PFC.DLL: Precision Flight Controls interfacing module

for Microsoft Flight Simulator

Freeware by Pete Dowson, © 6th March 2007

Support Forum: http://forums.simflight.com/viewforum.php?f=54

PFC is Precision Flight Controls, Inc,
makers of quality flight simulation controls and displays.

(see http://www.flypfc.com).

Version 2.20 of PFC.dll *(for FS9 and before)*
and
Version 4.20, PFCFSX.DLL *(for FSX and beyond)*

Note: All my Windows based software is always available in the latest versions from http://www.schiratti.com/dowson **.** (Selected modules are also available elsewhere). This is *not* my web site (I have none) but the list is there courtesy of Enrico Schiratti

PFC.dll also needs FSUIPC Version 3.53 or later for correct operation. The current version is 3.731
PFCFSX.dll needs FSUIPC4 for FSX—any version, but latest is best. The current version is 4.081

This package contains the following parts:

PFC.dll	PFC version 2 module, for FS9 and earlier
PFCFSX.dll	PFCFSX version 4 module, for FSX and hopefully succeeding versions
PFC.DLL User Guide.doc	This document: please read it! (Word 97 format)
PFC.DLL User Guide.pdf	This document (in Adobe Acrobat format)

USERS OF PREVIOUS VERSIONS SHOULD REFER TO IMPORTANT CHANGES IN THE *HISTORY* SECTION!

Introduction: what is PFC.DLL?

This program is a Microsoft Flight Simulator driver for the COM-port connected equipment produced by PFC Inc. It currently handles the following PFC products:

Any one control console out of these:

- Throttle Quadrant Console
- Cirrus II Console with built-in Jetliner, Beech or Mooney yoke
- Professional Flight Console, with or without hardware trim mechanism
- Jetliner Console with built in Avionics Stack and Jet-style "RIC" section
- Jet Cockpit, built to emulate a 737NG series aircraft
- PFC 737NG MCP with optional EFIS switch boxes and six-pack indicators
  (*The MCP can also be used in combination with one of the consoles provided the console is connected through the MCP and the latter is set to run at 9600 bps*).

with the following connecting options:

- Rudder pedals, with digital or analogue toe brakes
- Avionics Stack, except for Jetliner console and Jet Cockpit, where it is built in
- Remote Instrument Controller (RIC), connecting to the separate Avionics Stack
- Separate yoke connected via the controller, except for the Jet Cockpit, Cirrus II and Professional Consoles, where one is built in

NOTE that this driver does *not* support Game Port connected controls, such as those also made and supplied by PFC. For Game Port connections you will need a normal joystick driver and will follow the standard installation and calibrations for joysticks in both Windows and Flight Simulator. The same applies to other USB connected controls.

Also please note that the Rudder Trim knob on the consoles (but not in the cockpit) is a hardware trimming device and only applies to rudders actually connected through the console, not those connected to a Game Port or USB input.

All functions are either pre-programmed or user programmable, with some exceptions often depending upon whether you are using standard FS panels or one of the special ones supported: **Project Magenta** by Enrico Schiratti (PM), or **767 Pilot in Command** by Wilco (767PIC).

For use with 767PIC you must be using Windows 98 or 2000, or later. Earlier versions of Windows do not support the facilities used to send keystrokes, and Win NT doesn't support FSUIPC which is needed. Without the keystroke facilities you will not be able to successfully use the keystroke programming facilities, nor the 767 PIC option. Also, be aware that the integration for the FS2002 version of 767PIC is *much* better if you upgrade to version 1.3 of the panel. The update is available from the Wilco site and also from www.mcp747.com. [*767PIC support is **not** extended to the Jet Cockpit or MCP implementations*]

PFC.dll is a module for FS2000, FS2002 or FS2004, and it should be placed into the 'Modules' folder—see the **Installation** section below. It also needs the FSUIPC.dll module installed, of a suitable revision level. The FSUIPC package is *not* included here. Please note that updates to FSUIPC are quite frequent—please check the appropriate web sites, such as the Schiratti one mentioned above, and certainly obtain the full package for the documentation.

This module may work with FS98, CFS1 and CFS2, but at the time of this Release it has not been tested with those Microsoft simulators. If it does work, the functionality will not be as complete as with FS2000/2/4, for which it has been optimised. It **cannot** be used with CFS3.

PFCFSX.dll is a module for FSX, but it is loaded by FSUIPC4 *not* directly by FSX. You must have previously installed FSUIPC4 correctly. Then you can place PFCFSX.dll into the 'Modules' folder created by the FSUIPC4 installation. The FSUIPC4 package is *not* included here.

With only one minor difference the action and operation of the two versions of the PFC driver is identical. The difference is only where, in FS, you find the options menu entry.

Installation

For FS9 (FS2004) and earlier: copy the PFC.DLL file into your flight simulator Modules folder. Do the same with FSUIPC.DLL, if you haven't already installed this module.

For FSX, you *must* install FSUIPC4 first if you've not already done so. The FSUIPC4 installer will create a Modules folder, and it is onto that folder you then must copy the PFCFSX.DLL.

IMPORTANT: If you cannot *see* the DLL, please go to the Explorer's View menu. Select "Folder Options" and then the "View" Tab. Then choose either the "Show all files" button or the "Do not show hidden files"—anything *but* the "Do not show hidden or system files" button! (Windows 98 now seems to regard all DLLs as system files and not the "application extensions" they usually are!).

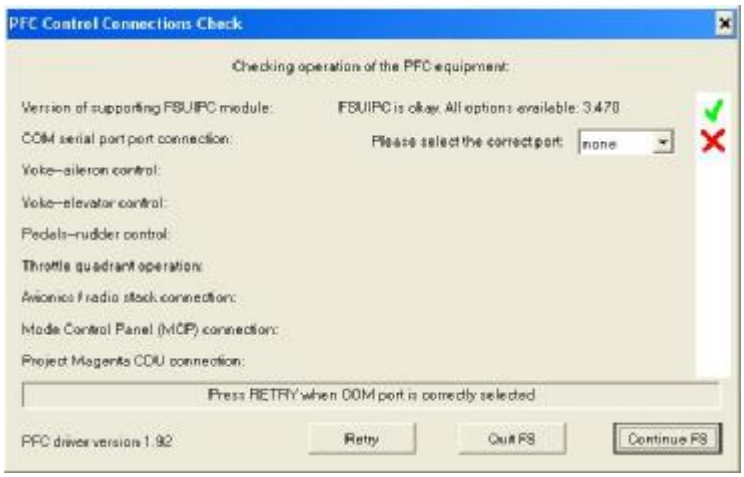
That's it!

WARNING (FS9 and before): Do **NOT** keep multiple versions of PFC (or any other module) in the Modules folder with simple renaming. If they are in that folder and still have the file type "DLL" they will still be loaded and used by Flight Simulator. The name is actually not relevant at all—Flight Simulator looks at all DLL files in that folder and loads all those that show the right external links. If you want to keep older versions of any modules, make a separate folder (e.g. "OldModules") and put them in there, with any name you like. (This warning is not applicable to FSX).

Okay. Now make sure you know which COM port is being used for your PFC equipment. This will usually be COM1 or COM2, but it is possible to install more than two COM ports on a PC. If possible, use a serial port adapter for USB instead of a real COM port—these give much more reliable operation, especially on Windows XP installations. When using one of these, you also install an appropriate driver (supplied with the adapter), and this effectively adds another COMn port, probably COM3, or one more than the number of COM ports already installed.

If you are using a PFC 737NG MCP ****(see Note below)**, please not that it already has a USB adapter built in, and can be connected directly to a PC USB port. The driver should have been supplied with it. Use the USB connection in preference to the serial connection. If you have another console, such as the Jetliner, connect that by serial cable to the MCP. At the time of writing the MCP normally operates at 19200 bps, but will have to be slowed to 9600 (by internal jumper) to allow the additional console to work.

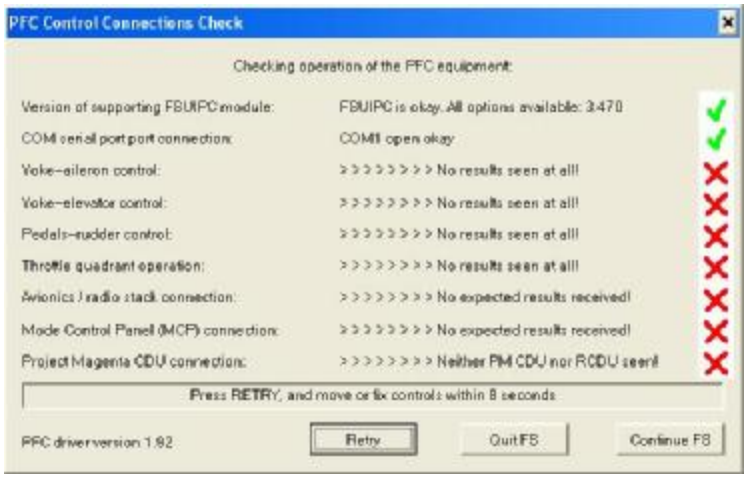
Load up Flight Simulator*. When you run it the first time after installing PFC.DLL or PFCFSX.DLL it will execute some connection checks, and will prompt you to configure the correct COM port as shown here:



**** NOTE:** The PFC MCP normally operates at 19200 bps, not the usual 9600 bps of other PFC devices. The PFC driver cannot detect this. If you have only the MCP connected and are using the PFC DLL for it rather than, say, the Project Magenta MCP.EXE connection, then you will need to add/or change the following parameter in the PFC.INI (or PFCFSX.INI file after running FS with the DLL installed for the first time. Close down FS and edit the file:

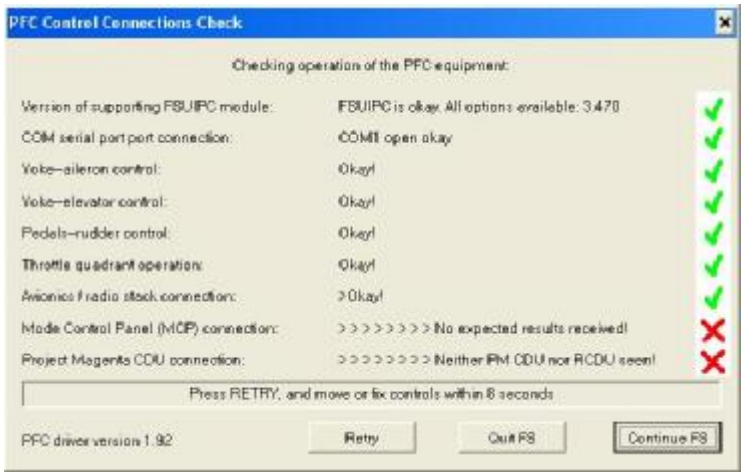
```
[Connection]
Speed=19200
```

Once you've done this, the connection checks will continue, but you may get the results as shown below:



The driver should normally work directly after the COM port is selected, but in some cases you will have to restart FS once the COM port is selected. To do this simply click the "Quit FS" button and load FS again.

Hopefully you will get something more like this, depending upon what you have connected:



Here all of the main PFC connections are okay (yoke, pedals, throttle quadrant and avionics stack), but there's no Project Magenta CDU or RCDU, and no MCP (whether the hardware PFC MCP or the Project Magenta MCP program).

Note that the checks do not necessarily operate automatically all the time. You may have to move the yoke or pedals, and at least ensure that some levers on the quadrant are not parked firmly at idle. By waiting or pressing "Retry" you get another few seconds in which to operate the controls to see if the driver recognises them correctly. Or you can either Quit FS, or elect to Abort the checks and continue with Flight Simulator.

