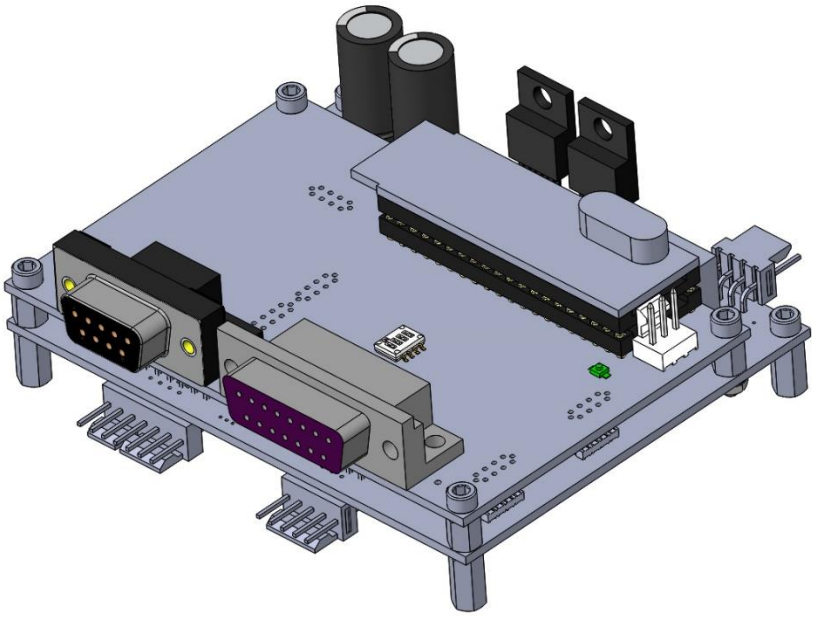

**OPTICS IN MOTION**

# OEM Fast Steering Mirror Controller
# Digital Potentiometer Version
# OIMC201-DP

**Rev B, November 1st, 2015**

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**Controller Description:**

Optics In Motion LLC OEM controller is a compact version of our standard controller designed for OEM applications. The controller is powered by an external voltage source with a range of +/-15V to +/-24V.

The motor drive amplifier needs to be heat sunk to prevent overheating. This can be accomplished via a finned heat sink attached to the power amp, or with a thermal strap to dissipate the heat to the user's enclosure. The case of the power amplifier (OPA2544T) is connected to the negative power voltage input so it must be isolate by using heat sink pads and isolated washers. Verify that the case of the op-amp is isolated from ground before turning it on.

