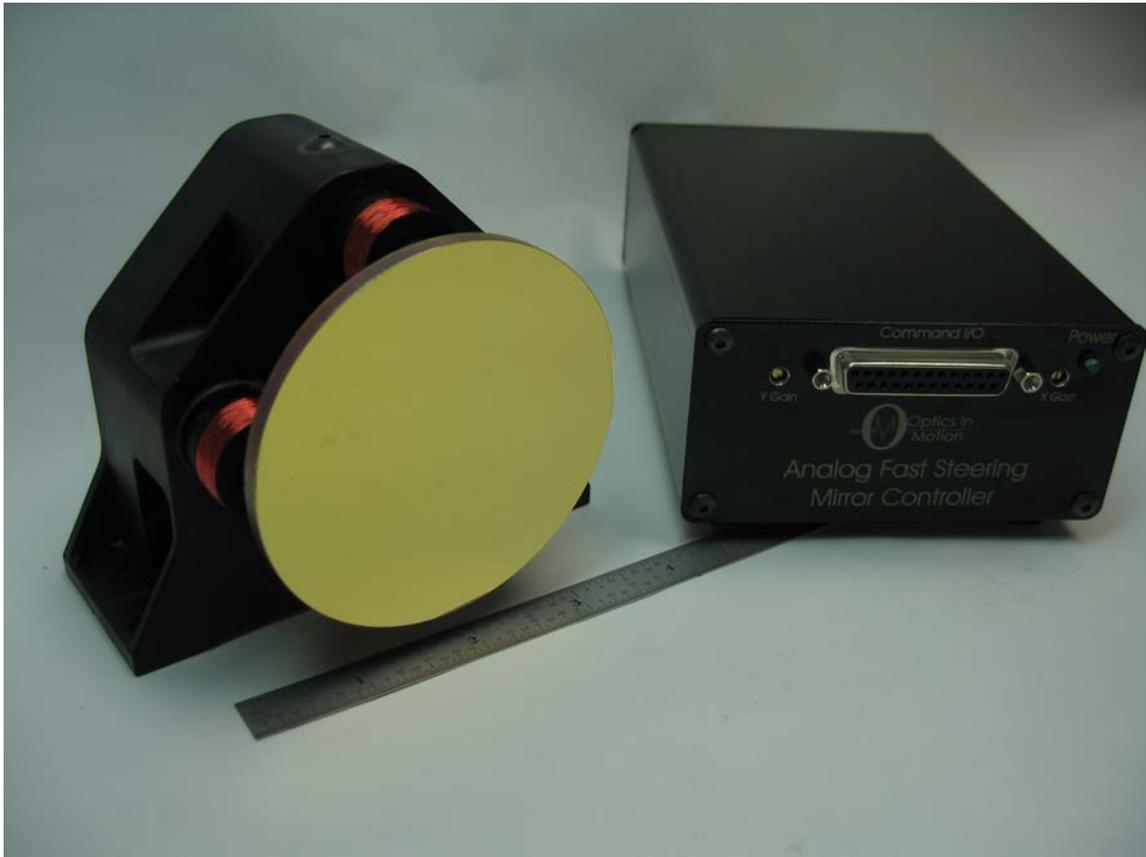


Fast Steering Mirror



User's Manual *Models OIM3300*



April 2, 2007
Revision B

Product Warranty

Optics-In-Motion LLC warrants this product to be free from defects in material and workmanship for a period of 1 year from the date of shipment. If the product is found to be defective during the warranty period, the product will either be repaired or replaced at Optics-In-Motion's option.

This warranty does not apply to defects resulting from modifications or misuse of any product or part.

Optics-In-Motion LLC shall not be held liable for any indirect, special, or consequential damages caused by the use of the product.