Once in FS proper, and ready to fly, you can enter the PFC driver options via ALT P, and tell it not to run these checks next time. If you are using the PFC 737NG cockpit this is not allowed, and, in fact, if you abort the checks then you will get a warning.

You can also change the COM port in the main PFC options, but this is not really recommended. However, these procedures will be made clear in the following sections.

Setting PFC options

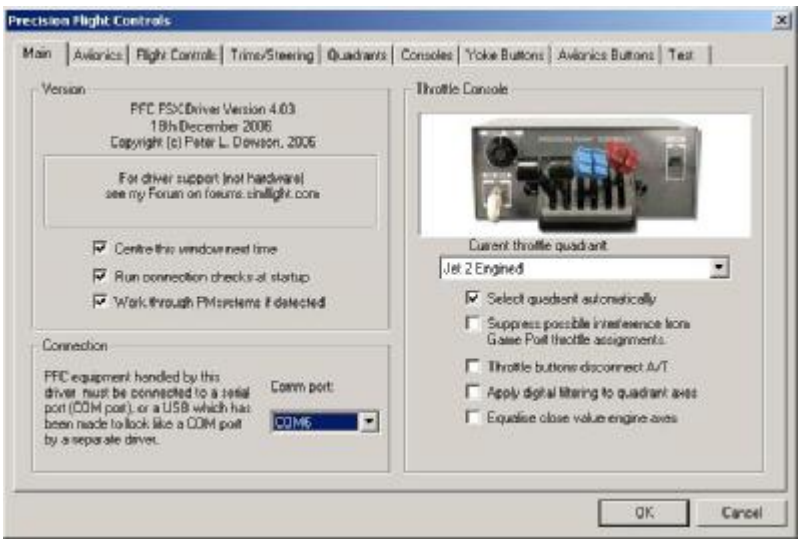
Options in PFC are actually controlled by parameter settings in a file called PFC.INI or PFCFSX.INI, respectively. This is not supplied with PFC, but it is generated the first time you run FS with PFC installed. It sits next to PFC in the FS Modules folder. If at any time you run into trouble, always try deleting this INI file before running Flight Sim, so that all the options are reset to defaults. It is actually a good idea to do this when updating to later versions of the DLL too, as some things may have been changed rendering some of the parameters in the INI file redundant or plain incorrect.

On the other hand, if you have spent time setting up the equipment and the driver settings to your liking, and it is all working well, please do take the precaution of making a back-up copy of the INI file, in case it ever gets corrupted or deleted. Also, if you have a good working installation for, say, FS9, you can copy the PFC.INI file over to your new FSX installation, in with the PFCFSX.DLL, renaming it PFCFSX.INI so that you don't have to set things up all over again for the new Sim.

Of course, if you do lose your INI file, or have cause to delete it and start again, you will have to re-specify the COM port and check your other settings, as now described.

All of the options of general interest are accessible whilst running FS, via a Menu entry. This is by far the best and easiest way to access the more popular options. There are some rather obscure ones which can only be accessed by editing the INI file, but these are not useful to most users and are only briefly described towards the end of this document, for more experienced users.

With the appropriate PFC DLL correctly installed, and Flight Simulator running and ready, look at the Menu. (Press ALT to bring it up if it is hidden). On FS9 or earlier there should be a PFC item. On FSX you will have to first select the Add-Ons menu entry, and then you should see the PFC entry next to the FSUIPC one. Either way, select it now. You will get the first page of the PFC Options display, very similar to the one shown here (the version number, date will be different, and there may be other minor differences:



Before going on to look briefly at each page of Options provided by the DLL, a quick word about how to operate the window. The tabs at the top select between various "pages" of options. You can visit all these, make changes, as you like, but nothing is actually changed until you press the "OK" button. If you press the ESCape key or "Cancel", or close the window using the close button at top right, then *none* of the changes you have made on *any* page will be effective. Pressing the "OK" button confirms *all* the changes made in *all* pages. You can re-visit any and all before confirming them in this way.

To get started

The various Settings pages contain quite a lot of options and settings you will want to look at and maybe change later, but to get started and try out your equipment you just initially need to pay attention to these parts:

1. Selecting the correct COM port for the PFC connection. You should have done this already, in the Connection Checks dialogue. If you need to change it, this is in the **Main Options** page as shown selected above.
2. The driver cannot detect what PFC equipment you have, so you need to tell it where it matters. The driver defaults to assuming you are using a Cirrus II console. If you are ***NOT*** using one of these, go to the **Consoles** page, select "Cirrus II Console" in the left/right selection window at the top (if it is not already selected), and uncheck the top right option which says you are using one. If you don't do this, and are using a Throttle Quadrant Console, then you may get some spurious switch settings made when you first load Flight Simulator.

3. If you are using a Jetliner Console or Jet Cockpit, go again to the **Consoles** page, select "Jetliner Console" or "Jet Cockpit" in the left/right selection window at the top, and **check** the top right option to say you are using one. (**NOTE:** if you are using a Cirrus II or Professional Flight Console, you can select both the Cirrus and the Jetliner consoles in the driver, but it will still act as if the Cirrus II or Pro is being used).

4. For you lucky 737NG cockpit users there's a separate page for you to check. If you do not say that you are using one of these, you will find that most of the extra buttons and switches in that simulator will not function correctrly.

5. If you are using a Cirrus II, Professional console or Cockpit, or have a yoke connected through the PFC console and so into the same COM port, you will need to enable the aileron and elevator axis in the **Flight Controls** page, and perform the calibration there too (more on calibration later). These are not enabled by default to avoid interference with Game or USB port yokes.

6. The same thing goes for rudder pedals and their toe brakes, if connected through the PFC system. PFC DLL handles both digital (on/off) and analogue toe brakes. See the **Flight Controls** page. Currently the **Trims and Steering** assignments need only to be made for the Jet Cockpit.

7. If you will *not* be using Wilco's 767 PIC (not really supported well for FS2004, and cetainly not for FSX) then it may be a good idea to check the option on the **Main** options page to "suppress possible interference from Game Port throttle assignments". Otherwise you should make sure there are no remnant assignments to Throttle axes in the Flight Simulator CFG file in the main FS folder). Unfortunately this option cannot be defaulted on, because the 767PIC auto-throttle uses the same joystick controls to manage the throttle inputs. The Phoenix (PSS) series of airliners also do this, and additionally in this case I don't think many of the autopilot functions work anyway with the PFC provisions—the PSS aircraft seem to use their own entirely independent autopilot.

   There will certainly be other add-on packages that do something similar.

8. Finally, for each Throttle Quadrant you own, you'll want to fix it to the Console, and enable it and calibrate it in the **Throttle Quadrants** page. For the Jet cockpit, the selection will almost certainly be the 737NG quadrant, which will be selected automatically for you.

Main Options Page

First, after installation, you must select the correct **Comm Port** (also known as a *serial port*). This is the one to which your PFC equipment is connected. The sockets may be marked A and B or 1 and 2, but these equate to the ports named COM1 and COM2 respectively. You may even have extra boards installed, or USB serial adapters, giving you more serial ports. Only those found available will be listed here.

If you did not set the COM port in the initial Connections Check, set it now. Click on the drop-down u button and select the correct entry, either using the mouse or the cursor keys.

If you are a Project Magenta user and run Pmsystems, some of the switches on your console, especially in the 737NG cockpit and on the Jetliner Console, will be routed via Pmsystems when it is running, instead of directly to FS. If you do not want this to happen, uncheck the **Work through Pmsystems if detected** option. (If you do not use Pmsystems this option is not relevant in any case).

The other options on this page, related to the Throttle Quadrant selection, are now described.

Throttle Console

The picture shown on this page shows the separate Throttle Quadrant Console, but everything specific to throttle quadrants detailed here applies equally to the throttle quadrant portion of the Cirrus II, Professional and Jetliner consoles, and the Cockpit.

On the Main Options page you can select the specific quadrant you wish to use, by clicking on the appropriate one in the drop-down list, or specify to the DLL that it should select the quadrant automatically depending upon the specific aircraft you have loaded into Flight Sim.

For the automatic facility to work correctly, you must do two things:

1. Go through all the Quadrants in the "Throttle Quadrants" Page, enabling all those quadrants which you have available to affix to the console. Do this by checking the "Enabled" checkbox top left of each quadrant page.
2. When you load and aircraft, be sure to change the actual Quadrant affixed to the console to the most appropriate one corresponding to the aircraft type.

For FS2000, FS2002, FS2004 or FSX, when you go to the specific Throttle Quadrant pages, you will also see a button at the top labelled "Assign to Aircraft". For foolproof automatic selection of a specific quadrant to a specific aircraft, by name, click that button. The driver will record the aircraft name and quadrant number in its INI file so that it will always use this quadrant for this aircraft—provided you have the automatic facility checked, of course. When you have an aircraft loaded with a specifically assigned Quadrant, the Quadrants section of the Main Options will have a button labelled "Delete current aircraft assignment", which simply undoes the assignment for the current aircraft. Each quadrant can be assigned to any number of aircraft.

If you don't explicitly assign quadrants to aircraft, the driver reverts to a simple system for determining the "best fit". This is not foolproof, it can only select amongst the standard configurations, and it will only be approximate when you have fewer quadrants than the variety of aircraft you fly. If you do have any problems with automatic selection, either use the assignment system, or turn the option off and always select manually, from the list.

As well as the ten different Quadrants currently available from PFC, facilities are provided for you to program the six levers to do whatever you want. Up to 15 such 'user configurations' can be specified and saved—more details are given later, in the appropriate section, of how to do this. User configurations can be assigned to specific aircraft in automatic mode, but will not be selected automatically without assignment.

Before actually using any throttle quadrant in Flight Sim, you should turn to the appropriate section in the Throttle Quadrants page and calibrate each lever correctly. Calibrations are saved for each throttle quadrant, so you should only have to do this once for each. More details in the appropriate section, later.

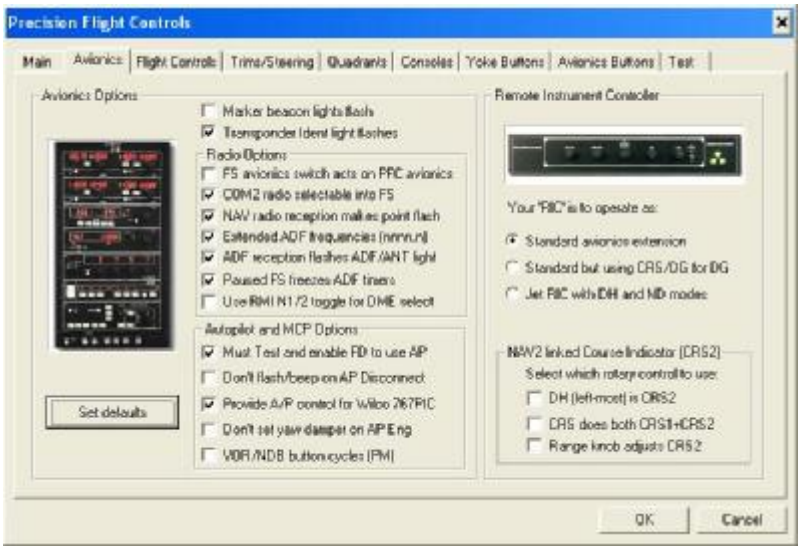
The option for suppressing joystick throttle inputs is important. It is there because, if you are using any joystick (or simply have one connected to a Game Port (or USB) but not in use with Flight Simulator), it is possible for the simulator to make assignments for the throttles. These appear in its CFG file automatically. They can cause FS to read spurious values that prevent proper operation of the Throttle Quadrant throttle inputs. The suppression cannot be on by default because Wilco's 767PIC (and others) uses the same input controls to operate the auto-throttle. Either enable this option here, or make sure there are NO throttle assignments in the FS CFG file. You may need to set LOCKED=1 for the joystick entry as well, to stop FS adding the assignments back again.