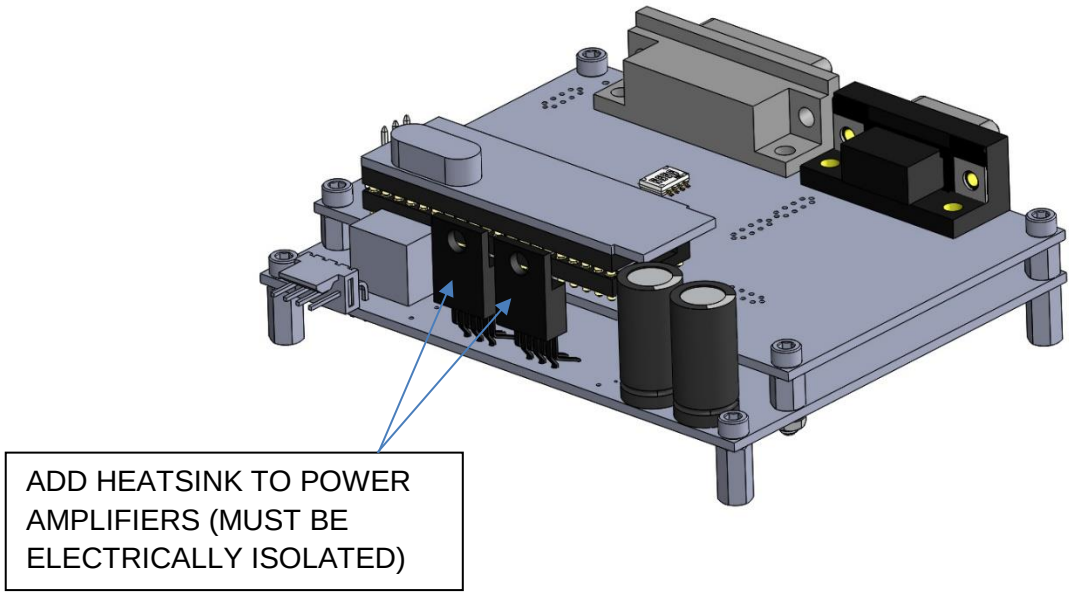


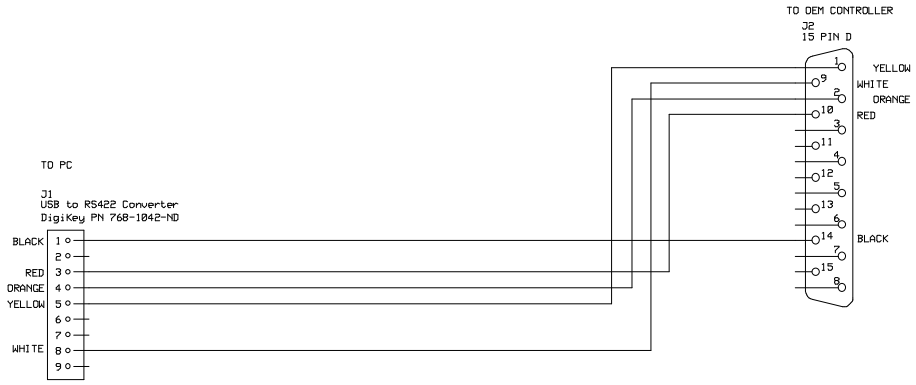

**Figure 1:** OEM controller Power Amp

Mirror commands are input to the controller through a 9 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 +10 volts to -10 volts. 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).

**Controller Digital Potentiometer Adjustments:**

**Figure 2:** USB to 15 pin D RS422 Adapter

Use a "USB to RS-422 adaptor cable" to connect from PC USB port to the 15 pin D connector (Digi-key PN 768-1042-ND)




When you power the PC on with the "USB to RS-422 adaptor cable" plugged in, you will need to install a driver. The driver can be downloaded from www.ftdichips.com The driver will create a virtual comport on the PC (COMX).

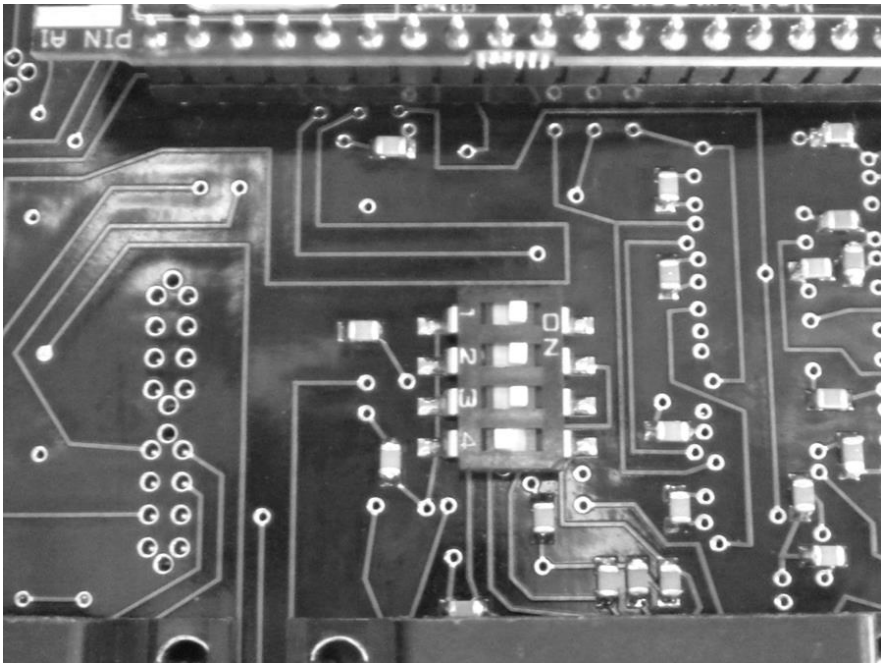
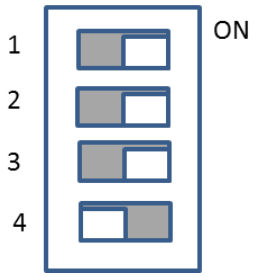