Table of Contents

	Page
Product Warranty	2
Table of Contents	3
Fast Steering Mirror Description	4
Fast Steering Mirror Models:	4
Drive Motors:	4
Mirror Suspension:	4
Mirror Angular Position:	4
Mirror Controller:	5
Mirror Power Supply:	5
Figure 1: Controller Front View	6
Figure 2: Controller Rear View	6
Figure 3: Model OIM3300 Mirror Head Front View	7
Figure 4: Model OIM3300 Mirror Head Rear View	7
Fast Steering Mirror Block Diagram	9
Figure 5: Block diagram for X-axis control	9
Figure 6: FSM Head ICD	10
Figure 7: FSM Electronics ICD	11

Fast Steering Mirror Description

Voice coil driven Fast Steering Mirrors (FSM) have been used for several years in military and aerospace applications for target acquisition, scanning, and beam steering. These mirrors were typically low volume - high cost parts. Optics-In-Motion has engineered a line of fast steering mirrors which have many of the attributes of the military versions (low noise, high pointing accuracy, and high acceleration/step speeds) but are available at commercial prices.

Fast Steering Mirror Models:

The 3000 series fast steering mirror product line consists of a 3 inch diameter aluminum substrate which has a replicated optical surface. Replication is similar to the process used to create optical gratings, however in this case the replicated surface is a flat mirror.

Drive Motors:

Both mirror models are driven by a push/pull configuration of voice coils (similar to speaker coil - magnet arrangement). However unlike a speaker the FSM is configured with a moving magnet instead of a moving coil. This arrangement has several advantages. The first being that since the coil is stationary the wires do not have to move which adds greater overall reliability. The second advantage is that the heat generated by the mirror coils is conducted to the mirror housing away from the optical mirror substrate. This prevents thermal distortions of the mirror wavefront quality.

Mirror Suspension:

The mirror is flexurally suspended in two axes. The flexure is designed for an infinite fatigue life under normal operation (the absence of high levels of external vibration). The mirror rotates in both directions around a single pivot point. The pivot point for model OIM3300 (3" mirror) is located 0.375 inches behind the mirror surface.

Mirror Angular Position:

Local Position - the mirror has a built in optical position sensor. The position sensor provides mirror feedback information to the controller which can also be monitored by the user. The local position sensor outputs a voltage which is proportional to the mirror angular position. The position sensor scale factor is

10volts = 5.0 degrees and has a range from +10 volts (+5.0 degrees mechanical +10.0 degrees optical) to -10 volts (-5.0 degrees mechanical, -10.0 degrees optical).

External Position - the mirror controller has inputs for a user supplied control signals. Typically these signals are from an external quadrant cell which is used to monitor the position of a beam reflected off the surface of the fast steering mirror. These external signals (x and y position angles) are differentially input into the mirror command connector. A TTL level high input to the command connector INT/EXT switch controls the source of mirror feedback, switching it from local to external position control.

Mirror Controller:

The mirror controller electronics are housed in a remote enclosure connected to the FSM via a 10 foot cable. Mirror commands are input to the controller through a 25 socket D sub-miniature connector. The commands are differential signals representing the x and y mirror positions, scaled to the +/- 10 volt range. For example, the X- command can be grounded and the X+ command can go from +10volts to -10volts. The input impedance of the command signals is 10K ohms. Monitor signals are provided for the actual mirror positions, error signals (feedback error between commanded position and actual position). The PID gain may be set from the controller front panel potentiometers (See fig. 1). CW rotation reduces gain and CCW rotation increase gain, total range = 25 turns.

Mirror Power Supply:

The controller is powered by an external +/-15 volt power supply capable of 1.5 amps of current. The external power supply is an air cooled tabletop supply which plug directly into a 110 or 220 volt wall socket.