There is an option in this section for treating throttle quadrant buttons as "AutoThrottle Disconnect". These buttons are available with certain Jetliner console quadrants, and by default operate the TO/GA (Take off/Go around) feature—also operating as "N1" or "THR" modes on some implementations (such as Project Magenta). If you elect to use the A/T disconnect feature, note that it operates by temporarily disarming the auto throttle. This is the only sure way of ensuring all possible A/T links are severed (SPD, Mach or IAS modes, TO/GA, N1 or THR modes, and the speed component of VNAV). The A/T will be re-armed a second or so afterwards, when the current throttle lever positions will also be re-read and sent to the simulator.

The other two options—the digital filtering and the Engine equalisation—are to help deal with those who suffer any difficulty getting exactly symmetric thrust consistently. The filtering operates for relative fast changing jitter only (2Hz or better) and applies to all axes except the main flight controls (aileron, elevator, rudder, etc). The equalisation makes port and starboard values of throttle, propeller pitch or mixture equal (by averaging) when they are very close—by default, within twice the expected resolution of the axes themselves. On 4 engined aircraft the outboard (1 and 4) and inboard (2 and 3) controls are equalised separately. There is extra equalisation for the third (#2, centre) engine on three-engined aircraft—that engine is brought into line with the other two if it is close, but it doesn't influence the other two.

The limits can be changed, but only in the INI file (see section near the end of this document).

Avionics Options Page



Remote Instrument Controller

This (henceforth known as **RIC**) is the accessory with several knobs and a switch, which connects to the rear of the Avionics stack and provides additional facilities. The RIC has, along with the Avionics Stack, been incorporated into the Jetliner console, and in this case two of its knobs have different roles. Those changes can be selected for use on the external RIC if you like. The functions of the knobs on the RIC are as follows (from Left to Right):

External	Jetliner	Description of actions available
ADF/RA	DH	Whether labelled ADF/RA or DH, this turns the ADF bearing dial if the aircraft panel you are using has such an adjustable gauge, but if you are using Project Magenta, or Wilco's 767PIC (and have this option selected), it normally controls the Decision Height instead. There's also an option in this section ("DH is CRS2") which when selected will make this knob adjust the course for the second NAV radio (i.e. OBI2) instead. If this option is selected it does not matter what software you are running with Flight Simulator. The RIC options are shown in the right part of the Avionics Options page.
CRS/DG	CRS	For the Jetliner this always adjusts the OBI bearing dial associated with the NAV1 radio, or the Course associated with the HSI or ND in VOR/ILS modes. It is also known as OBS1. There's an option ("CRS does 1+2") for both OBS1 and OBS2 to be synchronised and controlled together. This can be useful when the VOR1 and VOR2 displays are used for pilot and co-pilot. For the external RIC you can select between having this do the same, or adjusting the gyro compass to correct for drift. The latter is probably more appropriate on the light aircraft. The RIC options are shown in the right part of the Avioincs Options page.
HDG	HDG	Adjusts the heading bug on the gyrocompass and in the autopilot or MCP.
ALT	BARO	Adjusts the pressure setting ('Kollsman') for the altimeter, to allow it to be correctly set for QNH, QFE or standard (29.92" or 1013.2 mb) settings.
OBS	ND	If you are using Project Magenta, or Wilco's 767PIC (and have this option selected), then this adjusts either the ND mode (MAP, CTR, ROSE, PLAN) or the range (10–640 nm), according to the position of the toggle switch next to it (see next entry). If the external RIC is being used and either the "Jet RIC" option hasn't been selected, or you are currently flying a prop, then it adjusts either OBS1 or OBS2, depending upon the adjacent switch setting. There is also an option, primarily intended for use in the PFC Jet Cockpit, to change the "ND range" operation to instead operate OBS2 (CRS2) even when the "Jet RIC" option is selected.
NAV Select	Mode/ Range	This is only used in conjunction with the OBS/ND switch above. Its position is not independently detectable by the driver.

You will see from the above table that if you are using Enrico Schiratti's ***Project Magenta*** then the PFC DLL will detect when the Project Magenta (PM) MCP is running. If it is, then the RIC section *automatically* changes to operate the DH and ND Mode/Range settings—excepting the override to use ND range for CRS2, if selected.

Additionally, as indicated in the table above, the same actions are available for Wilco's 767PIC, but for this to operate automatically you need to select one of the avionics options, described below. This action is needed because of the possibility that the driver mistakenly identifies the use of 767PIC by module naming changes.

***Note:** adjusting heading, and other MCP registers, in the 767PIC is not as quick nor as precise as I'd like it to be unless you are using version 1.3 of the 767PIC panel, or later, with FS2002. It is the best I can do with the keystroke based interface the earlier versions of this panel provides. If you are a 767PIC user in FS2002 you would do well to get the latest update.*

***Note 2:** All functions of the R.I.C. or its Jetliner equivalent can be re-programmed in FSUIPC's "Buttons" section when using FSUIPC version 3.30 or later. See the section about **Button and Switch Re-programming** later in this document.*

Avionics Options

These are an assortment of operating options for the separate Avionics stack, and the avionics sections on the Jetliner Console and Jet Cockpit. Before going into the details for each of these in turn, here's a summary of the way the avionics buttons and indicators work with the PFC.DLL driver:

COM radios: The frequency required is set on the standby part then swapped into the active part for use. On the separate stack, on FS2000 and before, if only one COM radio is in use, that's it. On FS2002, FS2004 and FSX the standby frequency adjustments are not relayed to FS until you swap the active and standby, but any changes made in FS (for instance, by loading a new Flight file) will be reflected in the PFC avionics display.

Normally the On/Off buttons turn off the whole set, COM+NAV. On the Jetliner, with only COM1, the on/off button only affects the COM radio. However, the complete action of the On/Off button depends on the option labelled "COM2 radio selectable into FS" (with the Avionics Stack) or "COM on/off swaps COM1/2 display" (with the Jetliner on FS2002, FS2004 and FSX).

On the separate stack, if the option is selected, then the On/Off button cycles between being a COM radio selector and on/off button. With FS2000 and before, which don't have a COM2 radio, this is useful as it allows all 4 frequencies to be selected into FS. These are the sequences for the two radios:

Avionics COM1: Sets FS COM1 → Off → Sets FS COM2 → Sets FS COM1
Avionics COM2: Sets FS COM2 → Sets FS COM1 → Off → Sets FS COM2

Note that in this mode only the COM receiver turns off, not the complete set. If both COMs are in use, the one currently operating FS's COM1 radio has a flashing decimal point in the active frequency display. In FS2002 and later, if one of the PFC COM radios is off, the on/off button on the other does not change the assignment to COM1/COM2, it simply keeps the current assignment and alternately switches that radio off.

On the Jetliner console, with FS2002, FS2004 or FSX, the option allows the single PFC COM radio to display and operate either COM1 (flashing point) or COM2 (not flashing). The on/off switch cycles between these two and off.

NAV radios: When two frequencies are displayed, the knob sets the standby that you then swap into the active. Pressing the "RAD" button toggles into Radial display mode. If you are receiving a valid VOR signal then the current radial is displayed in the standby position. Otherwise this displays – – –. Note that ILS localisers do *not* provide radials.

Whilst the radio is in the Radial mode, the knobs set the active radio. This directly changes the radio values in Flight Sim, so should be used carefully—there can be a little lag if you turn the knobs too fast. You can still swap frequencies with the one 'hidden' behind the radial display.

The DME is also tied to the NAV frequency, switchable on the DME between NAV1 and NAV2. There is no separately tunable DME receiver in Flight Simulator. When the in-use NAV frequency is also displayed on the DME it can be changed by the DME frequency knobs irrespective of the mode of the related NAV radio.

On FS2002, FS2004 and FSX standby NAV frequency adjustments are not relayed to FS until you swap the active and standby, but any changes made in FS (for instance, by loading a new Flight file) will be reflected in the PFC avionics display.

Optionally (see below) a valid VOR or ILS signal is indicated by a flashing decimal point in the active frequency display.

The Ident button toggles the Flight Sim Morse VOR/ILS ID sounder, if a valid signal is being received.

ADF radio: This device is quire complex. As well as being a receiver for NDB radio signals it is *also* a flight *and* elapsed timer *and* count down time with alert. I'll describe the main NDB reception facilities first:

NDB frequencies range from 200.0 to 1799.9, though FS has an upper limit of 1699.9 (making quite a few South American facilities untunable). In the USA and Canada most, if not all, current NDB frequencies have zero in the fractional part and so a simple 4 digit display is adequate in that part of the world. This is why the PFC NDB has, unfortunately, only 4 display digits for the active frequency. In Europe there are many NDB frequencies with .5 fractional parts and there may be areas in the world where other fraction values are used.

With a real ADF receiver in the real world, being a fraction off the correct frequency might not matter so much. The reception might be weaker but it may not be cut off altogether. Flight Sim is not that lenient. You have to be spot on.

So the ADF operation on the PFC Avionics stack is actually (and optionally) more complex than the ones you'll see in real life. I've used the **ADF** and **BFO** buttons to swap between display modes and selection of fractions. In the optional full 5-digit (nnnn.n) mode, you use the ADF button to swap between displaying the top four (integer) digits (nnnn) and the lower four digits (nnn.n). You can never see them all at once, except on FS's panel ADF.

To make it more confusing I cannot show the decimal point as that is inaccessible with this hardware, so the only way you can tell which part is displayed is by the ANT and ADF indicators. When the ADF indicator is lit or flashing then the integer portion is being displayed. When the ANT indicator is lit then the lower part, including the fraction, is being displayed. The indicator is flashing only when a valid NDB signal is being received.

When the fractional part is being displayed (i.e. the ANT indicator is lit), the BFO button is used to select the fraction for changing with the inner knob. The BFO indicator is lit when this is the case. When the higher part is displayed the BFO button does nothing and the indicator will not light.

Note that all of this is optional. For flying in parts of the world with no fractional NDB frequencies you can simplify it all by switching the option off, as discussed below. In the simple mode the ADF button merely toggles the ANT/ADF indicators and the BFO button merely toggles the BFO indicator. Neither have any function in Flight Sim itself.

As with the NAV and COM radios, the knob adjusts the standby frequency with the **FRQ** button swapping them over. In Timer modes, the standby frequency is lost in favour of the timer value, so then the knob adjusts the active frequency. Unlike the NAV radios, pressing the FRQ button when a timer is displayed does *not* swap frequencies, but merely brings back the standby frequency display. Press again to swap.

Timer operations are initiated by pressing the FLT button. This is actually a FLT/ET button, and in timer mode toggles between the Flight Timer (FLT) and the Elapsed timer (ET). As there is no FT/ET indicator, they are distinguished by having a space preceding the flight time and a – preceding the ET. The time format is nn.nn with minutes and seconds shown unless the value is one hour or more, in which case hours and minutes are shown.

The ET can be reset to 0 by pressing the SET button. Holding the SET button in for 2 seconds causes the ET to reset to 00.00 and flash. You can now set a time in minutes and seconds with the knob. Press SET (or pretty much any other button) and the Timer counts down. When it reaches 00.00 again the right hand display in the ADF will flash *irrespective of its current mode* indicating the preset time having elapsed. It will resume counting up at the same time. The flashing continues for a number of seconds, or it can be cancelled by pressing one of the buttons.

The timer operations abide by the specifications of the Bendix King KR87 series ADF units, so please refer to the Bendix King manuals for further details.