**Figure 3:** Controller Mode Switch Setting

# Potentiometer Adjustment Mode

Switch setting: 8




Switch 1 = ON
Switch 2 = ON
Switch 3 = ON
Switch 4 = OFF

Set the DIP switch on the top of the controller PCB as shown in the figure (1-ON, 2-ON, 3-ON, 4-OFF). This will set the controller in tuning mode. When you turn the PC on with the adaptor cable connected, the controller will display start up screen stating potentiometer adjustment mode (use a hyper-terminal program). Keying in 'V' will display the current tuning values.

The settings for the Comport are:

BAUD 115200

PARITY= none

Bits= 8

Stop bits = 1

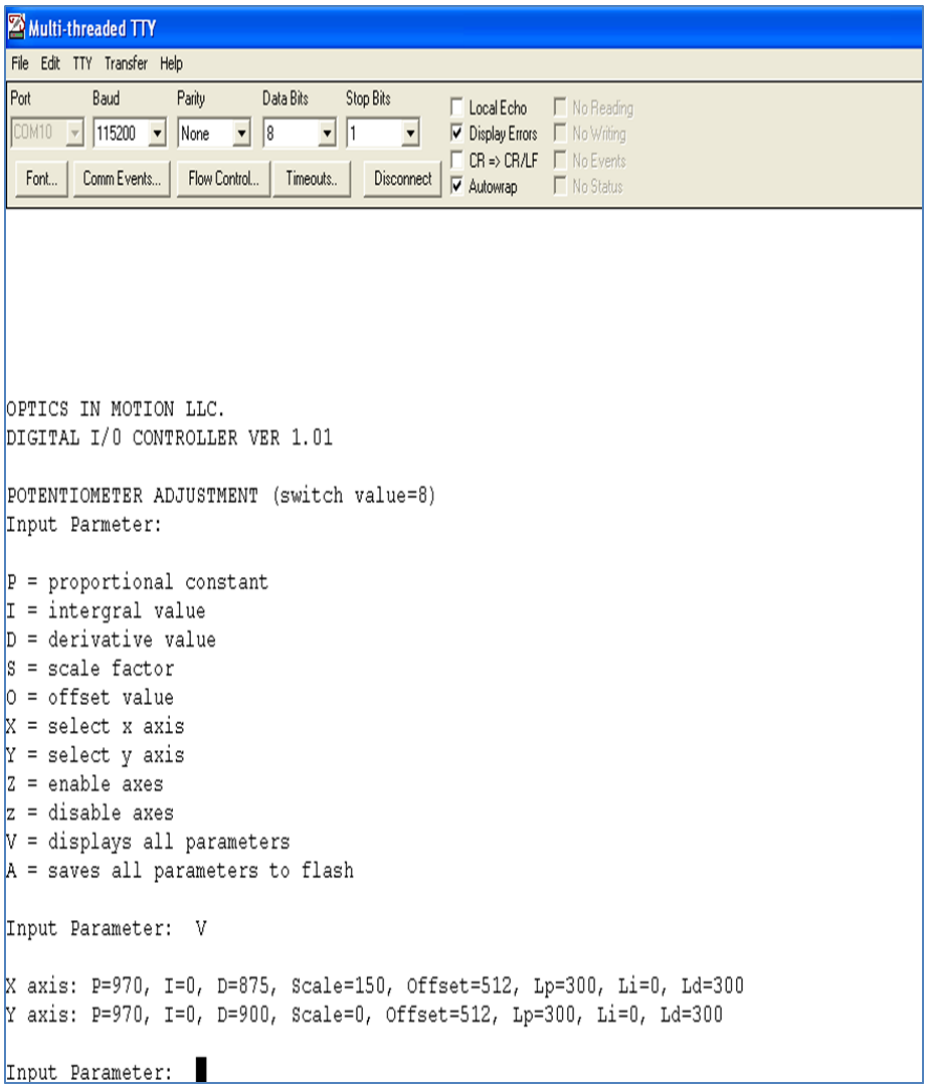



**Figure 4:** Start up Screen

The input parameters are as follows:

P = proportional constant

Pressing a capital P will ask the user to input a P parameter value for the currently selected axis.

Valid range = 0-1023

I = integral value

Pressing a capital I will ask the user to input an I parameter value for the currently selected axis.

Valid range = 0-1023

D = derivative value

Pressing a capital D will ask the user to input a D parameter value for the currently selected axis.

Valid range = 0-1023

S = scale factor

Pressing a capital S will ask the user to input a S parameter value for the currently selected axis.

Valid range = 0-1023

O = offset value

Pressing a capital O will ask the user to input a O parameter value for the currently selected axis.

Valid range = 0-1023

X = a capital X will select the X-axis for ALL adjustments.

Y = a capital Y will select the Y-axis for ALL adjustments.

Z =  capital Z enables both axes.

lowercase Z disables both axes.

V = both capital & lowercase: will display all current parameter values.