Figure 1: Controller Front View

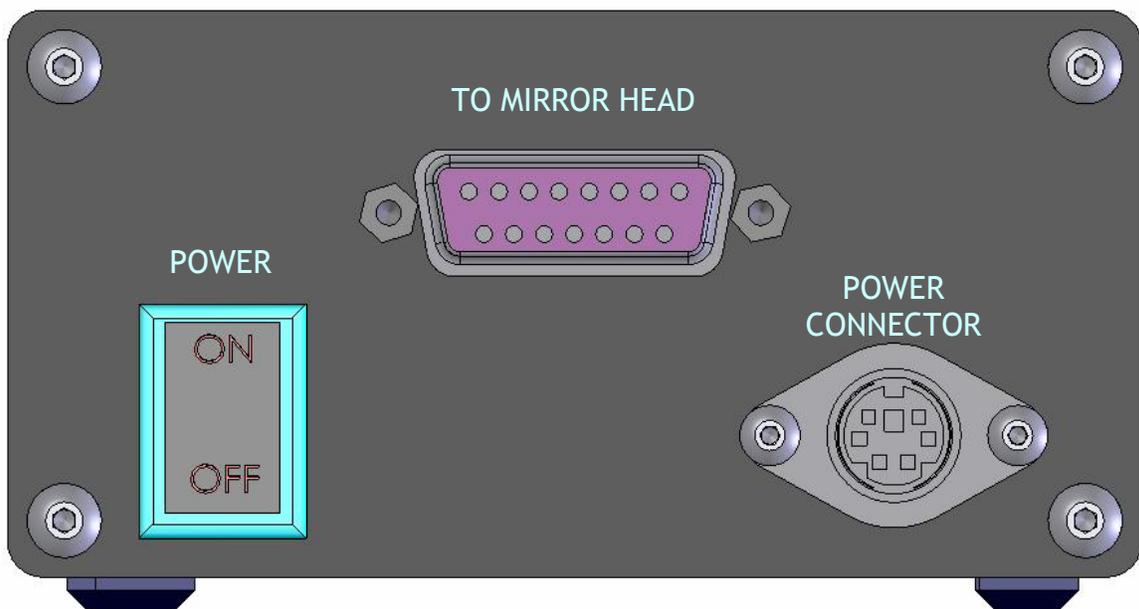


Figure 2: Controller Rear View

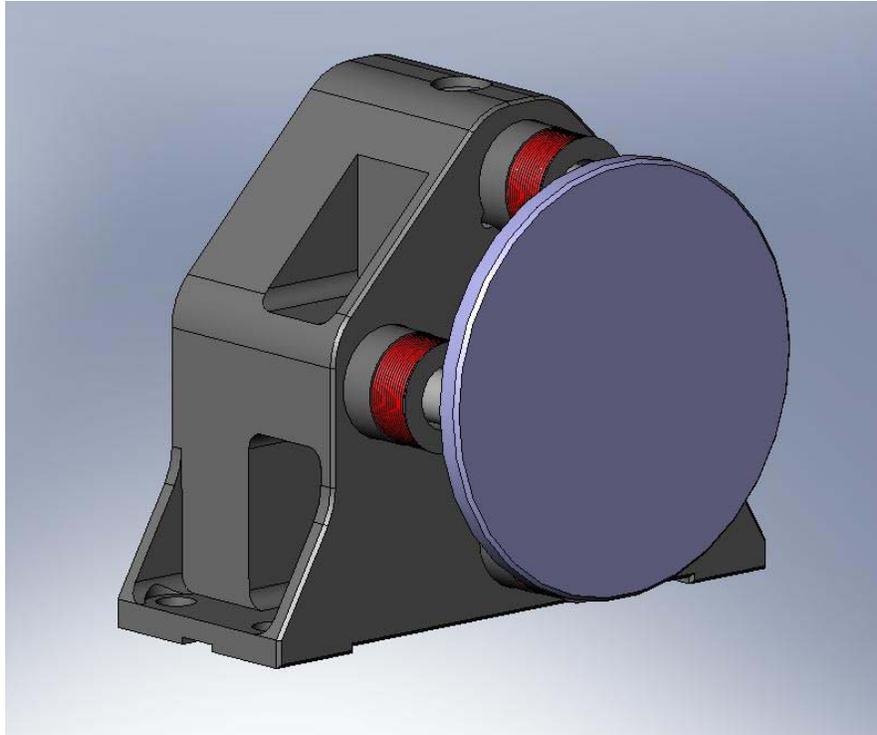


Figure 3: Model OIM3300 Mirror Head Front View

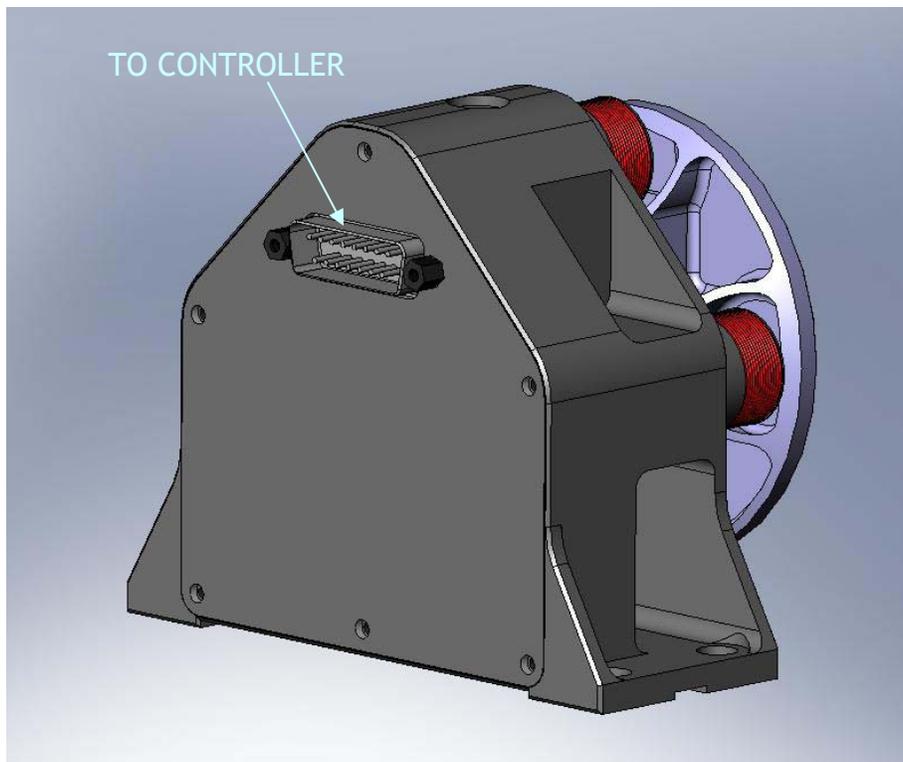


Figure 4: Model OIM3300 Mirror Head Rear View

Table 1: Command I/O Connector Wiring

25-Socket Sub-miniature D Connector

Pin Number	Signal Name	I/O Type	Description
1	X ERROR	Output	X summing junction error voltage output, difference between commanded and actual position. (referenced to ground)
2	INT/EXT SWITCH	Input	Normally low TTL input. High level switches the position feedback input from local to external. (used with input pins 10,11 and 17, 5)
3	X- COMMAND	Input	X mirror position command. Low side of differential command input. Range +/-10 Volts.
4	X+ COMMAND	Input	X mirror position command. High side of differential command input. Range +/-10 Volts.
5	X- EXTERNAL	Input	X external mirror position. Low side of differential position input (from external quad or similar position sensor)
6	GND	Output	Ground Reference
7	-15 VOLTS	Output	-15 VDC for external loads of less than 100ma.
8	RESERVED		
9	N/C		
10	Y+ EXTERNAL	Input	Y external mirror position. High side of differential position input (from external quad or similar position sensor)
11	Y- EXTERNAL	Input	Y external mirror position. Low side of differential position input (from external quad or similar position sensor)
12	Y- COMMAND	Input	Y mirror position command. Low side of differential command input. Range +/-10 Volts.
13	Y+ COMMAND	Input	Y mirror position command. High side of differential command input. Range +/-10 Volts.
14	X POSITION	Output	X mirror angular position readout from local position sensor. (referenced to ground)
15	+5 VOLTS	Output	5 VDC for external loads of less than 100ma.
16	GND	Output	Ground Reference
17	X+ EXTERNAL	Input	X external mirror position Low side of differential position input (from external quad or similar position sensor)
18	RESERVED		
19	+15 VOLTS	Output	+15 VDC for external loads of less than 100ma.
20	GND	Output	Ground Reference
21	RESERVED		
22	GND	Output	Ground Reference
23	Y POSITION	Output	Y mirror angular position readout from local position sensor. (referenced to ground)
24	Y ERROR	Output	Y summing junction error voltage output, difference between commanded and actual position. (referenced to ground)
25	RESERVED		

