

# **BFF PID Servo Controller (v2.6beta962) - Dimension Engineering Sabertooth controller Start Guide**

## ***Introduction***

Version v2.6beta of the BFF PID Servo Controller software adds support for Dimension Engineering Sabertooth and SyRen motor controllers. These may provide an alternative to the Devantech MD03 motor controllers initially used in the system.

Note this is a BETA development at present. I have not been able to load test the controllers although their unloaded behaviour in the servo drive seems smooth and well controlled.

This is up to date for v2.6beta962.

## ***Hardware Setup***

The hardware arrangement differs from that for the MD03 motor controllers – the Sabertooth/SyRen controllers are commanded directly from the PC and not from the 64/40SPU-1 signal processor card. So the I2C connector on the 64/40SPU-1 is unused when in Dimension Engineering controller mode.

The basic hardware layout is slightly different for systems that include SyRen controllers and those that only use Sabertooth controllers. Sabertooth controllers have a built-in serial data timeout feature which will stop the motor drive if serial data stops flowing from the controlling PC. SyRen's do not have this feature and in order to provide the necessary safety shut-down in the event of loss of data from the PC the S2 connectors on the SyRen must be wired to the 64/40SPU-1 – this wiring arrangement is shown in Figure 1 (on second to final page).

If potentiometer position feedback is being used the high/low drive enable output from the 40SPU-1 is on connector CN3-1, terminal 1. If MA3 encoder feedback is being used the high/low drive enable output is on connector CN3-2, terminal 1. (ie it is on the 1<sup>st</sup> terminal of the unused feedback connector.)

On 64SPU-1 cards the high/low drive enable output is connector AUX OUT 1.

Only 40SPU-1 cards with revision B firmware can provide the required high/low drive enable for the SyRen – ie cards ordered after Feb 2010. 64SPU-1 cards already have the required firmware.

For Sabertooth-only set ups S2 does not need to be wired to the 64/40SPU-1 – see wiring diagram shown in Figure 2.

The motor controllers must be configured for “Mode 4 – Packetised Serial” input. This is done using the dip-switch settings on the motor controllers – see the controller user documentation.

## ***Controller/Actuator Arrangement***

Dual channel Sabertooth 2x25's and single channel SyRen 25's can be combined to provide 3 motor drive channels for a 3 DOF motion platform drive by connecting their S1 input to the same TTL level RS232 Tx line.

Each motor controller must be set to a different address using the dip-switches on the

controllers. The mapping between the motor controller addresses and the drive actuator numbers is made by settings in the PID26.cfg configuration file.

For example, lines 34 to 36 should be set -

```
128-1      ;motion drive actuator 1 is controller 128 channel 1
128-2      ;motion drive actuator 2 is controller 128 channel 2
129-1      ;motion drive actuator 3 is controller 129 channel 1
```

### ***USB to TTL RS232 Adaptor Cable***

The serial input to the Dimension Engineering controllers must be TTL level, true (non-inverted) RSR232. This means the controllers can NOT be connected directly to a PC serial port and need to be connected through a level converter. This can be achieved using a MAX232 chip and capacitors, however it is probably most conveniently done using a USB/TTL converter cable. There are several on the market – [I have used this one](#).

S1 on the motor controllers must all be connected to Tx (data out from PC) and 0v connected to 0v on the cable. Rx on the cable is NOT connected as the serial comms with the Dimension Engineering controllers is one-way only.

When your USB/TTL converter cable is installed a virtual COM port is available and this COM port number must be set in the PID26.cfg file, together with the baud rate for the serial comms with the controllers.

For example lines 32 to 33 should be set -

```
COM2      ;COM port to use
38400     ;baud rate for sabertooth/syren comms
```

The Dimension Engineering controllers support 9600, 19200 and 38400 bauds – use the highest setting that gives reliable comms.

### ***Power & Motor Connections***

Sabertooth 2x25 and SyRen 25 controllers are limited to 24V operating voltages.

Sabertooth 2x50 units can be used at up to 48V – check the user documentation for full specs for the controllers you are using and do not exceed their recommended operating voltages.

Note that the motor connectors on the dual channel units are symmetrical (handed). The outer-most connectors are motor -ve and the inner-most motor connectors are motor +ve. See the wiring diagrams at the end of this document.

It may be convenient to include a removable connector on the battery + lines – the power supply will need to be removed from the controllers to power them down and re-set them if required.

## **Software Setup**

### **Driver Setup**

No unusual settings need to be made for the motion driver – it should be configured with MEM data output mode to allow the PID Servo Controller software to receive the actuator position demand data.

Please read the configuration settings sections of the Motion Driver User Manual for more information or read the text notes in the .bff configuration file examples.