DME unit: This should emulate a separate receiver, capable of being tuned independently to the other radios in the stack. However, Flight Sim does not provide support for a separately tuneable DME radio, so some aspects of the PFC one are redundant.

The operation of the RMT/FREQ/GST slider switch is correct, except that the GST mode is identical to the RMT mode. In both cases the Speed and Time are shown, if available in the right hand part of the display, but in both cases the values are related to the VOR being received on the selected NAV radio. The FREQ mode is similar but shows a copy of the NAV radio frequency. In this mode the tuning knobs on the DME can be used to change the related in-use NAV frequency, even if a standby frequency is displayed on that receiver.

The operation of the NAV1/NAV2/OFF slider is correct in its default mode, selecting NAV1 or NAV2 for the DME reception, or switching the unit off. There is an option to use the NAV1/NAV2 RMI selector instead for NAV selection, as the switch is bigger and it is easier to see what is currently selected. (Flight Sim has no RMI with NAV1/2 selectable without mouse actions, so if this latter option is not selected the RMI switch has no function).

The distance on left is in nautical miles, and is always the *slant* distance to the ground-based transmitter. The speed is in knots, where valid, and the time is an estimate in minutes. Both assume a direction directly to the radio aid in question and are not valid for any other direction or useful indications when close to the radio or high above it.

Transponder: The operation of this is fairly obvious. The mode selector works as shown except that the "ALT" mode is incomplete on the PFC unit as there's no display position provided for the encoded altitude display. Optionally (see below) the transponder has an intermittently flashing light, showing it transmitting in response to an interrogation. When you press the Ident button that indicator lights solidly for a few seconds whilst the complete identification encoding is transmitted. None of this has any counterpart in Flight Sim, but Squawkbox3's transponder control (FSUIPC offsets 7B91 and 7B93) is supported. The selector switch settings Standby, Off and Test are signalled as Standby and the On and Alt selections are signalled as 'normal'. The Ident key triggers but only in 'normal' modes.

Autopilot: Parts of the autopilot mechanisms occur in other places—on the RIC, in the Altitude Pre-selector, optionally in the GPS section (or, on the Jetliner, the section below the Autopilot), and even on the Yoke (trim, AP disconnect, and CWS/pitch sync operations). For a full understanding please peruse all these parts. Here I just concentrate on the buttons and indicators in the section made to look like a Bendix King autopilot and actually labelled 'Autopilot'.

First, with a standard Bendix King A/P as depicted in the PFC Avionics stack, none of the A/P functions can be selected until you have successfully run the unit through its Test. To do this, simply press the 'Test' button. The test sequence will begin with all the indicators lit, then just the AP Eng indicator flashing with a beeping sound. At the end of this the Autopilot is ready.

Second, also standard with this type of autopilot, you should engage the Flight Director (FD) first. AP Engage will not normally work unless the FD is engaged. Selecting FD modes (such as ALT, HDG) instead will automatically engage the FD in any case.

Both of these restrictions can be optionally lifted, and they are both removed automatically when using Project Magenta's MCP, or Wilco's 767, which also change several aspects of the A/P to make it more amenable to airliner type operations. You will then also want to select the option to stop the A/P Engage LED flashing (and the PC beeping) whenever the A/P is disengaged.

That said, here are the functions explained:

External	Jetliner	Description of actions available
FD	FD	On those aircraft with a Flight Director, this button switches it on and off. See above for interactions with the other autopilot switches.
ALT	ALT hold	Sets the **current** altitude into the autopilot and engages altitude hold. With Project Magenta's MCP the altitude is rounded to the nearest 100 feet. The value used in the autopilot is the one registered by the altimeter, so it is dependent upon the Kollsman pressure setting.
HDG	HDG sel	Engages Heading hold for the heading set by the heading bug (or, for airliners, in the Heading register of the MCP). To hold current heading you need to set the bug first.
NAV	vor LOC	Engages a hold on the NAV1 radial specified by the OBS1 value, in either the To or From direction, as indicated on the OBI. You should be on or close to the desired radial and in the correct direction first. The NAV indicator in the A/P flashes until the correct course is locked. On Project Magenta and 767PIC this engages LOC mode, which operates similarly for VOR signals or provides Localiser only approaches with ILS signals.
APR	APP	Engages an Approach course, on both localiser and glideslope (if both are available). When using FS's autopilot, the APR light flashes until the localiser is acquired, and the GS light illuminates when the glideslope is acquired. Whether this occurs with other autopilots depends upon their implementation. Airliner MCP indications are not the same.
BC	AP/2	For FS panels, this is similar to APR but for a Back Course. If you are using Project Magenta's MCP or 767PIC this button instead enables the other autopilot—***when*** you are in the correct position to be able to use it. On Project Magenta, you can enable either A/P, but only both on approach. On 767PIC (with the option selected, see below) you can only operate this autopilot if the other one (on the A/P button) is enabled first ***and*** you are on approach. This difference is simply because of the need in 767PIC to use the main A/P disconnect bar below the A/P buttons. There's no separate disconnect bar on the PFC equipment.
AP eng	A/P or AP ENG	Engages or disengages the only or main autopilot. See above regarding optional restrictions on this. [*If the Jet Cockpit is selected as the console, this is only an AP disconnect button, as is the red button on the yokes. The AP buttons on the MCP are used to engage the A/P*] Except in the Jet Cockpit, PFC.DLL enables the Yaw Damper when the autopilot is engaged with this button, and disables it when the autopilot is disengaged using the same facility. Normally, in airliners, the yaw damper is kept engaged at all times, but this tends to make

		ground operations tricky in FS. If you don't want this automatic YD switching, check the box in the avionics options. **N.B.** By default FS2002/4's autopilot always engages the wing leveller whenever the Autopilot is switched on.. This is apparently correct for some A/Ps, but really it is not appropriate for the Bendix King type fitted in the Cessna and replicated in the PFC Avionics Stack. To prevent the wing leveller coming on, you need to edit each aircraft's AIRCRAFT.CFG file, adding these to lines to the [Autopilot] section (adding that section too if it is missing): use_no_default_pitch=1 use_no_default_bank=1 Take care, as these may have some other side effects.
TRIM	TRIM	The trim rocker has three different functions, as in the Bendix King KFC150 and KAP150 units. • With no AP modes engaged it is identical to the electric pitch trim on the yoke. • In AP altitude hold modes it adjusts your held altitude, commanding a climb or descent of 500 fpm until released, at which time the new altitude is held. • In V/S mode it adjusts the set V/S by 100 fpm up or down for each second it is held. When using Project Magenta these actions are approximated to quite well (with the 500 fpm rate adjusted to the normal rate for the airliner). However, they are not likely to work well with 767PIC. In the latter case the trim rocker should only be used in manual flight modes.

Note that as well as Wilco's 767PIC, there are some other excellent but complex third party FS panels which provide highly integrated autopilot, FMC and MCP operations, but which do this by completely bypassing the FS autopilot, or using some FS parts in other ways. Examples are PSS 747 and 777 aircraft packages. Please do not expect the PFC (or for that matter any other) external controls to be able to work correctly with such panels. For those you will usually have to use the on-screen facilities, probably via mouse operations. The special provisions in this driver for Wilco's 767PIC are only possible because they provide keyboard shortcuts for many of the needed controls—and even then, adjusting the values using anything but the mouse can be painfully slow or imprecise at best.

Note: *All of the Avionics buttons, knobs and switches can be re-programmed in FSUIPC's "Buttons" section when using FSUIPC version 3.30 or later. See the section about* ***Button and Switch Re-programming*** *later in this document.*

Extended autopilot features (Jetliner Console): OR **GPS and Altitude Pre-selector (Avionics stack):**

On the Jetliner console the larger section below the Bendix-King style Autopilot section is totally dedicated to some more advanced autopilot and avionics functions, applicable to modern airliners. These functions are also available on the GPS and Altitude Pre-selector sections of the separate Avionics stack, the allocations being as illustrated here from the Jetliner:

[*Note on GPS:* *Although FS2000 and FS2002 are supplied with a GPS unit, its functions are not accessible through controls or keypresses, only though mouse actions on screen, so the GPS functions on the PFC Avionics stack are re-used for these other actions.*]

Except when flying with Project Magenta, the bottom row of six buttons, (NAV to APT/VOR on the external stack, or VOR/NDB to Std Baro SET on the Jetliner), are all available for user programming. (See the section on Button programming for more details on the user programming facilities).

When using Wilco's 767PIC (or most other advanced panels with their own Autopilot programming), the LED indications on the PFC autopilot are unlikely to operate correctly. The driver can read genuine FS settings and also Project Magenta settings, but not those local to specific separately programmed systems.

These are the button allocations and actions:

External	Jetliner	Description of actions available
NAV/GPS	N1	With Project Magenta and 767PIC, this sets N1 or THR mode. For other FS panels it operates the TO/GA facility. This requires the Auto-Throttle to be armed, but there is no specific AT Arm switch on the separate avionics stack. To handle this, on all standard FS panels and Project Magenta, if the Auto-Throttle is not armed when N1 (THR) mode is engaged, the driver automatically arms it. Similarly the A/T is disarmed when the mode is cancelled unless some other mode needs it. (This is not done for 767PIC as there's no way the driver can detect whether the A/T is armed or not).
ON/OFF	IAS/ MACH	Selects IAS or MACH on the MCP's speed dial. For most FS panels this selection only operates when the autothrottle is armed and speed mode engaged. With Project Magenta and 767PIC the changeover should be immediate.
Direct To (Ð)	SPD	Sets the IAS or Mach speed hold mode, assuming the auto-throttle is armed. Whether IAS or Mach mode is used depends on the preceding button. Note that there is no specific AT Arm switch on the separate avionics stack. To handle this, on all standard FS panels and Project Magenta, if the Auto-Throttle is not armed when SPD mode is engaged, the driver automatically arms it. Similarly the A/T is disarmed when the mode is cancelled unless some other mode needs it. (This is not done for 767PIC as there's no way the driver can detect whether the A/T is armed or not).

MSG	VNAV	Not used except with Project Magenta or 767PIC, where it operates the VNAV button. This requires the Auto-Throttle to be armed, but there is no specific AT Arm switch on the separate avionics stack. To handle this, if the Auto-Throttle is not armed when VNAV mode is engaged, the driver automatically arms it. Similarly the A/T is disarmed when the mode is cancelled unless some other mode needs it.
ENT	LNAV	Not used except with Project Magenta or 767PIC, where it operates the LNAV button.
GPS knob	SPD knob	Adjusts the speed setting, whether Mach or IAS. The outer adjuster changes the IAS in 10 knot increments, the inner in 1 knot. For mach the increment is normally .01 for either. (There are currently some problems with MACH setting in Project Magenta).
NAV	VOR/ NDB	Programmable except for Project Magenta, where it selects VOR and/or NDB locations for display on the ND. The button can be set to switch both VOR and NDB together (the default), or to cycle through VOR – NDB – both – neither. The option appears in the Jetliner section of the **Consoles** page.
WPT	WPT	Programmable except for Project Magenta, where it selects Waypoint (fixes and intersections) for display on the ND.
FPL	ARPT	Programmable except for Project Magenta, where it selects airports for display on the ND.
CALC	DATA	Programmable except for Project Magenta, where it operates the route waypoint data (times and restrictions) for display on the ND.
AUX	POS	Programmable except for Project Magenta, where it selects VOR/ILS positional data (as in an HSI) for display on the ND.
APT/VOR	Std Baro SET	Programmable, but pre-programmed by default to toggle the altimeter between the last set QNH value and the standard Barometric Pressure (29.92” or 1013.2 mb) for flying Flight Levels
ENG VS	V/S	This engages Vertical Speed mode. Set the vertical speed using the knob with the VS/ALT switch set to VS. **NOTE:** With 767PIC or Project Magenta, this merely passes on the V/S mode request. For FS panels it gets a little more complicated. FS doesn’t truly simulate V/S mode as such. Setting it doesn’t make much difference. In ALT hold mode or FLCH you can adjust both altitude and V/S and the simulator will try to abide by both, providing the power is available. It seems to give priority to the V/S rather than the Speed setting, but this may vary from flight model to flight model. So, PFC DLL provides V/S mode in FS by setting FCH (ALT) mode if it isn’t already set, and also, if a different altitude target is *not* already set, setting an extremely high (or low, depending on direction) target altitude so that the V/S requested will be obeyed. When V/S mode is disengaged the ALT mode will be retained. If the previously set target has been passed the current altimeter reading is set as the altitude to hold, after rounding up or down (according to direction) to the nearest 500 feet. If, however, the previously set altitude value has not yet been attained, it is restored. And FLCH mode ensues. This last action was added in version 1.31 of the DLL.
ARM ALT	FLCH	This engages ALT hold mode without changing the altitude register. Set the altitude to the target value using the knob with the VS/ALT switch set to ‘Alt’. If you are using Project Magenta or 767PIC, this button sets FLCH mode, not ALT hold.
VS/ALT	VS/Alt	Use this toggle switch to select which of V/S and ALT you adjust with the rotary knob.
SET	SEL	Set the V/S or Altitude with this, after selecting one with the VS/ALT switch.