Fast Steering Mirror Block Diagram

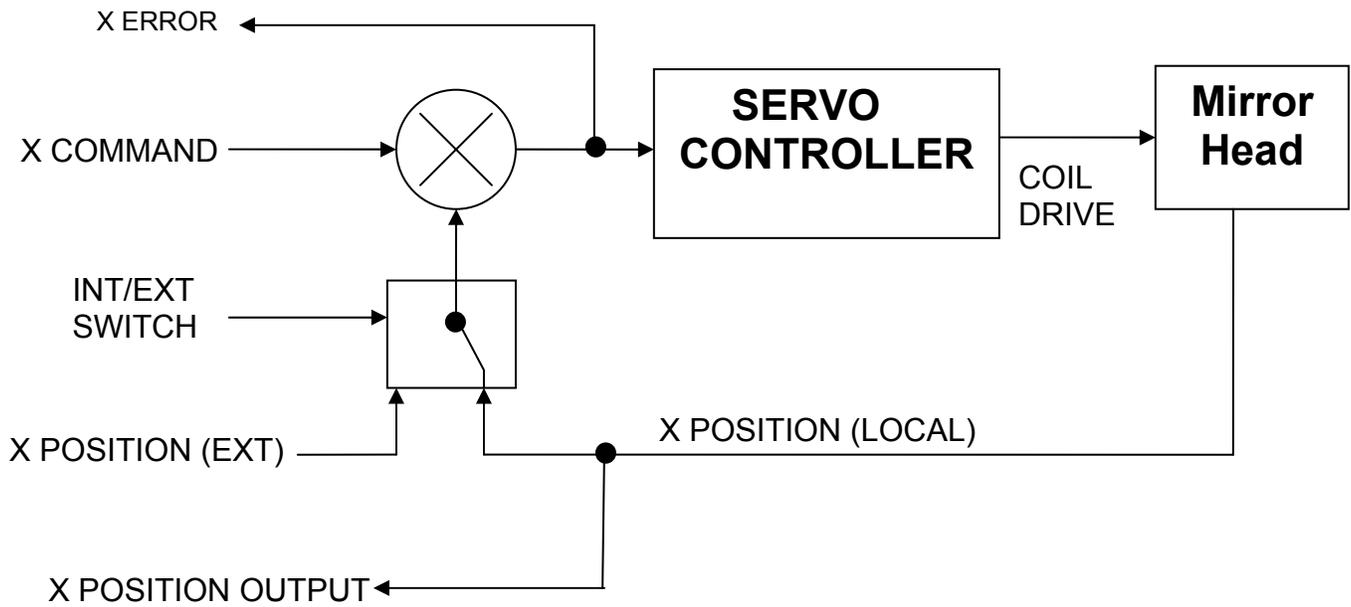