### **PID Servo Controller Setup**

The system is configured to use Sabertooth and/or SyRen controllers using the PID Servo Controller's PID26.cfg configuration file in the motion driver file directory. Lines 31 to 37 are significant here.

Lines 31 to 37 – (note the comments should NOT be included in the file)

```
Serial2      ;"I2C" for MD03 controllers, "Serial2" for Dimension Engineering 2x25v2 and 2x50
              controllers, "Serial2x25" for use when Sabertooth 2x25v1 or Syren are connected.
COM2         ;COM port to send the Sabertooth commands to
38400        ;baud for sabertooth serial comms
128-1        ;controller address and channel for motion drive actuator 1 (pitch)
128-2        ;controller address and channel for motion drive actuator 2 (roll)
129-1        ;controller address and channel for motion drive actuator 3 (heave)
High         ;Process priority for the serial comms process used by the PID Servo Controller
```

**IMPORTANT:** If you are using Sabertooth 2x25 v1 or Syren controllers then output mode "Serial2x25" should be used instead of "Serial2". This removes the 2x50 specific set up commands from the output and is a precaution against Syren and/or Sabertooth 2x25 v1's mis-interpreting the 2x50 specific setup commands. This should not normally be a problem however there is a possible 2x25 firmware issue reported by Dimension Engineering in this area (June 2010).

For Sabertooth 2x25 v2's and 2x50's output mode "Serial2" should be used. NOTE the software assumes that the 2x25v2 and 2x50 default baud rate is set to 2400 – the commands to change the controllers to the final working baud are issued at 2400. You may need to use the Dimension Engineering DEScribe software to set 2400 baud before first use of the controllers. Or use the DEScribe software to set the full working baud in the first place – eg 38400.

Do not enter any duplicate address/channel combinations.

For 2 DOF platform drives the feedback from the unused drive channel to the 64/40SPU-1 card should be disabled using the binary settings in line 29 of the PID26.cfg file. See the 64/40SPU-1 data sheet for details of how to do this.

### **FS9/X Setup**

Other than installation of an up to date version of Pete Dowson's FSUIPC for the version of MSFS you are using there are no special setup requirements for the flight sim. FSUIPC must be installed for the motion driver to communicate with the flight sim.

Setting the flight sim not to pause on task switch will make swapping between the flight sim and motion driver windows more convenient as the flight will then not pause when you switch away from the flight sim window to view the motion driver window.

### ***Motion Driver and PID Servo Controller Operation***

Assuming the system wiring is complete (motor connections to the controllers should be left unattached until you are happy the comms between the PC, 64/40SPU-1 and Controllers are operating properly).

If you are using a joystick input configuration then the motion driver can be run on its own and the appropriate .bff configuration file selected.

If you are using the normal FS9/FSX flight sim input then the flight sim must be started and running BEFORE the motion driver is started.

In this case start a flight and put it into a stable position (eg parked on the ground). Start the motion driver and select your .bff configuration file.

Leave the driver in “Hold Start Position”. Make sure your Dimension Engineering controllers and 64/40SPU-1 card are powered-up and click “Start\_PID\_Controllers” to start the PID Controller software.

Once started it will ask you to confirm that the controllers are powered and available to accept configuration commands. Once confirmed the software will issue baud, timeout and other commands to the motor controllers before opening comms with the 64/40SPU-1 card to receive position feedback from the platform drives.

If the comms are operating properly you should see data refresh times reported by the PID Servo Controller of roughly 20 to 30 ms and continuous green LED (or slight flickering each data loop) on the 64/40SPU-1 card.

The separate background comms process that handles the serial comms with the Sabertooth / SyRen motor controllers can be made visible by hitting \s, \h will hide it again. The data refresh rate for this process should ideally be around 50 sets/sec – if it is a lot less than this try increasing the process priority setting to High in the PID26.cfg file. If this doesn't help (and you are running FSX on the same PC) then you might be better moving the motion software to a LAN PC so that it does not have to compete with FSX for the system resources it needs to run smoothly. See the driver user manual for use for LAN use. This is important, you will not achieve smooth platform motion if your PC is not powerful enough to support both FSX and the motion driver software – it is better to move the motion software on to a LAN PC – even an old single core machine will be fine.

The v2.6beta PID Servo Controller has three drive settings (previous versions had only two).

The controller will start in “Stop Motion” mode – in this mode zero speeds are demanded from the motor controllers – ie the platform is instructed to stop motion at its current position.

In “Hold at Start Pos” mode the servo drive will move the platform to the “start/park” positions specified through the motion driver .bff configuration file. It will do this at a reduced speed.

In “Engage Drive” mode the controller will resume live position following to follow the position demands sent by the BFF Motion Driver.