On the Jetliner Console there’s also an AT ARM switch, which operates the auto-throttle arm facility in FS and on the Project Magenta and 767PIC panels, and possibly a TO/GA button on the throttle lever for Engine #1. The latter operates TO/GA in most FS panels and in Project Magenta, or either N1 or GA in 767PIC, depending on whether the aircraft is on the ground or not at the time—and if so, whether the indicated airspeed is less than 50 knots or not.

Note that in all the above, the facilities for Wilco’s 767PIC panel only operate if you have not de-selected the option to detect the 767PIC panel (see Avionics Options, below)..

Simulator buttons: Along the bottom of the Avionics stack, and on the front vertical face of the Jetliner Console, there are six buttons which have labels relating them more to simulator actions than anything to do with real flying. These are all programmable by you, the user, as described in later sections, but also come with some pre-defined default actions, as follows:

RESET	Free for user programming
START	Free for user programming
FREEZE	Pauses or un-pauses the simulation
MAP	Toggles the view between the normal cockpit/forward view and the top-down 'map' view. Same as the keyboard Ctrl+S key.
CON	Cycles through all the views in FS – same as the keyboard 'S' key.
INSTR	Toggles between full-screen scenery view and normal panel+scenery view. Same as the keyboard 'W' key.

***Note:** All of the A/P and GPS buttons, knobs and switches can be re-programmed in FSUIPC's "Buttons" section when using FSUIPC version 3.30 or later. See the section about **Button and Switch Re-programming** later in this document.*

THE AVIONICS OPTIONS

Marker beacon lights flash: This option makes the Marker Beacon lights, at the top of the Avionics stack, flash when indicating a marker, rather than just hold steady. The flashing pattern is correct for the beacon type, matching the sound (dots and dashes) which should be made by Flight Sim. The reason it is optional and defaulted off is that I found the beacon lights far too bright, and having them flashing made this worse and very distracting! <G>

Transponder ident light flashes: If this option is set the ident light (on the left of the display) flashes intermittently to simulate the transmitted responses to received inquiries. There's nothing functional in this for Flight Sim; it is just an extra attempt towards more realistic operation. It does show that FS and the PFC driver are still active, of course.

FS avionics switch acts on PFC avionics: If this option is set then the operation of the Avionics switch in most FS panels will also toggle the PFC avionics displays on and off. This is particularly useful for the avionics stack when connected through the Throttle Quadrant System, which has no avionics switch of its own. It may even be better using this than the hardware switch on the Cirrus and Jetliner consoles, as the latter also removes power from the avionics controller board and when it is switched back on this can sometimes supply odd parameters or even fail to initialise correctly.

COM2 radio selectable into FS: (Avionics stack), or
COM on/off swaps COM1/2 display: (Jetliner console on FS2002 and FS2004):
This varies according to FS version:
FS2000: this only supports only one COM radio, whilst the separate PFC Avionics stack has two COM radios. You can either just never use the COM2 radio, or set this option and use the On/Off button to not only switch them on and off but also select which one is connected to Flight Sim's COM1. The one being used has a flashing decimal point. [*This option is not applicable to the Jetliner Console*].
FS2002/FS2004: on the Avionics stack, COM1 corresponds to FS's COM1 and COM2 corresponds to FS's COM2. You do not need anything further. However, for compatibility and convenience, this option will allow you to use the on/off button select either of the PFC COM radios into FS's COM1, and the other then maps to FS's COM2. Thus you effectively have one active and three standby frequencies for each radio. The active COM1 radio has a flashing decimal point. On the Jetliner console, which only sports a single COM radio, the option is more important as it allows that radio to be used as COM1 or COM2. The decimal point flashes when it is COM1.

NAV radio reception makes point flash: With this option set the decimal point in the "Use" frequency flashes when a valid VOR or ILS station is tuned and received.

Extended ADF frequencies (nnnn.n): This allows NDB stations with fractional parts in their frequencies to be tuned on the ADF receiver. See the lengthy description above to find out how five digits are managed with only a four-digit display.

ADF reception flashes ADF/ANT light: With this option set the ADF or ANT indicator (whichever is currently applicable, according to the use of the ADF button) flashes when the ADF is receiving a good NDB signal.

Paused FS freezes ADF timers: If this option is not set then the timers continue counting even during pauses in FS.

Use RMI N1/2 toggle for DME select: The RMI NAV select switch just below and apparently associated with the DME device is actually intended, instead, to select the NAV receiver to drive the NAV needle on the RMI gauge. However, those FS aircraft panels with such gauges unfortunately have no means other than mouse clicking to make such a selection. This option allows that switch to be used to select which NAV receiver supplies the DME signal. If selected, the little N1/N2/Off slider merely acts as an On/Off switch for the DME instead.

Must Test and enable FD to use AP: Strict simulation of the original Bendix King autopilot should mean that you must run the self-test before using any aspect of the autopilot, and engage the Flight Director (either directly or indirectly—by selecting a control mode) before engaging the AP itself. Turn this option off if you want to be free of this. If you use Project Magenta's MCP, or the Wilco 767 PIC, these requirements don't apply in any case.

Don't flash/beep on A/P disconnect: The autopilot is modelled on General Aviation Bendix-King types. These flash the AP Engaged indicator and beep repeatedly when the AP is disengaged. This is not wanted in an airliner cockpit environment, and so an option is provided to turn it off.

Provide A/P control for Wilco 767PIC: If you own and use this aircraft and panel package, the PFC driver can be set to automatically configure many of the avionics buttons, dials and switches to operate the 767's autopilot. The driver detects when the panel is loaded by looking for the B767W module running in FS (this is installed by Wilco into your Modules folder), *and* the gauge B767WAFDS running at the time. It will not perform these checks if you have this option de-selected. This should be used if you encounter any problems with similarly named modules. *[The 767PIC options will not work on Windows 95 or earlier, nor on versions of NT before SP3.]*

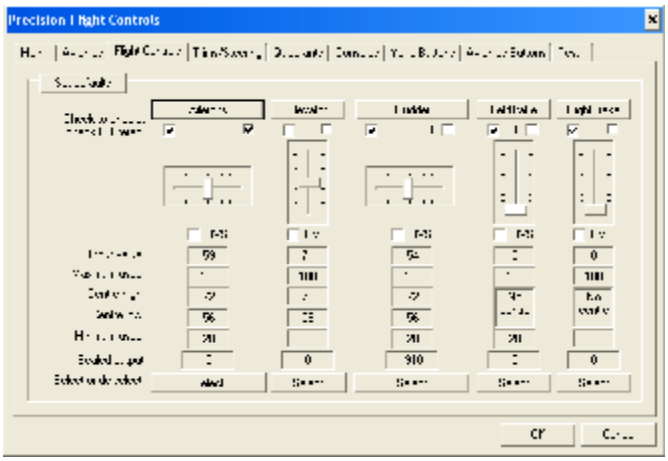
The driver controls the 767PIC autopilot through the keyboard shortcuts provided. If you change these you will need to reload a flight or change aircraft from and back to the 767 in order to force the PFC driver to read the revised keyboard assignments.

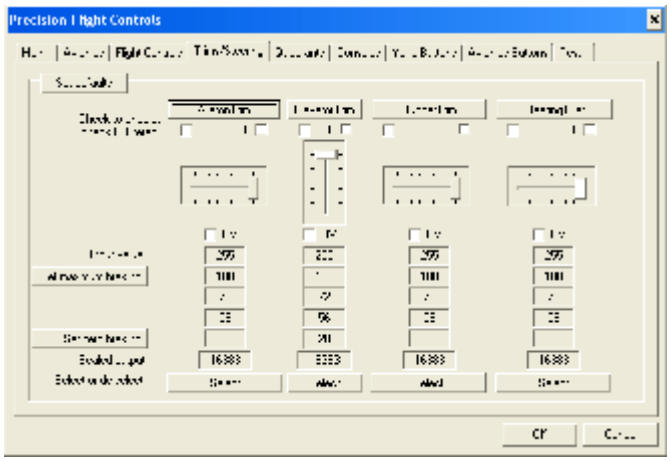
As well as the automatic re-assignment of actions to suit the 767PIC panel, you can assign any of the available 767PIC controls to any of the programmable buttons. (See the section later on user programming).

Don't set yaw damper on AP Eng: Normally PFC.DLL enables the yaw damper when the autopilot is engaged with the main "AP ENG" button (or the yoke equivalent on PFC yokes), and disables it when the autopilot is disengaged using the same facilities. In airliners the yaw damper is usually engaged at all times except when an engine is out, but this tends to make ground operations tricky in FS. If you don't want this automatic YD switching, check the box in the avionics options.

VOR/NDB button cycles (PM): This option refers to the Jetliner avionics button labelled "VOR/NDB", but it has an equal effect when using the separate Avionics stack and Project Magenta. It allows the Project Magenta ND display options to be cycled between VOR, NDB, VOR+NDB and off, effectively combining two ND option buttons into one. [Note that on the regular Avionics Stack the button is the one labelled NAV in the GPS section].

Flight Controls and Trims/Steering Pages





These pages are used to enable and calibrate the main flight controls, trims and steering tiller, if these are available and connected through the PFC system. These controls are not all enabled by default as they can produce unwanted interference with game port or USB connected joysticks and pedals if you are using those for any of the main flight control in Flight Sim. Only you know which devices you have connected where. There is no automatic way the driver can configure this.

Check the little check boxes for each of these devices you are using through the PFC system. Make sure the others are not checked. In the picture above left three of the controls are enabled, and the Rudder is shown selected, ready for calibration. Note also the "response curve" top left. This is shown with its default setting—a linear response. You can set different curves for each control, to get the responsiveness, the "feel" you prefer.

Note that, even if they are not enabled, the sliders shown on this page will move when you operate the controls—assuming that you do have them connected through the PFC system. However, they will only be effective in FS if you check the appropriate "enabling" checkboxes.

In the unlikely event that any of the sliders move in the *wrong* direction, check the relevant "RVS" (for reverse) checkbox. This will make the driver interpret the incoming values in the opposite sense. Do this *before* attempting calibration as described next—otherwise you will probably have to re-calibrate in any case.

The checkboxes marked "F" operate a simple digital filtering. Enable these only if you get a fluttering on the controls. The filter operates for changes in direction faster than 2Hz.