Figure 5: Block diagram for X-axis control

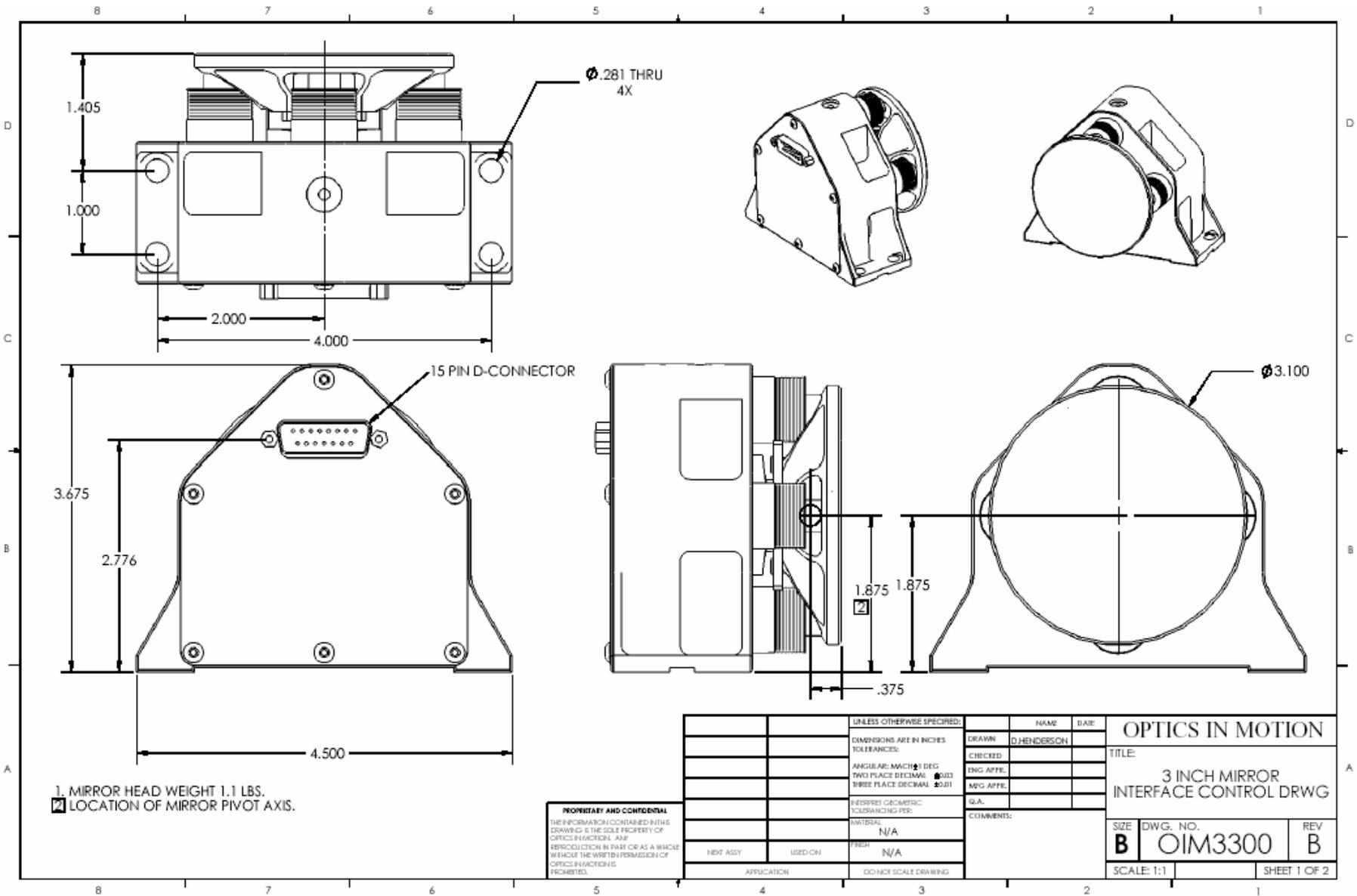


