# Plasma USB Module

# ADDENDUM A: BOARD REV 1.01

**DOC No. : 16409-A**
**Rev. : A7-101**
**Date : 9, 2004**
**Firmware Rev. : 600-110**

The Plasma (Rev. A7-101) **Firmware Rev. 1.10** module you have received conforms functionally to the Plasma (Rev A7-101) **Document No. (16409)**, except for the difference described below.

## Plasma Configuration

The Plasma module has several user-adjustable DIP switches that allow the configuration of various onboard systems, features and device modes.

### Mode Selection DIP Switches

Mode selection DIP switches (Figure 1: S1 – SW1 & SW2) are used to set the device in 4 possible modes of operation.

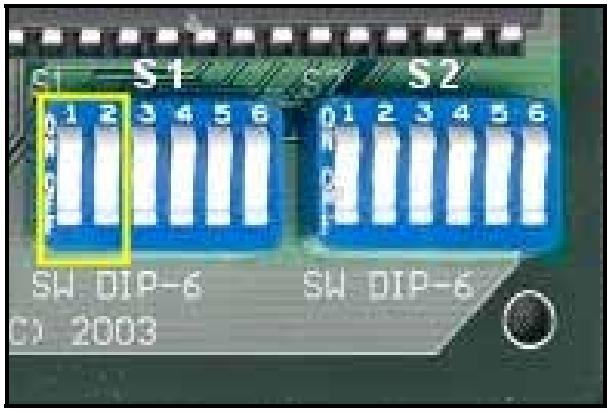



*Figure 1*

**DIP Switch S1:**

SW1 – DUAL mode switch
SW2 – HOTAS mode switch

**Modes of Operation:**

Mode A: *Plasma - USB Adapter*
S1 – SW1: OFF
S1 – SW2: OFF

Mode B: *Plasma - Dual USB Adapter*
S1 – SW1: ON
S1 – SW2: OFF

Mode C: *Plasma HOTAS - USB Adapter*
S1 – SW1: OFF
S1 – SW2: ON

Mode D: *Plasma HOTAS - Dual USB Adapter*
S1 – SW1: ON
S1 – SW2: ON

## Configuration Selection DIP Switches

Configuration selection DIP switches (Figure 2) can be used to activate additional features and affect all modes of operation.

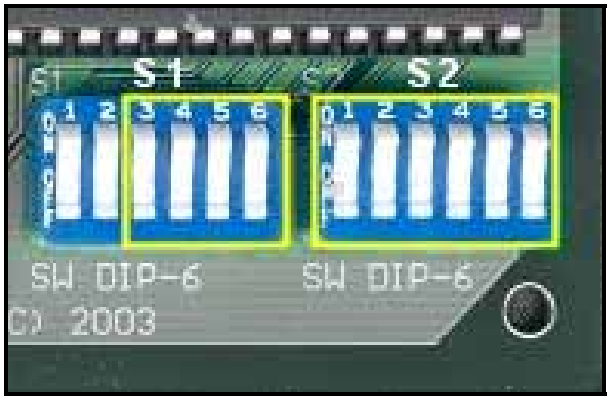



*Figure 2*

DIP Switch S1:

Switch 3 – **Level 1 Analog Axis Filter**, Device 1
Switch 4 – **Level 2 Analog Axis Filter**, Device 1 (Level 1 must be active)
Switch 5 – **Level 1 Analog Axis Filter**, Device 2
Switch 6 – **Level 2 Analog Axis Filter**, Device 2 (Level 1 must be active)

DIP Switch S2:

Switch 1 – **ACE Expansion Port**
Switch 2 – **ACE Rotaries** (ACE Expansion Port must be active)
Switch 3 – **Digital POV HATs**, Device 1
Switch 4 – **Digital POV HATs**, Device 2
Switch 5 – **Analog Axis Resolution** LSB (Least Significant Bit)
Switch 6 – **Analog Axis Resolution** MSB (Most Significant Bit)

## Configuration Options

**Level 1 Analog Axis Filter**: is adequate for eliminating a substantial amount of jitter (noise), but has poor attenuation properties on spikes and extreme cases of line noise. This level of filtering has no noticeable effect on input sensitivity.

**Level 2 Analog Axis Filter**: virtually eliminates most forms of spiking and line noise but may adversely affect input sensitivity. As a result, level 2 filtering should only be activated when absolutely necessary. Level 2 filtering will only work in conjunction with level 1 filtering therefore level 1 filtering *must be turned ON*.

NOTE: ACE rotaries are not filtered due to their digital nature.

To activate filtering on either device, toggle ON the appropriate dip switch on S1.

A substantial improvement was made over the filtering algorithm used in the previous version of Plasma with the addition of a user selectable level of filtering for jitter (noise) and spikes, the two most common drawbacks associated with potentiometers.

In certain instances where raw input data is preferred, reducing the axis resolution can be sufficient to effectively eliminate these undesired elements.

**ACE Expansion Port** – If you have connected an ACE add-on board to your Plasma unit you can activate the unit by toggling ON switch 1 on S2.