A = capital A saves all parameter values to static flash.

CAUTION must be taken to record values. Using the capital A loses the factory settings. Factory settings are recorded on test value sheet.

T = will run a program that will use the low gain PID parameters when the error exceeds a threashold of 1.5 volts (used to reduce overshoot during a step)

Lowercase p, i, d will set low gain PID values.

This mode is only active when the DIP switch on the controller is set to (1=OFF, 2=ON, 3=ON, 4=ON) This setting als ɐ controller in digital command mode (RS422 serial commands control mirror position).

**X&Y Scale Pots:**
Change the mirror angular range versus command inputs. To adjust, sweep the mirror full scale +/-10 volts and turn pot until desired angular range is reached. Caution this scale may be larger than the physical mirror range or the position sense detector range.

**X&Y Offset Pots:**
Adjust this potentiometer to move the mirror null pointing position to zero out any desired offset pointing. The range of adjustment is ~ +/-1.5 volts of displacement per axis.

**X&Y P Pots:**
Adjusts the ‘P’ term of the PID controller

**X&Y I Pots:**
Adjusts the 'I' term of the PID controller

**X&Y D Pots:**
Adjusts the 'D' term of the PID controller

**X&Y Low Gain Pots:**
Used to set low gain P value to eliminate overshoot during large mirror steps. To adjust, input a full scale square wave into the mirror controller (+/-10 volts @ 5Hz) and monitor the amount of mirror overshoot on an oscilloscope (monitor the x or y position outputs). Adjust the Low Gain Pot to minimize the overshoot while minimizing the slowing of the step response.