CALIBRATION

Control axes such as those used in joysticks, rudders, yokes and throttles are almost always based on variable resistance provided by a potentiometer and moving wiper contact. The game port, USB or other interfacing circuitry converts this into a numerical value by electrical tricks such as timing how long it takes to charge or discharge a capacitor through the resistance. This is simple, it works, and it is cheap. However, it does tend to give some variation in the readings obtained even for apparently the same positions of the operating lever and hence wiper contact. These variations are due to an assortment of physical conditions, including temperature, humidity and simple mechanical movements.

Many applications of controls such as these do not need precise values in any case, and the fact that it is going up or down is often sufficient. However, with flight controls there are certain positions which do need to be fairly precise: for example, the minimum or "idle" value for a throttle, and the centre values for ailerons, elevators and rudders.

Since the software drivers for your controls cannot predict with any accuracy the range of values it might see, nor certainly the centre positions, you need to perform some 'calibration'. This is simply the measurement of the range of values returned by each control, and the setting of specific positions or 'zones' to represent important values.

To calibrate your controls in the Flight Controls page, perform the following actions on them, one at a time:

1. **Select** an axis to calibrate: click on the 'select' button at the bottom of the column for that axis. The column will be highlighted as shown for the Aileron axis in the picture above. The "select" button will change into a "Set automatic" button, and other setting buttons will appear to the left. *[We'll look at the "automatic" facility after trying things manually, as it is important you understand what is going on]*.

2. Move the control to the extremes—full forward and back, or full left and right. Note that the value shown in the column in the row labelled "input value" changes. To make full use of this entire range, when the input value reaches its *highest* click

the top button on the left—this may be called different things according to axis being set. For the ailerons it will be the "**right-most limit**" because, to get those high numbers you will be turning the yoke to the right. In generic cases this button will simply be labelled "**Set upper limit**", but it will be reasonably descriptive in all cases. When you click it you will see the input value recorded in the selected column, and in that row. You can do the same with the *lowest* value, using the **left-most limit** button.

3. This is all there is to basic range calibration. However, you should consider leaving a 'dead zone' at both extremes. This is an area of control movement, very small, at either end, in which the value being *used* in the program doesn't get larger or smaller, despite the input value changes. By doing this you can guarantee full range in Flight Sim even across variations in the values returned by your controls.

   Set dead zones either end by doing the minimum and maximum calibration, as in step 2, but with the control moved away from the extreme position, so that it returns a slightly lower or higher value.

   Once you've done this you should find the **Scaled output** value, which is the one actually sent to Flight Sim, always ranges from its minimum to its maximum, for that particular control type. The aileron, elevator and rudder controls have a full range of –16383 to +16383. Your calibration should enable this to be achieved 100% of the time.

4. With these particular controls (but not with them all), the *centre* position is also very important. Your flight controls should self-centre themselves automatically when released. Again, because of variations the values actually returned for their stable central "hands-off" position will not always be the same. You need to set a small range of values which the driver will interpret as meaning "centred", and for which it will always return to FS the same centre value (0).

5. To do this, hold the control slightly off-centre, to the higher side (reading the *input value*) and press the **Set centre high** button. Then do the same with the control held to the low side and pressing **Set centre low**. You may need to review these settings occasionally to be sure you always get a zero **Scaled output** value for hands-off operation.

Repeat these steps for each active control. The "toe brake" operation may be digital or analogue. If it is digital then there's little calibration needed, provided the **Scaled output** value is 200 when the brake is operated and 0 when released. This is the braking range implemented in the DLL for Flight Sim.

Note that there is nothing permanent about anything you may do here. The results are saved in the PFC.INI file, but you can revisit this page and re-calibrate at any time. The fact that you do not have to exit Flight Sim or even reload it makes it much easier and you can immediately test the results of your changes.

If you do think you've made a real mess and want to start again, just click the **Set defaults** button at top left. This will restore the values to they way they were when you originally installed the PFC.DLL.

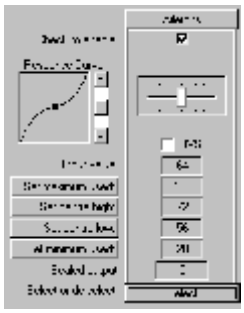
AUTOMATIC Calibration facilities are now also included. Once you have selected an axis for calibration you can toggle between manual setting and automatic setting using the button at the bottom of the selected axis column. Automatic calibration works as follows:

1. After selecting "**Set automatic**" (the button changes to "**Set manual**" to enable you to change back) the program is recording the maximum and minimum values, as you move the axis. So move it to both extremes several times, then leave it in the centre.

2. Having measured the maximum and minimum positions, the calibration is set 10 units away from those extremes—to give a safety margin, a definite "null" zone, at either extreme. This may be too much or too little—it is not possible in automatic calibration mode for the program to do better. You may want to go back to manual mode to adjust these extremes.

3. With axes having "centre" positions, after moving the axis to either extreme several times, leave the axis, still selected, in its central or parked position for several seconds, and watch the two centre values. They will automatically adjust to give a central range of about 12 units, 6 either side of your parked position. Again this may be too much, or not enough, to assure you of a good stable centre. [For the "ARM" position of the Spoiler axis, mentioned later, you will most certainly need to calibrate manually].

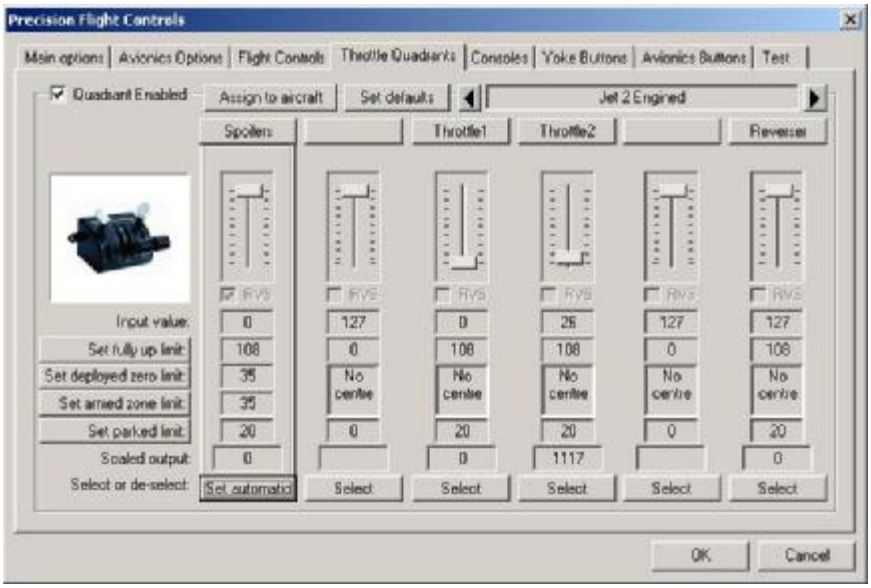
Sensitivity changes: “Response Curves”



The three main flight controls—aileron, elevator and rudder—can, if connected through the PFC console, be subjected to some adjustment in the driver. The values fed to Flight Sim can be made to change more slowly near the centre, whilst still reaching the extremes by faster adjustment further over. This produces a sort of “S-curve” response, like the one shown in the illustration for Ailerons, to the right. The response curve setting only appears when the control is selected, and is remembered for each of the three main controls, independently. Adjust the flatness to suit your controls and your FS aircraft models by using the scroll bar to the right of the graph.

This adjustment is most useful on rudders, which can often seem too ‘fierce’ in Flight Sim, but you may also find it improves your control over the other flight control surfaces too.

Throttle Quadrants Page



The PFC throttle quadrant system provides interchangeable controls with varying numbers of axes up to a maximum of six. There are, at the time of writing, ten different quadrants available (with some variations for the Jetliner console with its additional button capability), and the PFC.DLL is pre-programmed to handle each of these correctly, assigning the correct (labelled) lever to the appropriate Flight Sim control.

The selection of quadrant can be done specifically by you, the user, or automatically according to the name or the type of aircraft loaded. But, always remember, the DLL *cannot* tell what quadrant you have actually bolted to the console.

For automatic selection to work you need to tell the driver which quadrants you have at your disposal. Do this by checking the **Quadrant enabled** checkbox at top left on each quadrant entry. Change from one entry to another using the arrow buttons to either side of the quadrant description.

There are sections for 15 user-configured quadrants as well. Leave these alone for now—first get all your quadrants working correctly the way they were originally intended.

For each quadrant you own you need to connect it, find the right section in the Throttle Quadrants page, check the operation of each of the levers, ensuring they match what you see on screen, and then proceed to *calibrate* each lever. Calibration here is exactly as described above (for flight Controls), and this won’t be repeated here. Please follow the same directions. However, there are a few things to note for each control type:

CarbHeat	Operates the carb heat on props, or the anti-ice on jets, but only supported on the Throttle Quadrant for the single carburated prop. This control is digital so should need no calibration. The **scaled output** value is simply 0 or 1 and will change over somewhere near the centre of the lever's movement.
Condition	The *condition* controls are actually the same, to Flight Sim, as the Mixture controls, but provide a centre setting capability so that the "Low Idle" position, on the notch, can be calibrated. This should be set to give a **scaled output** value of 8191 (i.e. halfway in the full mixture range of 0–16383).
Mixture	There are up to four mixture controls, although never more than two used on the default quadrants. The **scaled output** range for these is 0–16383.
PropPitch	There are up to four of these, but again only two ever used on default quadrants. The range is 0–16383
PropPitchR	The TurboProp uses reversible pitch propellers, which require these controls which have a forward and reverse range just like the ***ThrottleR*** controls described above. You need to set the centre dead zone to encompass the notch area, which represents zero pitch or "feathered" props.
Reverser	The jet reverser lever has a **scaled output** range of 0 (full forward) to –4096 (full back). This is how it should be calibrated. [*The actual maximum reverse varies from aircraft to aircraft, and for FS2002 or later PFC.DLL detects this and re-adjusts the –4096 value accordingly. But this difference will not show during calibration*]. In operation its effect is to modify the values sent by the other (up to four) throttle levers. The reverser is *ignored* if any of the throttles are not at full idle (**scaled output** of 0). As the reverser is pulled back, all throttles simultaneously engage reverse and feed the range 0 to –4096 Or whatever) to Flight Sim. Differential reverse thrust can then be established by moving any individual throttle forward. Only a quarter of the travel is used, and pushing a throttle forward by that amount will reduce the reverse thrust from that engine, from maximum reverse back to idle. Once reverse is engaged, the throttles cannot be used for forward thrust again until the reverser is pushed full forward (to the "stowed" position) and the throttles returned to idle. This latter interlock is to avoid sudden engagement of forward thrust after using asymmetric reversal. Note that the PFC driver automatically activates ground spoilers if Reverse is engaged using the Reverser when on the ground with an airspeed of 60 knots or higher. The spoilers do not need arming for this to occur.
Reverser1 Reverser2	Separate jet reversers work just like the single reverser described above, but relate just to Engine 1 or Engine 2 specifically. This facility is only intended for use with twin jet aircraft.
Spoilers	The analogue spoiler setting (or "speed brakes") provides a **scaled output** range of 0–16383 as usual, but note that the action is reversed: full *forward* gives the spoilers down value of 0. The reversal is already built into the default quadrant settings where the spoilers are used. You will also notice that the dialogue provides for a "centre" position for this lever. This is so that you can set an "arming" position on your lever, for auto-deployment of full spoilers by FS on touchdown. The range of values above full down (a 'scaled output' of 0) and up to and including the lower value for the 'centre' is the ARM position. Any range set from low centre to high centre is wasted (it will give zero spoiler). Then from the higher centre value to full up (scaled output of 16383) gives the full range of manually set spoiler positions—i.e. 0–100% deployed. Calibrate the spoilers so that you have a range of movement for ARMing. On the PFC quadrants featuring spoiler levers there is a position marked 'Arm'. Try to calibrate it so that the ARM read-out for 'scaled output' on the screen coincides with that area on the lever. Make sure there's enough dead zone at the minimum end (full up) to guarantee a scaled output of 0 there. Note that the PFC driver automatically activates 100% (ground) spoilers if Reverse is engaged using any of the Reverser axes when on the ground with an airspeed of 60 knots or higher. The spoilers do not need arming for this to occur.
SpoilersD	This is a special version of the Spoiler axis control designed for levers with two détentes—one for the ARM position and another for the FLIGHT position. The two are calibrated as if they are either extremes of an extended 'centre'—follow the button labels on screen. The position from spoilers retracted (output 0) to the ARM calibrated notch, plus 6 more units (to allow for small jitter) is treated as ARM. Then the movement from the ARM notch+6 to the FLT notch–6 is calibrated for 7% minimum up to 75% (default) spoiler deployment, smoothly. It remains at 75% until the axis goes to or above the full spoiler deployment ("Ground"), where, when the aircraft is on the ground, it moves immediately to 100% There is no adjustment between Flight and Ground deployment values. When in flight the maximum deployment is the Flight deployment, which can be adjusted. Do this in PFC.INI before loading FS via the parameter **SpoilerFlightPercent**.