**ACE Rotaries** – Toggling ON switch 2 on S2, ACE rotary digital data will be used for the X & Y axis inputs on each device. The X and Y analog axis ports on Device 1 & 2 will no longer be active and ACE digital data will be used instead.

Leaving switch 2 on S2 in the OFF position will default all inputs of the ACE Expansion modules to button inputs increasing the button input count by 16 to each device in all modes.

NOTE: ACE axis data cannot be diverted to any other analog axis ports. ACE's are only available on the X & Y axis of each device of the Plasma unit in all modes of operation and are ideally suited for throttle levers.

**Digital POV HATs** – Each device on the Plasma unit has two POV HATs, which can be configured as either analog or digital. Digital HATs are 8-way POV whereas analog HATs are only 4-way POV and are based on the Thrustmaster standard.

To activate digital HATs, simply toggle to "on" the appropriate switch, SW3 for Device 1 HATs and/or SW4 for Device 2 HATs on S2. DIP switches that are in the "off" position default to analog HAT input mode.

**Analog Axis Resolution** – All analog axes have 4 pre-settable axis resolutions. One setting affects all analog inputs on the Plasma unit. The step number represents the maximum number of possible discrete positions on the output.

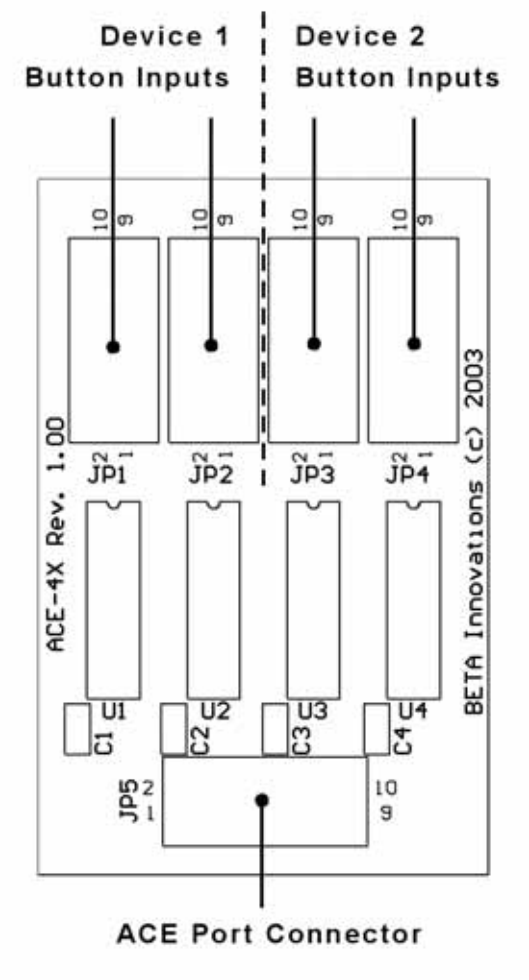
DIP Switch S2:
Switch 5 – Analog Axis Resolution LSB
Switch 6 – Analog Axis Resolution MSB

32 step resolution:
Switch 5 – off
Switch 6 – off
64 step resolution:
Switch 5 – on
Switch 6 – off
128 step resolution:
Switch 5 – off
Switch 6 – on
256 step resolution:
Switch 5 – on
Switch 6 – on

The higher the step size the more likely the output will suffer from the effects of jitter due to the LSB uncertainty in the ADC conversion process. As such, there is a trade off between resolution and stability of the output signal. The output signal stability is also heavily dependent on the use of high quality input devices (i.e. Hall Sensors, Potentiometers, etc.). Therefore, activation of the digital filter is recommended if a clean stable signal is required at the output while maintaining a high degree of step size and resolution.

## Plasma Pin-Out

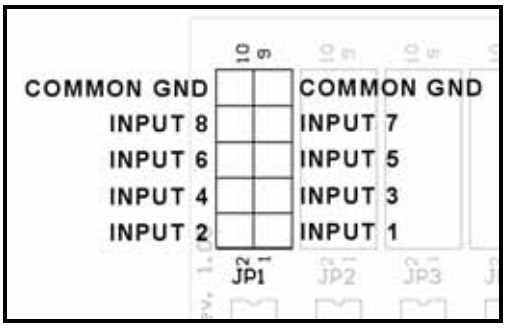
### ACE Expansion Module (Button Inputs Mode)



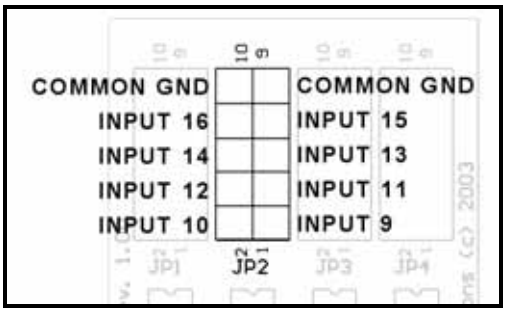

When the ACE expansion module is configured for button inputs, 16 additional button inputs per device become available in all modes. In Modes A & B, the additional inputs appear as buttons 17 through 32 and in Modes C & D, the additional inputs appear as buttons 33 through 48 on the Plasma device.