**Controller DIP Switch Settings:**

The DIP switch located on the controller sets the active mode of the controller. After changing the settings the controller must be power off and on, or the small RESET switch can be pressed (See figure 5 for the location of the RESET switch). The current valid setting for the switch are:

1) No program mode, 1=ON , 2=ON, 3=ON, 4=ON
2) Digital I/O, & low gain switching, 1=OFF, 2=ON, 3=ON, 4=ON
3) Parameter settings, 1=ON , 2=ON, 3=ON, 4=OFF

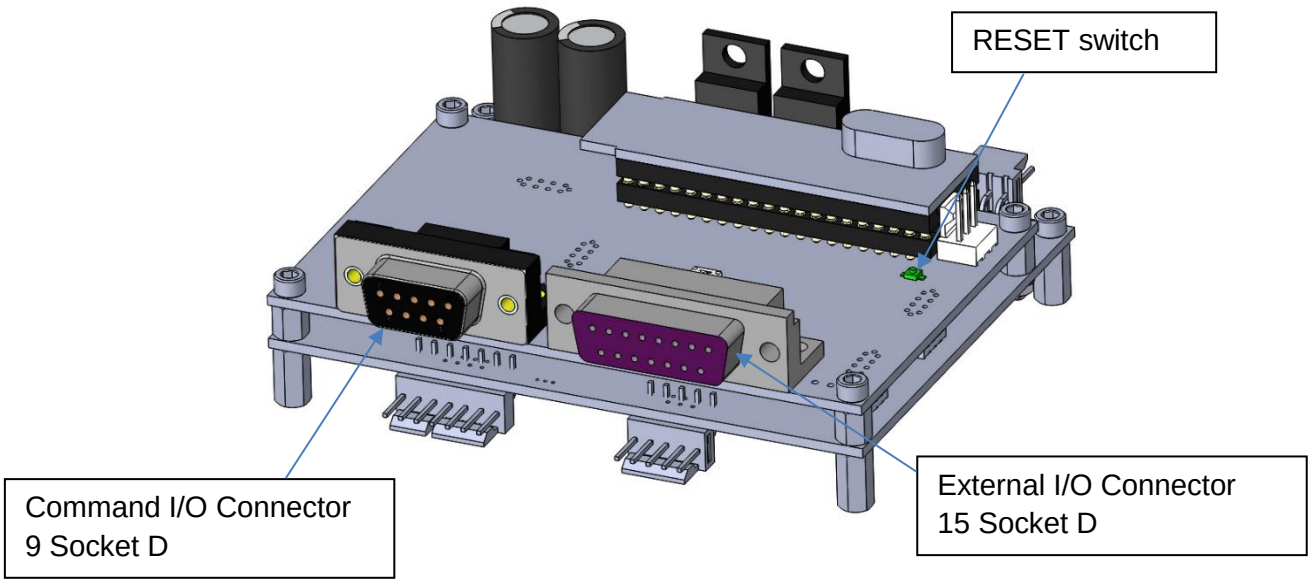


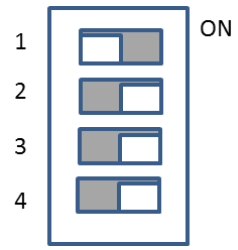

**Figure 5:** Controller Input Connectors

# Serial Input Mode

Switch setting: 1

Set switch on BNC adaptor to position 1:

Switch 1: OFF
Switch 2: ON
Switch 3: ON
Switch 4: ON




The mirror is now in the serial I/O mode.

In the serial input mode, the error on the FSM position is monitored and if the error goes above 1.5 volts, the FSM is switched from high to low gain PID mode. The reason the FSM goes into low gain mode is to reduce overshoot during large steps. If the user wishes to disable this feature, set the low gain values equal to the high gain values (See Potentiometer Adjustment mode SW8 for setting low gain PID values).

Using a comport communication program like *Ultra Serial Port Monitor,* which can be downloaded from www.download.com

The settings for the Comport are:

BAUD 115200, PARITY= none, Bits= 8, Stop bits = 1

In serial mode, the FSM will accept binary commands to move mirror positions in the X and Y axes.