Figure 6: FSM Head ICD

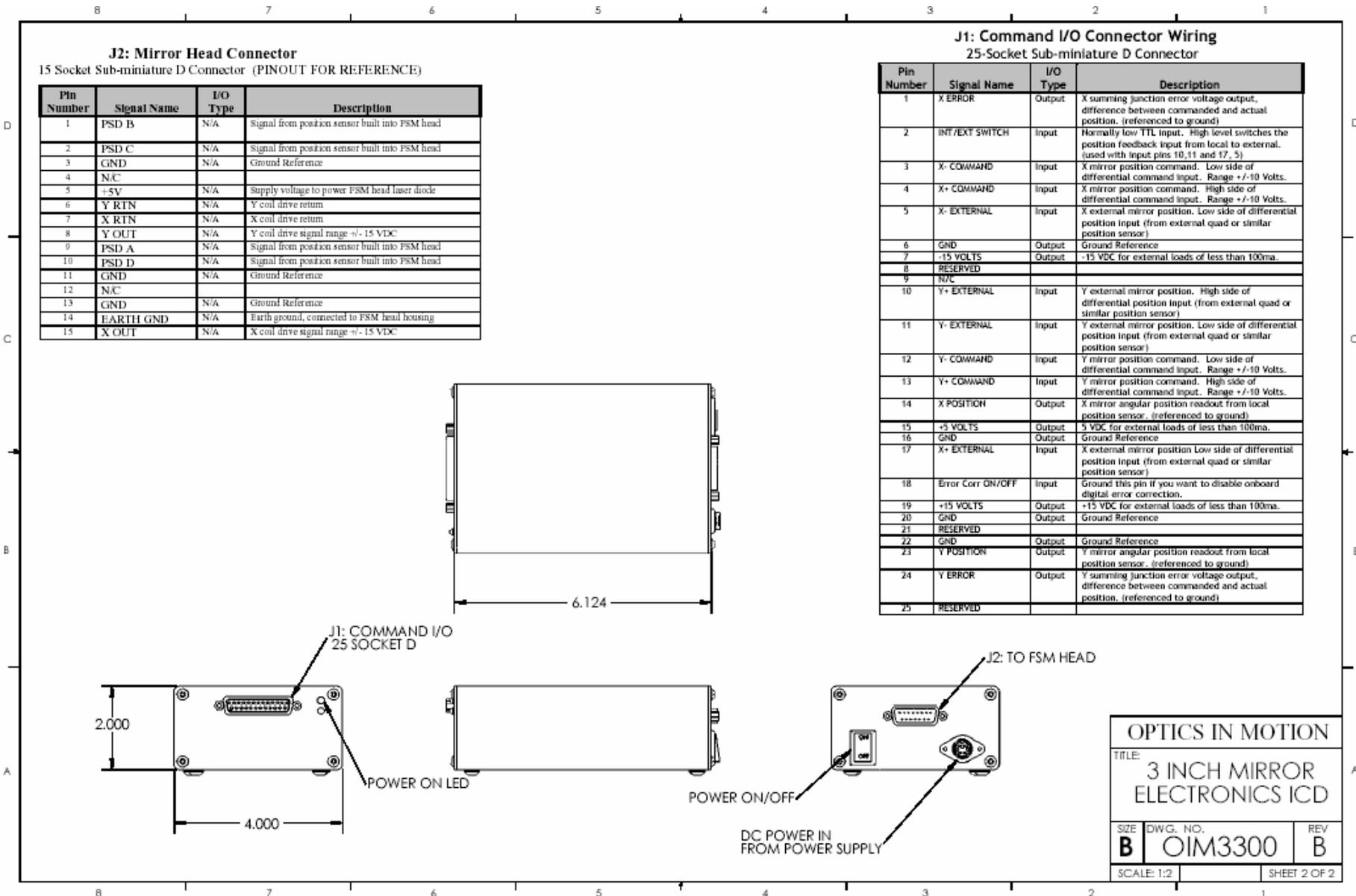


Figure 7: FSM Electronics ICD