**NOTE: Button inputs in Modes C & D will not be visible in the Windows Games Controller applet. These additional 16 buttons are only available to applications that use DirectX Direct Input. If your application does not support these additional 16 inputs through DirectX, you can assign keyboard key macros by using Keyboard Studio for complete keyboard emulation.**

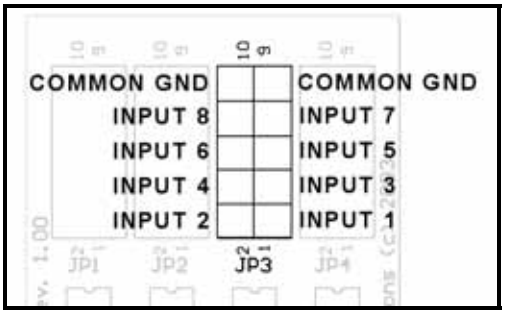
**JP1 – Device 1 Inputs**



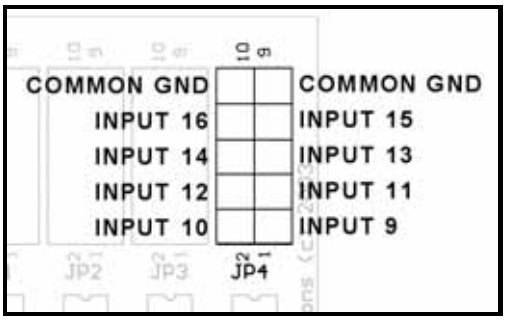

**JP2 – Device 1 Inputs**




**JP3 – Device 2 Inputs**

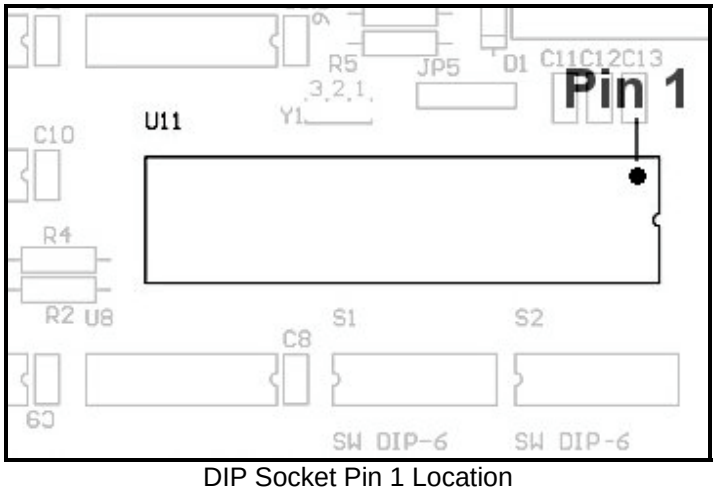



**JP4 – Device 2 Inputs**

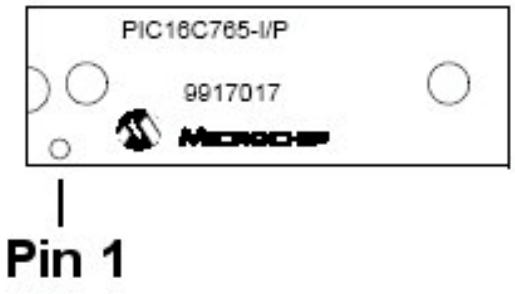


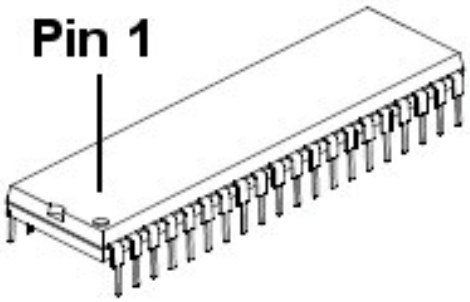
**IMPORTANT:** Clearly identify all PIN 1 positions prior to component placement. Particular attention must be paid to the orientation of the following critical components:

PIC16C765-I/P Microcontroller




DIP Socket Pin 1 Location




PIC16C765-I/P Pin 1 Location

## Hardware Specifications

The firmware runs at 40 ms iteration rate in all Modes of operation. As such, any custom interface software should poll this device at least every 40 ms to prevent lost inputs. The 40 ms interval time is more than adequate to debounce switch contacts if any are used as inputs. Note that all inputs are active low, which means you must ground an input in order to register a high “ON” signal at the output.

Most operating systems will detect and load the appropriate HID driver for your device and do not require that a custom device driver be installed. On some operating systems, these default drivers may not support all features of the Plasma module.

Maximum power consumption is 500mW (100mA) and is powered by the USB bus. You do not need to use an external power supply for this device, even when connecting (and powering) several rotary decoder modules to the onboard power pins specifically added for this purpose.

NOTE: **DO NOT CONNECT any of the Plasma Vcc pins to external power supplies or voltage sources.** Although common grounds can be safely connected to external grounds, it is not recommended and should be avoid whenever possible. Doing so may adversely affect performance, possibly causing strange or erratic behavior under certain conditions.

Visit www.betainnovations.com for the availability of kits, fully assembled modules and accessories.