The format for the binary commands are as follows:

FDXXXX hex
FD = x commands
XXXX = 16 bit signed integer value for mirror position.
Range = -32,767 to +32,767
Null position corresponds to an input of 0 (FD0000H)
Y commands = use FEXXXX hex

After a command is sent, the current position of the mirror is returned as 16 bits of data (X or Y, depends on command sent)

## **Table 1:** Command I/O Connector Wiring Table

9-Socket Sub-miniature D Connector

| Pin Number | Signal Name | I/O Type | Description |
|---|---|---|---|
| 1 | X+ COMMAND | Input | X mirror command. High side of differential command input. Range +/-10 Volts. |
| 2 | Y ERROR | Output | Y summing junction error voltage output, difference between commanded and actual position. (referenced to ground) |
| 3 | GND | Output | Ground Reference |
| 4 | X ERROR | Output | X summing junction error voltage output, difference between commanded and actual position. (referenced to ground) |
| 5 | Y+ COMMAND | Input | Y mirror command. High side of differential command input. Range +/-10 Volts. |
| 6 | X- COMMAND | Input | X mirror command. Low side of differential command input. Range +/-10 Volts. |
| 7 | X POSITION | Output | X mirror angular position readout from local position sensor. (referenced to ground) |
| 8 | Y POSITION | Output | Y mirror angular position readout from local position sensor. (referenced to ground) |
| 9 | Y- COMMAND | Input | Y mirror command. Low side of differential command input. Range +/-10 Volts. |

## **Table 2:** External I/O Connector Wiring Table

15-Socket Sub-miniature D Connector

| Pin Number | Signal Name | I/O Type | Description |
|---|---|---|---|
| 1 | TX+ | Output | RS422 signals |
| 2 | RX+ | Input | RS422 signals |
| 3 | DIO1 | In/Out | Digital input or output, can be configured in software |
| 4 | DIO3 | In/Out | Digital input or output, can be configured in software |
| 5 | +12 VOLTS | Output | +12 VDC for external loads of less than 100ma. |
| 6 | +3.3 VOLTS | Output | +3.3 VDC for external loads of less than 100ma. |
| 7 | INT/EXT SWITCH | Input | Normally low TTL input. High level switches the position feedback input from local to external. Referenced to ground leave unconnected for normal operation. |
| 8 | X EXTERNAL | Input | X external mirror position (from external quad or similar position sensor*) Range +/-10 Volts. |
| 9 | TX- | | RS422 signals |
| 10 | RX- | | RS422 signals |
| 11 | DIO2 | | Digital input or output, can be configured in software |
| 12 | DIO4 | | Digital input or output, can be configured in software |
| 13 | -12 VOLTS | Output | -12 VDC for external loads of less than 100ma. |
| 14 | GND | Output | Ground Reference |
| 15 | Y EXTERNAL | Input | Y external mirror position. (from external quad or similar position sensor*) Range +/-10 Volts. |

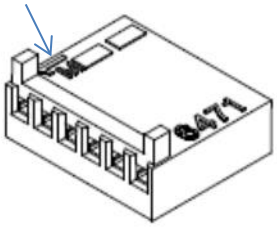
* Note: Signals from external position sensor must be electronically processed and converted to analog voltages. These signals should be of opposite polarity to the position sensor outputs and of the same magnitude.

## **Table 3:** Power Input Connector Wiring Table

Connector - Molex, Right Angle, 4 pin (DigiKeyWM4302)

| Pin Number | Signal Name | I/O Type | Description |
|---|---|---|---|
| 1 | -15 to -24 VDC | Input | Negative Supply min 2 amps |
| 2 | GND | Input | Positive and Negative Supply Return |
| 3 | +15 to +24 VDC | Input | Positive Supply min 2 amps |
| 4 | EARTH GND | Input | Earth Ground, may be tied to GND |

PIN 1



Mating Molex Connector Digikey PN (WM2614-ND)

