

## NOTES – BFF CL System Wiring

### A) **IMPORTANT – POWER SUPPLY PROVISION**

The BLDRV2-24 cards operate on a 24V DC power supply. The PSU to be used MUST be a smooth, voltage regulated supply capable of sustaining the supply voltage at the demanded current draws – variation of the supply voltage above the data sheet specifications will damage the cards, and any electrical noise on the supply will be felt as roughness in the force feedback at the controls.

A suggested PSU is **Mean Well S-350-24** or similar. This is a 24V 14.6 Amp power supply suitable for 2 axis systems,

**See - <http://www.meanwell.com/search/s-350/s-350-spec.pdf>**

The Mean Well SE-450-24 18.8 Amp is suitable for most 3 axis systems. However if all three axes are to be used routinely at full output simultaneously then a larger PSU may be required.

1. BFF Control Loader software and FS9/X with FSUIPC or with X-Plane V9.6+ and XPUIPC. For X-Plane use a custom XPUUIPCS offsets file must be installed – see CL Software user guide.

The CL software can be run on a networked PC via WideFS.

2. Three BLDRV2-24 brushless motor drivers are shown – one for each control axis. Elevator, aileron or rudder allocation is set using jumper settings on the cards.

The driver cards are normally connected together and to the CL\_SPU card using the on-board inter-pcb header connectors. They are shown separated in the diagram for sake of clarity.

PC comms is to the CL\_SPU card via a FTDI chipset USB/TTL cable. **The FTDI cable must be programmed for inverted RS232 signals (idle low).**

3. Wiring details are shown for the Elevator drive only – the Aileron and Rudder wiring is the same to their respective drivers. All the drivers can be supplied from the same 24V DC power source so long as it has adequate current capacity.

PLEASE NOTE the grounding requirements for the cards described in the driver card data sheet section 3.L.

The driver to motor wiring connects the 3 power phases, the quadrature encoder and one hall-effect position sensor to the driver. The hall sensor input is used to calibrate the absolute position for the quadrature encoder. The quadrature encoder provides the continuous motor shaft position feedback required for the motor commutation.

4. Position feedback to FSX via a joystick card is NOT normally required for the main control axes. The control positions can instead instead derived from the motor

encoders and sent to the flight sim via FSUIPC. This can be overridden in the CL software settings to allow potentiometer position feedback to FSX if required.

A joystick card will be required for trim inputs – either via pots or buttons.

Joystick card axes or buttons can be assigned to the CL system trim inputs using the Configuration Manager Tab 7.

Do not enable these trim axis assignments in FS9/X and do not use the FS9/X internal trim adjustments otherwise the sim and CL flight controls zero positions will not match.

5. Low cogging force feedback motors. Brushless DC motors with sinusoidal back EMF characteristics of the type specified. Not all low cost BLDC motors will operate satisfactorily in a CL system – even with the BLDRV-12/24 drivers. Many have trapezoidal back-emf characteristics and can not generate smooth enough torque output.

The motors should have 360cpr quadrature encoders fitted.

The mechanical design of the motor to control drive is another critical area for the overall system performance, as is the mechanical connection of the position pots to the controls. Transmissions must be stiff and precise with low levels of friction and as little backlash as is possible.

6. The Aileron and Rudder axis wiring is the same as is shown for the Aileron. All three drivers can share the same power supply if it has adequate current capacity.
7. To maintain smooth performance the BFF CL software needs to export the force demands to the CL\_SPU at high baud rates. The default baud is 516129 to match the baud of the CL\_SPU default programming. This is a non-standard baud but it is supported by FTDI chip based USB/TTL cables. To obtain best results at this baud the “Latency Timer” setting in the advanced options for the virtual com port associated with your cable(s) should be reduced from 16 to 1 or 2 ms. Do this through the control panel – device manager on the PC.
8. A single throw double pole on/off switch is required to correctly switch on/off the logic power to the CL\_SPU.

The USB/TTL cable side of the CL-SPU card is fully electrically isolated from the BLDRV2-24 side. The logic level circuits on both sides are therefore separately powered. The STDP switch connected to jumpers JMP-1 and JMP-2 ensures the logic power to both sides is switched on/off simultaneously.