The normal start-up procedure would be -

...with the Motion Driver running and in “Hold Start Position” mode,

1. start the PID controller (in “Stop Motion” mode).
2. select PID controller “Hold at Start Pos” mode to move the platform to its start position.
3. select PID controller “Engage Drive” mode to enable live position following.
4. in the BFF Motion Driver select “Drive” to commence motion.

The normal shut-down procedure would be -

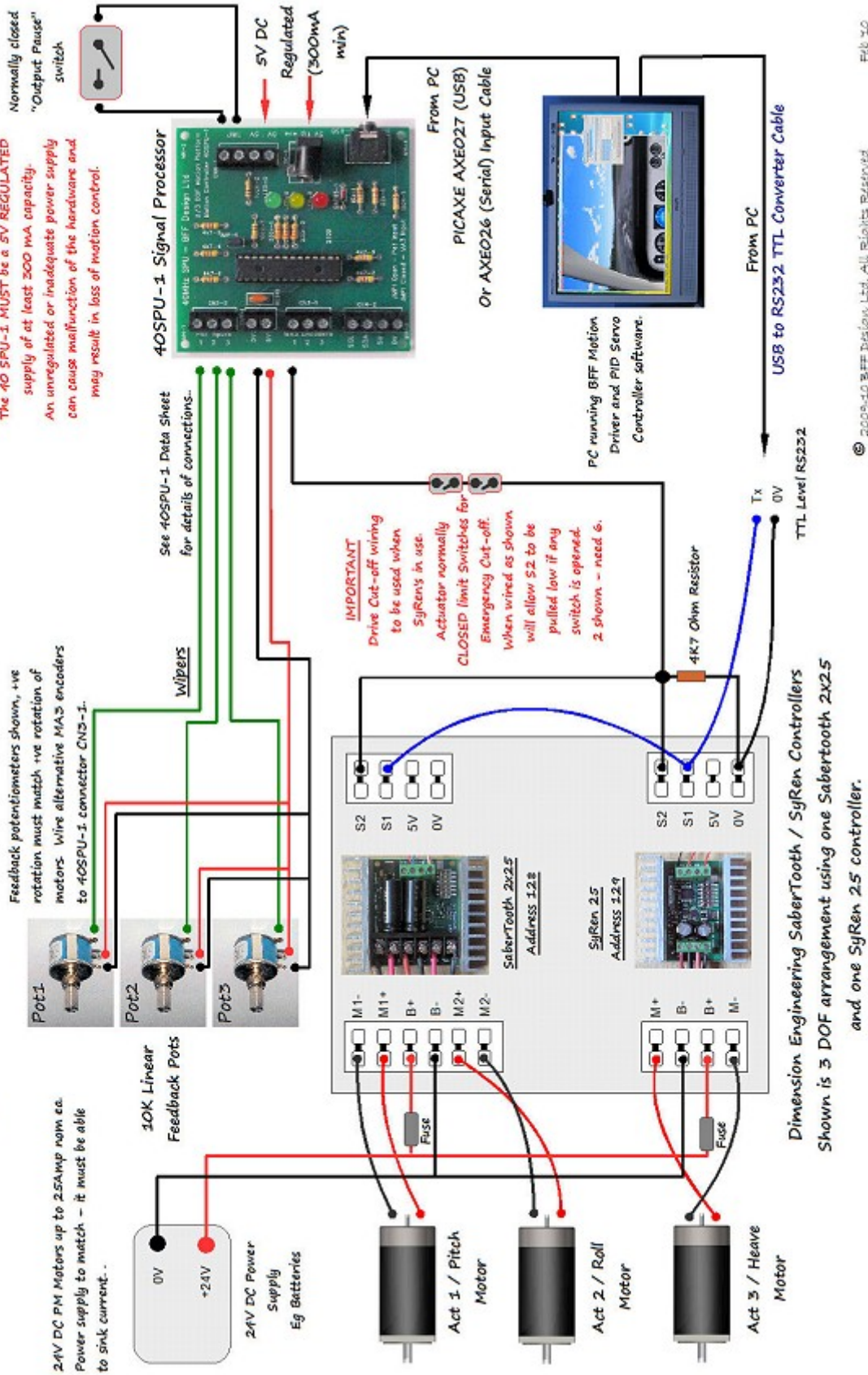
1. in the BFF Motion Driver select “Hold Start Position” to slowly park the platform.
2. select PID controller “Hold at Start Pos” mode to disengage position following and keep the platform at its start position.
3. select PID controller “Stop Motion” to demand zero actuator speed to disable system induced motion.

The PID Servo Controller can be closed down when platform unloading is complete or when otherwise required. Note that when the PID Servo Controller is closed the servo drive will release control of the drive motors and the platform may drift into a different “relaxed” position. Where this position actually is depends on the load on the actuators and their unpowered mechanical and electrical characteristics.