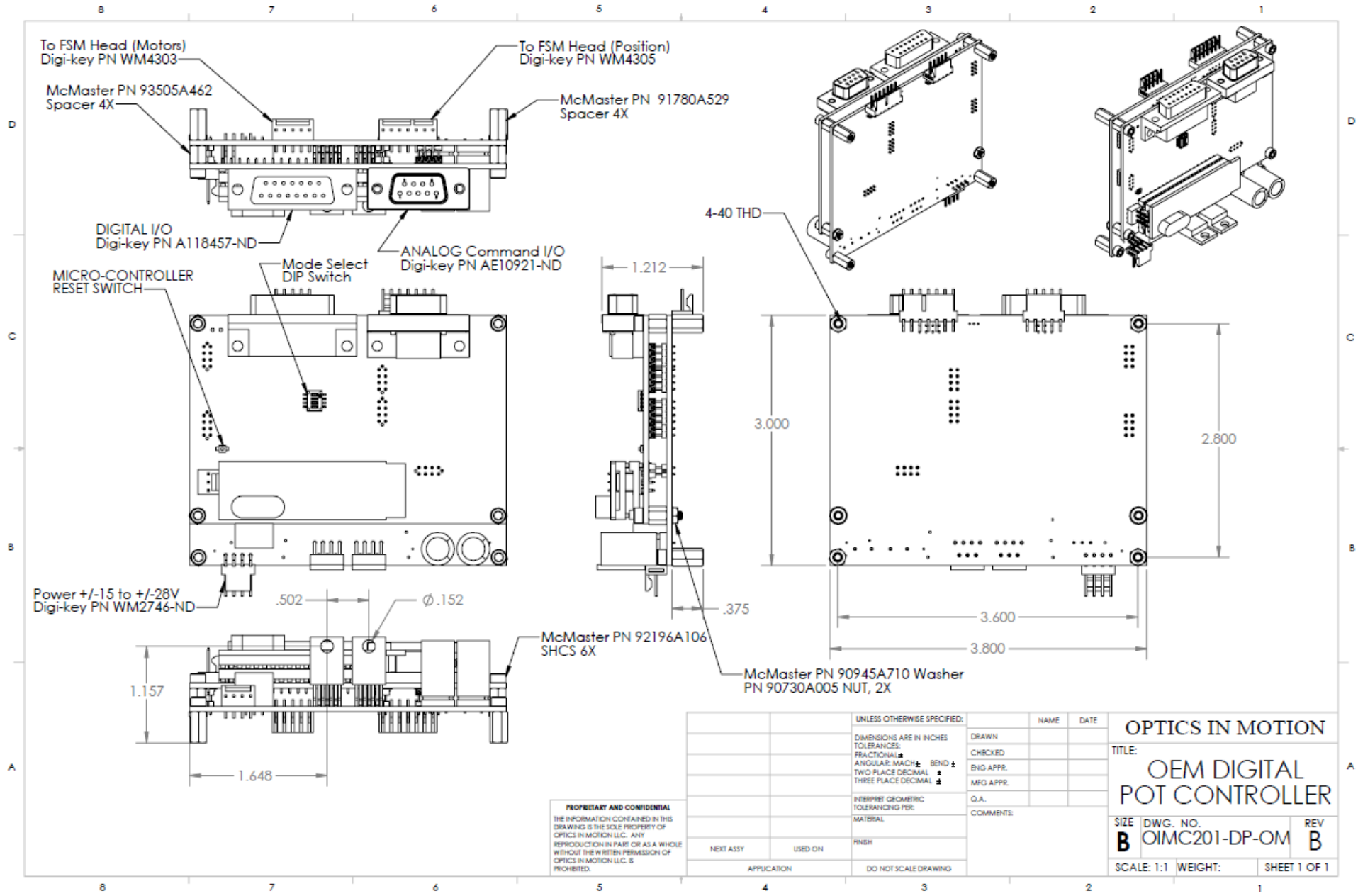



**Figure 6:** OEM Controller ICD