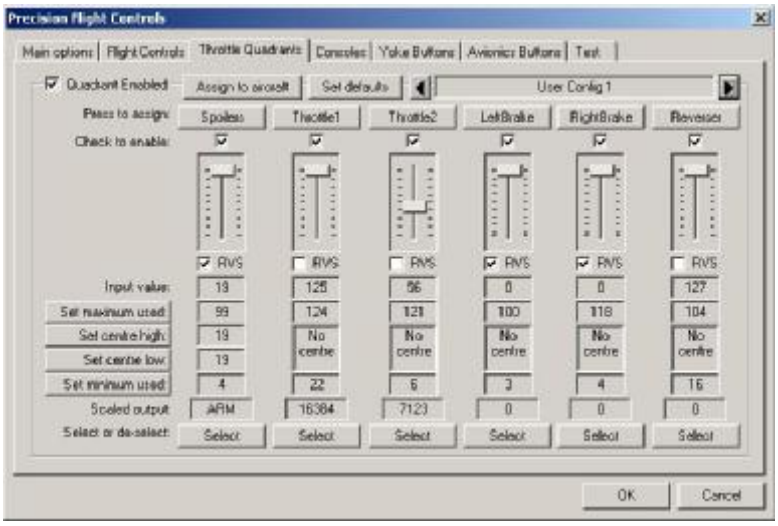
	Note that the PFC driver automatically activates 100% (ground) spoilers if Reverse is engaged using any of the Reverser axes when on the ground with an airspeed of 60 knots or higher. The spoilers do not need arming for this to occur.
Throttle	There are up to four throttles, 1–4, corresponding to the maximum of four engines supported by Flight Sim. The **Scaled output** values for the standard throttles operate from 0 (idle) to 16383 (max thrust). The jets with Reversers supply the capability of a reverse thrust range of 0 to –4096 (adjusted for each aircraft), but you won't see this in the calibration screens as there each control is treated separately. There's no reverser interaction with throttles whilst calibrating. Note that on the jet quadrants it is ***very*** important that the throttles can be reduced to complete idle (i.e. a **scaled output** value of 0). If any of them do not reduce to idle when pulled right back you will not be able to engage reverse thrust with the reverser lever.
ThrottleR	There are also up to four throttles with a reversing range. These are used on the TurboProp quadrant. With these throttles a "centre" dead zone should be set to always encompass the 'notch' in the lever slot, being the ***idle*** position. The region below this is then the reversing zone. The forward thrust zone ranges from 0 (idle) to 16383, whilst the reverse zone goes from 0 to –4096 (which, in FS2002 or later, is adjusted when used, for each aircraft independently).
Flaps	You can calibrate an axis for flaps control. This is best done with an axis which has détentes to provide positive positions for each setting, but it is possible without those if you have visual feedback of your setting. To calibrate the flaps first set the position for flaps "up" and flaps "full". These should be calibrated when slightly off the end stops to allow for small variations. You will see the buttons marked appropriately when you select the flaps axis. Then set up to 7 intermediate or interim flap settings. It is best to start from the flaps up position and work down. The two centre display boxes show each calibrate flaps value (this will be the ***centre*** of that flap position range) and the flap setting number (#1 to #7). You add a new position using the "Set Interim Detent" button, and clear the one displayed with the "Clear Interim Detent" button. If you have already set 7 interim values (making 9 positions in total), further uses of the "Set" button merely alters the currently displayed centre, unless it is "up" or "full". The Automatic Setting mode can be used for this too, and may be appropriate if your axis has no détentes at all. The automatic setting sets the correct number of détente values for the currently loaded aircraft—for example 9 including the "up" and "full" values for the 737, and 4 for the Cessna light aircraft.
Elevator Trim Aileron Trim Rudder Trim	Trim axes are actually provided in the Jet Cockpit, but can also be allocated on a quadrant and calibrated there. In this case you don't have the luxury of response curve assignments, but those shouldn't be needed in any case.
Steering tiller	This can be calibrated to provide a separate steering capability to the rudders, when on the ground. When both rudders and a tiller are in use, PFC.DLL automatically gives more effect to the tiller at low speeds and gradually transfers that effect to the rudders as the ground speed increases. By around 60 knots it will be all rudder. The tiller has no effect in the air.

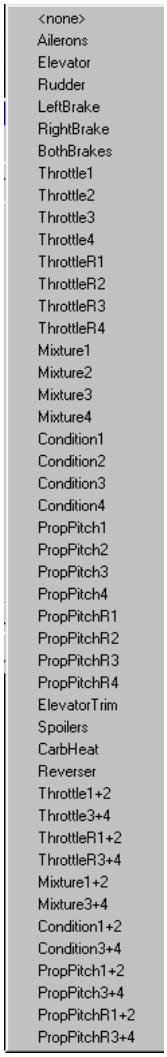
USER CONFIGURED QUADRANTS

The driver provides slots for up to 15 quadrants where you, the user, can decide which lever does what. Obviously, to do this you'll need a real quadrant that is equipped with levers in the positions you want to use. One example, which we'll work through here, is using the 4-jet quadrant to fly twin jets with the two spare throttle levers being used for proper analogue "toe" (or rather, in this case hand) brakes.

Note that, to be able to use any user-defined quadrant, you will either need to switch off the automatic quadrant selection (in the Main Options page), and select them yourself—or just press the **Assign to aircraft** button near the top of the quadrant window for each aircraft you want to use it with (loading the aircraft first, of course!).

Here's a picture of a user quadrant configuration that is quite easy to set up following the steps below:





You can see that all six levers are allocated, enabled, and they are also all calibrated for use with the 4-engined jet quadrant—but configured to fly a two-engined jet with proportional 'hand brakes' (substituting for a lack of analogue toe brakes, for example). The steps to achieving something like this with any "User Configuration" are:

1. Affix the actual quadrant you wish to use. This is needed for both correct lever association and for calibration.
2. Choose a lever you wish to use, make sure the on-screen slider moves with it, then click the button in the **Press to assign** row at the top of the relevant column. If you've not used this before it will be blank. You'll get a menu listing all of the possible axis assignments you can make (see picture on right—this is an example only, there are already additional facilities added).

   Most of these will already be familiar to you, and are described earlier. The only extra ones you'll find here are "elevator trim", a combined Left+Right Brake ("bothBrakes"), and a list of "combination" controls for engines 1+2 and 3+4.

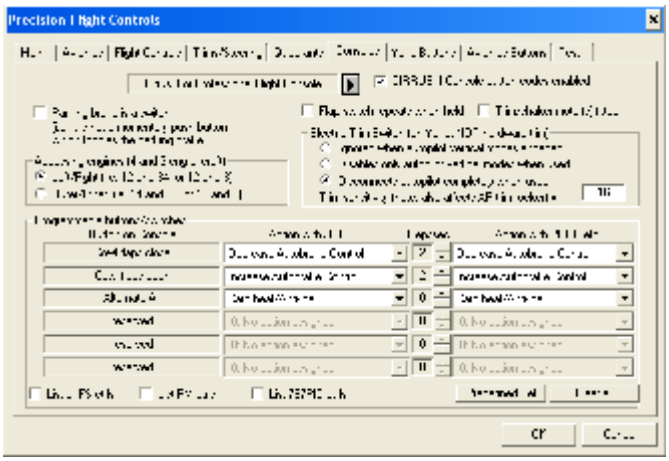
   This elevator trim control is a direct analogue control over the pitch trim, which is rather different in operation to the incremental trim used everywhere else.

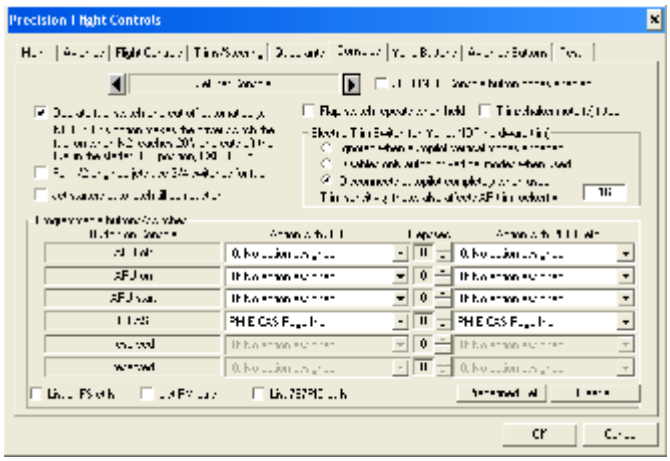
   The engine combination controls (covering Throttle, ThrottleR, Mixture, Condition, PropPitch and PropPitchR) are provided to allow you to run up to 4 engines with a 2 engined quadrant, or possible 2 engines with a 1 engined quadrant.
3. Having chosen one of the listed functions for this lever, you will see it described in the button at the top of the column. Make sure you check the **Check to enabled** checkbox, otherwise the axis won't be seen in Flight Sim.
4. Now check the direction of movement. If necessary check the **RVS** (reverse) checkbox to ensure that the direction of travel meets your expectations. If you are strangely inclined to allocate aileron or rudder control to a lever here then, since the slider orientations are only vertical, you'll need to know that the **scaled output** value needs to be negative for LEFT (port), positive for RIGHT (starboard).
5. Finally, **calibrate** the axis just as described earlier.

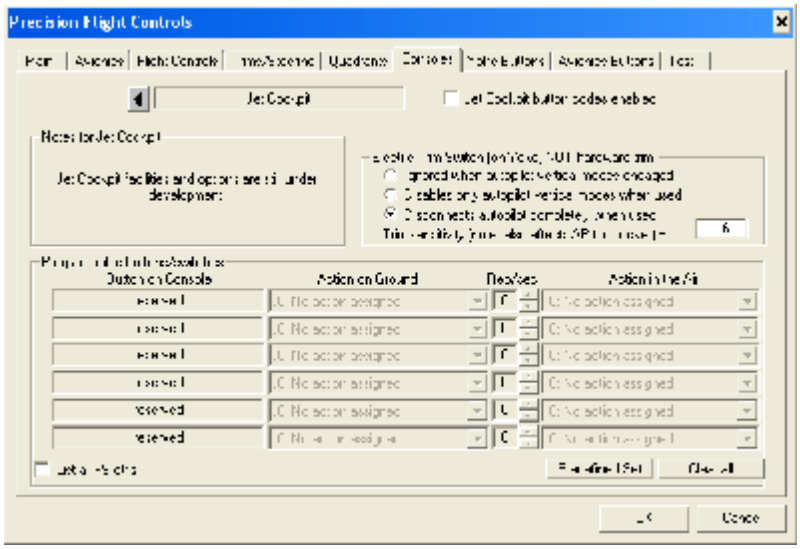
Repeat all these steps for each lever you want to use. You can also rename the set. Instead of “User Config n” just edit the name, there in the display. The names are saved in the INI file (and can be edited there as well if you like, but do this when FS isn’t running).

