

# Automated Lighting Controller

## Single card controller uses both on-board and off-board amplifiers for top performance

### Application Challenge

Automated lighting fixtures are becoming more complicated with each new generation of musical and theatrical performance. In addition to basic pan & tilt motion of the light, additional motion control axes control filter wheels, focus, and a plethora of special effects axes. How do we build an eight axis motion controller that supports centralized synchronization and a mix of power levels, while keeping costs low and the overall control package very compact?

### Application Considerations

Feature/Function	Units/Description
<b>Motor Type</b>	- Two 8 amp brushless DC motors for pan & tilt - Six 2.5 amp step motors for other effects axes
<b>Motion Modes</b>	Point-to-point, rate control
<b>Synchronization</b>	CANbus network to central lighting control panel
<b>Speed</b>	Worst case point-to-point pan & tilt slew in 1.2 sec

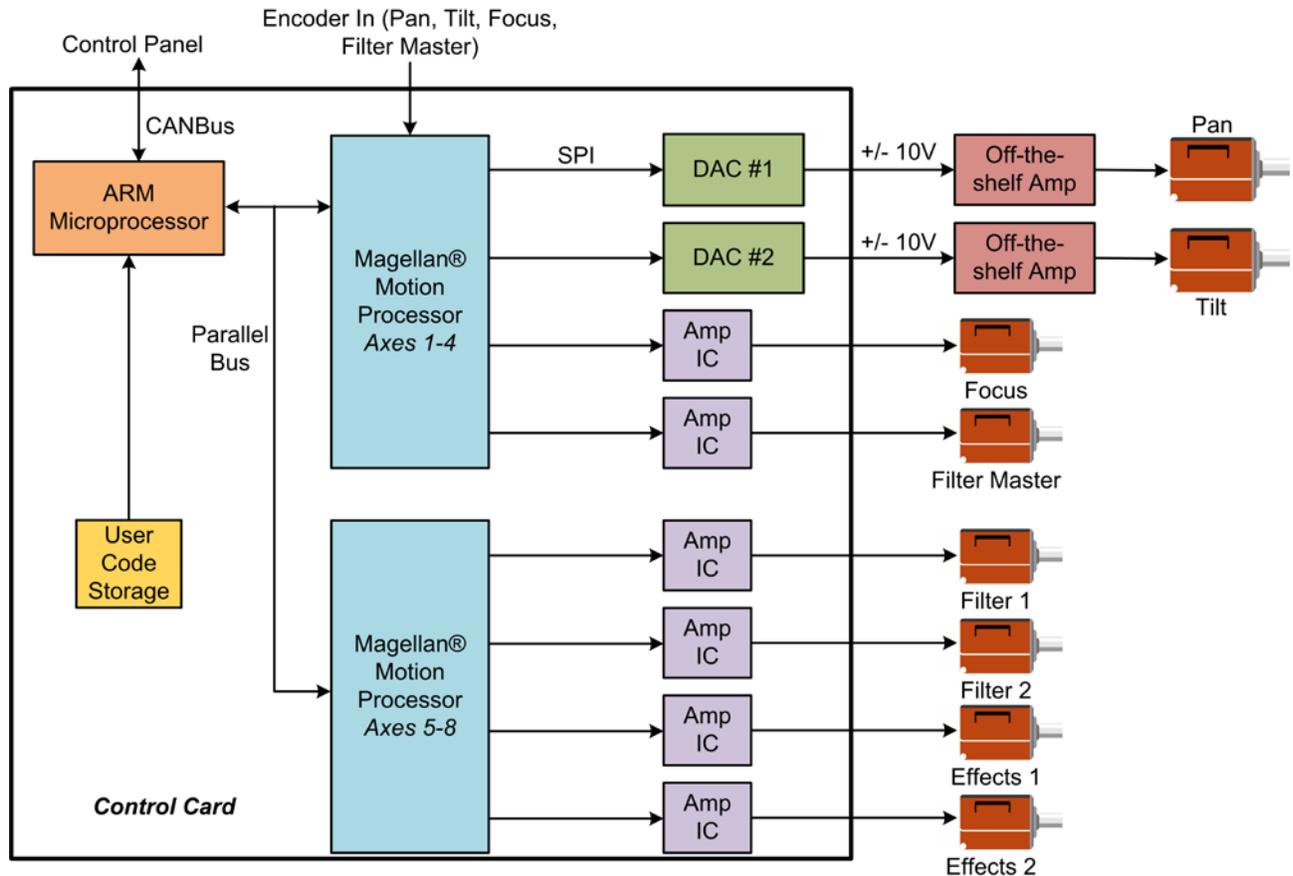


Figure 1: Automated Lighting Solution Controller Card

## Motion Control Solution

In this application, two four-axis **Magellan® Motion Processors** from PMD are used to provide all motion control functions. One of the Magellans controls two brushless DC motors and two step motors, and the other controls four step motors as shown in the figure above. The Magellans, an ARM-based microprocessor, a small keypad with LCD, and all associated peripheral circuitry are packed onto an 8" x 10.5" control card.

Two different types of amplifiers are used. Off-the-shelf brushless DC amplifiers drive the pan and tilt motors, and are connected to the Magellan via its SPI (Serial Peripheral Interface) output, which is driven by low cost dual serial D/As and op-amps that output +/-10 V. The remaining six axes are driven by on-board dedicated step motor amplifiers. These low-cost ICs accept an analog current reference for each motor phase from the Magellan, and provide current control as well as fast/slow decay control for higher step motor performance.

The ARM-based microprocessor holds the automated lighting controller application code, and connects to the two Magellans via a 16 bit parallel bus. It also connects to the central theatre control console via CANbus, using a proprietary protocol. In addition to the motion control functions, there are LEDs on the card, a small touch panel with LCD for servicing, and a serial port for teach pendant connection. The ARM manages all these functions using custom application code.

A unique feature of the software loaded onto the ARM microprocessor in this application is that it can 'pass through' commands from **PMD's motion software Pro-Motion** to the motor axes. In this mode, Pro-Motion, running from a standard Windows PC, allows a technician to remotely control and tune individual axes. This special application code is derived from PMD's PRP (PMD Resource access Protocol) processing library, which is used with all **CME (C-Motion Engine)** products.

The two brushless DC motors provide encoder feedback and are driven by a high speed servo loop by the Magellan IC. Two of the step motor axes use encoders to provide 100% motion confirmation, while four of the step motor axes are open loop.

## Going Further

The next step for a system such as this is to bring all of the amplifiers on board. Connectors and cables represent increased reliability risk, and dramatically increase the overall controller size. Solderable high density amplifiers can solve this problem. They can drive current as high as 10 amps, with footprints as small as 2.0 inches<sup>2</sup>.

The **Magellan® Family of Motion Control ICs** provides high performance chip-based motion control for multiple motor types. Magellan motion control ICs are available in 1, 2, 3, and 4-axis versions. They are designed for demanding and precise applications such as this single-card lighting controller solution and other automation and instrumentation challenges.



**Contact our customer support team at +1 781 674 9860 for more information including details on Developer's Kits and application support. We would like to assist you in improving your motion system.**