

NOTES – BFF DIY Control Loader System Wiring & Config.

1. BFF Control Loader software and FS9/X with registered FSUIPC installed. Ideally the PC should be capable of running the CL Software at or around 500Hz. The CL software can be moved to a LAN PC if the refresh rates are not high enough when it tries to run alongside FS9/X.
Add the following line to the [Keys] section of your FSUIPC.ini file to ensure proper matching of elevator zero position following AP disengage in FS9/X.
23=222,10,65706,1,65706,0
2. The 64SPU-1 card should be electrically isolated from the MD03 motor controllers using a BFF I2C Isolator card. The 64SPU-1 can process force demands from the PC software at a max rate of approx 500Hz. Sending data faster than this will not cause a problem however the intermediate data packets will be ignored. Force demands will only be passed on to the MD03's when the force level changes.
3. BFF I2C Isolator card to isolate the 64SPU and control end of the system from any noise generated by the MD03's and/or drive motors. Isolation is very important for removing noise from the control axis position feedback signals.
4. MD03 motor controllers set for I2C operation with the addresses shown. The I2C addresses match the output to the control axes. Note the MD03's are 8 bit controllers and this provides one limit to the smoothness of the force feedback. The force range can't be implemented any smoother than in 255 steps. Also the MD03's have a fixed upper limit on rate of change of motor voltage change and this means that the response to very fast rates of force change will be inhibited. This will affect reproduction of fast vibration effects.
5. Bodnar BU083A 12bit joystick card. NOTE the 10bit version of the BU083 is NOT suitable. 12bit resolution on the control axis position feedback is a minimum requirement for an effective force feedback. The max refresh rate of the position feedback with the board is 500Hz. Note the joystick axis mappings to the control axes – Aileron – X, Elevator – Y, Rudder – Z, Elev Trim – RX, Aileron Trim – RY, Rudder Trim – RZ. 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.
6. Precision potentiometers must be used for the control axis position reporting. They should be mechanically geared to ensure that as much of their electrical working range is employed as possible – this helps to maximise the resolution of the position reporting. The pots should be electrically isolated from the drive motors to prevent noise propagating to the position signals. The pots must be connected to the BU083A card using shielded cable and the cable shields should be grounded to 0V on the BU083A card. This will help to minimise the effects of RF radiation from the motors on the signal resolution.
7. The CL software implements trim forces separately from the FS9/X internal trim system. Three trim posts are required – connected as shown to the joystick board.
8. Force feedback motors. I have obtained best force smoothness using disc armature (pancake) type motors only. Skewed rotor servo motors are next best but are probably not satisfactory. Other DC motor types will not give smooth enough shaft torque output.
If possible ground the motor cases and power cable shielding to minimise noise

transmission effects.

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.

9. In general the high current/voltage end of the system (motors, batteries and motor controller power electronics) should be physically separated from the low current/voltage logic electronics. Keep power lines and logic lines separate from each other. The quality of the flight control position reporting through the 12bit joystick card is critical to the system performance and all steps should be taken to isolate the pot signals from noise sources.
10. To maintain high control loop refresh rates the BFF CL software needs to export the force demands to the 64SPU-1 at high baud rates. The default baud is 516129 to match the baud of the 64SPU-1 default programming. This is a non-standard baud but it is supported by FTDI chip based USB/Serial cables and so also the PICAXE AXE027 cable. To obtain best results at this baud the "Latency Timer" setting in the advanced options for the virtual com port associated with your cable should be reduced from 16 to 1 ms. Do this through the control panel – device manager on the PC.