See the User Manual for details of the other on-screen adjustments available through the Motion Driver and PID servo Controller window.

**FIGURE 1 – Illustrative wiring for set ups with SyRen controllers**

**DIY Motion Platform Illustrative System Wiring – With Dimension Engineering  
SaberTooth x 2.5 / SyRen 2.5 Controllers**

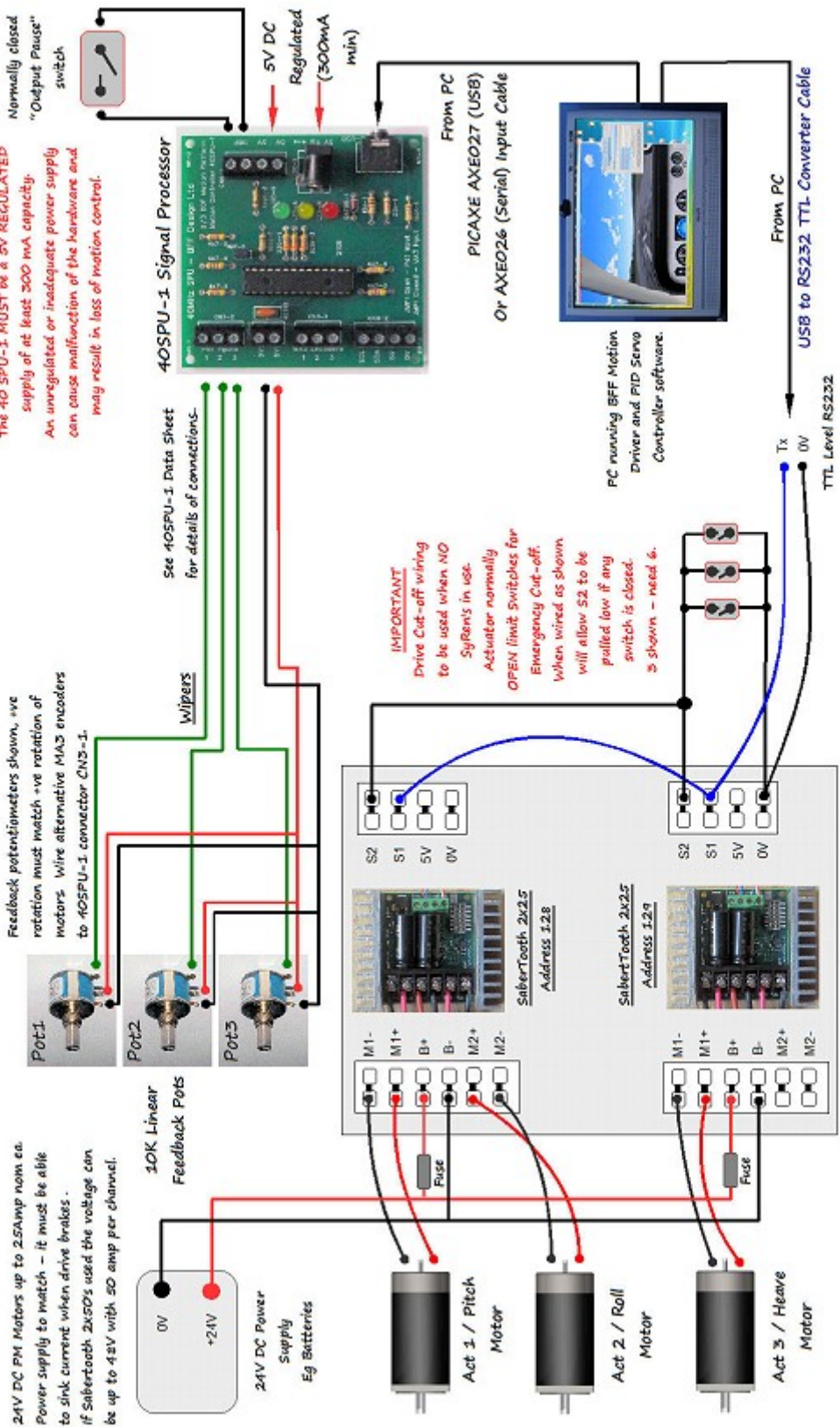


**NOTE** For 64SPU-1 card use SyRen high/low drive enable is from AUX OUT 1.



**FIGURE 2 – Illustrative wiring for set ups with NO SyRen controllers**

**DIY Motion Platform Illustrative System Wiring – With Dimension Engineering Sabertooth 2x2.5 (or 2x50) Controllers.**



Dimension Engineering Sabertooth Controllers  
Shown is 3 DOF arrangement using two Sabertooth 2x2.5 Controllers (wiring similar for 2x50 controllers).