When you’ve done, when you press the “OK” button, everything will be saved in the PFC.INI file. You may want to make a copy of that *now* to safeguard all this hard work!

Consoles Page







IMPORTANT: If you are using the Throttle Quadrant Console, *not* a Cirrus II, Professional, Jetliner Console, or Jet Cockpit then you should uncheck the option saying that a Cirrus is being used (“CIRRUS II console button codes enabled”). Otherwise, since this is defaulted, you may get spurious switch changes when starting FS.

If you are using a Jetliner Console, be sure to uncheck the top right option in the Cirrus/Pro section, and then check the option to enable the Jetliner console button codes in its own section. If you have both console codes enabled (which is allowed for development and testing purposes), then the Cirrus II button codes and assignments take precedence.

If you are in a Jet Cockpit, disable the Cirrus selection and enable only the Jet Cockpit one.

There are several options applicable to the Cirrus II and Professional Consoles, including three user-programmable buttons. But … the way PFC equipment buttons are assigned is very similar throughout all parts of the driver, so this subject will be covered together, for Avionics, Console and Yoke buttons: see **Button Assignments** later in this document.

The other options on this page are related to differences in the ways the other switches and buttons can be made to behave. Before going into those, I will review the switches and buttons available on both current consoles, and what they do in Flight Sim, by default.

Note that *most* switch positions are self-synchronising, in that the setting on the Console is automatically reflected in the Simulator. However, this isn't the case with some switches, due to the way the firmware works in the unit itself, and sometimes you may need to toggle some switches to make the simulator match their settings.

Also, after switching on the Avionics (by the Avionics switch on the Jetliner, or this switch or the Battery switch on the Cirrus II), wait for a few seconds for the avionics to correctly initialise before operating any other switches or buttons. The driver automatically discards all signals for more than a second after these switches are enabled in order to try to avoid incorrect settings.

Also, sometimes, in my experience, the avionics come up in a strange mode with some switches not working correctly (the Gear switch seems prone to this). If this happens, switch off again, count to 5 and try again. It usually sorts itself out. This phenomenon must be to do with hardware initialisation as it isn't detectable or correctable in the software.

***Note:** All of the console buttons and switches can also be re-programmed in FSUIPC's "Buttons" section when using FSUIPC version 3.30 or later. See the section about **Button and Switch Re-programming** later in this document.*

Cirrus II or Professional Flight Console

The table below is in order from top left, row by row to bottom right, facing the console.

Magneto (Left)	For props, controls Magneto setting (off/right/left/both) for the first or only engine. See below for options with three and four engined aircraft. Note also that the operation of Magneto switching on FS98 aircraft transposed into FS2000 is not correct. The controls that are provided in FS98 to control these settings are broken in FS2000 except for FS2000 native aircraft or derivatives. For jets this switch is only used to select between 'off' and 'gen' on the starter switches. This actually duplicated the function of the Alternator switches. Any position other than 'off' on the Magneto switch selects 'gen'.
Magneto (Right)	As for the left switch, but for the second or right engine on a twin. See below for options with three and four engined aircraft.
Battery Master	Operates the battery master switch, of course. Note that when this is off the optional PFC Avionics stack is also off (unpowered). When it is turned on the driver discards further input for about one second, so that spurious signals from the avionics do not upset things.
Alternator (Left)	Operates the left or only alternator switch, if one is provided in the current aircraft. In jets this also switches between "off" and "gen", actually overlapping in this function with the Magneto switches. See below for options with three and four engined aircraft. Another thing to note is that, because of interlocks on some FS panels, the alternator switches can get out of step with those on the panels.
Alternator (Right)	As for the Left one, this operates the right alternator where one is provided. See below for options with three and four engined aircraft.
Avionics Master	Operates the avionics switch, where one is provided. Note that when this is off the optional PFC Avionics stack is also off (unpowered). When it is turned on the driver discards further input for about one second, so that spurious signals from the avionics do not upset things.
Rudder Trim	This is handled completely within the Console and is not subject to any driver programming.
Landing Gear	Operates the landing gear where applicable. Note that the driver synchronises the state of the landing gear in FS with the position of this switch. This can prove embarrassing if you ever reset your FS flight from one flying with gear

	retracted to one on the tarmac or runway—the aircraft may immediately do a belly flop on loading! Be sure to lower gear before selecting any new flight that starts on the ground!
Flaps	Operates the flaps. There's an option for making this a one-hit switch, or repeat whilst held. See below.
Engine Start	This operates starters for props and jets, though FS98 props transposed into FS2000 may start up on magneto switching in any case (see the comment on the Mag switches, above). With genuine FS2000 and FS2002 models, for props you have to ensure a rich mixture setting, then hold the starter on until the engine starts. For FS2000/2002 jets you hold it on until N2 reaches 20% or more, then switch on the fuel (**Fuel boost** switch). The starter switch is inoperable if the corresponding magneto switch is in the 'off' position. Pushing the switch left operates the left starter, or number one engine. On twins you push the switch right for the right or number two engine. See below for options with three and four engined aircraft.
Yoke	The yoke fitted to the Cirrus II Console may be a Jetliner, with 12 button operations (4 rockers and 4 buttons), or a Beech or Mooney, each with 6 button operations (2 rockers and 2 buttons). Many of these are user programmable, and they are all described in the sections on the Yokes page. There's an option concerning the *electric trim* action, described below.
Lights	The four light switches are active as applicable to the various aircraft or panels. The four switches operate the following lights, as available: NAV — Navigation, Wing, Recognition, Instruments STROBE — Strobes, Beacon LDG — Landing TAXI — Taxi, Logo
Parking brake	Controls the parking brake. This may be a push button or a pull/push switch. See the option below. The driver needs to know which type you have fitted.
Pitot Heat	Controls the pitot heat switch in all panels and aircraft so equipped. Always fly with pitot heat enabled, or risk suffering AirSpeed Indicator (ASI) failures and consequent auto-throttle errors.
Fuel Boost Left	On jet aircraft this controls the fuel switch for Engine number 1, on the left in a twin. It needs to be on to allow the engine to start—normally you turn the turbine with the starter till N2 reaches 20%, then switch on the fuel. To stop the engine, turn this switch off. On other aircraft, fitted with fuel pumps, this operates the fuel pump for the first or left engine. Whether the aircraft needs the fuel actively pumped depends on a variety of circumstances. See below for options with three and four engined aircraft.
Fuel Boost Right	Same as the switch for Fuel Boost Left, except operating the fuel for the second or right engine on twins. See below for options with three and four engined aircraft.
Fuel Tank Selector	Selects the fuel tank to feed the engines: off, left, both or right, as marked. This applies exactly to non-jet aircraft so equipped, or as near as possible to others—usually with 'both' interpreted as 'all'. On jets, this is made a little more useful. The 'off' is still off, the 'both' selects 'all', but 'Left' selects Crossfeed Left-to-Right and 'Right' selects Crossfeed Right-to-Left. Note that some jet fuel switch gauges actually indicate crossfeed incorrectly,

	or at least ambiguously. If you want to check the selected setting, look in the Aircraft–Fuel menu in FS. In FS2002 (and maybe before?), you will find some aircraft with multiple fuel selector switches, whilst the PFC consoles only feature one. The PFC driver now operates all engine fuel selectors together (in FS2002 and FS2004 only), providing these settings for the Cirrus II selector switch: Off — Both switches 'off' Left — Left to 'on', right to 'crossfeed', so both tanks feed the left engine Both — Both switches 'on' Right — Left to 'crossfeed', right to 'on', so both tanks feed the right engine Thanks are due to Frank Oberbuchner for prompting this approach.
Cowl flaps	This is a user-programmable switch, but is defaulted to operate the cowl flaps on aircraft so equipped (not jets), and the autobrakes on jets.
Alternate Air	This is also a user-programmable switch, with default operations defined. Whilst there appears to be some provision for "alternate air" in the inner workings of FS2000 and FS2002, there are no controls or indicators for this in the default aircraft. The standard equivalent on the types of non-jet aircraft implemented in FS is "Carb Heat", and this switch operates this function. On jets the default action of this switch is to control the anti-icing.

***Note:** All of the console buttons and switches can be re-programmed in FSUIPC's "Buttons" section when using FSUIPC version 3.30 or later. See the section about **Button and Switch Re-programming** later in this document.*

CIRRUS II and PROFESSIONAL CONSOLE OPTIONS

Parking brake is a switch: There are two different parking brake switches which can be fitted on the Console. One is a simple push button. You push it to engage the parking brake, and push it again to disengage it. The other type is a push/pull switch, as provided for the Alternate Air control. In this case you should pull the switch to engage the parking brake, and push it back in to release it. This more accurately reflects real aircraft parking brake operation.

The driver cannot tell which sort of parking brake switch your Cirrus II console has fitted. By default it assumes it is a simple push button, so check this option if you have the more realistic push/pull switch.

Accessing engines (4 and 3 engined aircraft): The Cirrus II Console has a number of switches that refer to twin engines: the two **Magneto** switches (off-right-left-both), the **Starter** (a single left-right switch sprung to centre), the **Alternator** (Left and Right) and the **Fuel boost** switches (also Left and Right). With all of these the Left switch always operates the first or left most engine or its fuel. In a twin there's no ambiguity: the Right switch operates the number 2 or right engine or its fuel.

In three-engined aircraft you can have Left controlling 1+2 (i.e. left AND centre) and Right still controlling right, or have left controlling 1+2 and Right controlling the number 2 or centre engine.

In four-engined aircraft you can have Left controlling 1+2 (i.e. both left engines) and Right controlling both right engines, or have left controlling the 'outermost' (1+4) engines, and Right controlling the 'innermost' (2+3) engines.

The option is provided because one method (the default) is more obvious and less confusing, whilst the other method is actually, potentially, more useful. To explain: imagine you have landed your 747 and are either not confident that you have enough fuel to get you to the gate, or you are cost conscious and want to save fuel in any case. In this circumstance you should cut two of your four engines and continue taxiing on the other two. Now obviously you want symmetric thrust available, so you cut engines 2+3, or possible 1+4. You wouldn't cut both engines on the same side because this would give you some steering difficulty and type wear, to say the least.

You stop a jet engine by cutting off its fuel. If the **Fuel Boost** switches are configured to operate Left=1+2 and Right=3+4 you can *only* stop both engines on one wing or the other.

Anyway, it is your choice. If you don't fly 3 or 4 engined aircraft there's nothing to decide.

The other point to note here is the way the **Starter** switch operates with 3 and 4 engined aircraft. You cannot start more than one engine at the same time, so the starter switch is designed to operate the starter of the first engine assigned to the direction you press it (Left/Right) if that engine is not already running, and otherwise start the second such engine. This means that with the 1+2/3+4 arrangement you cannot start Engine 2 before 1, or Engine 4 before 3. With the 1+4/2+3 arrangement the order is 1 then 4, 2 then 3.

If you have an engine failure this could prove problematic, depending which engine is failing.

Flaps switch repeats when held: This is a simple option which, if selected, allows the flaps to continue to lower or raise whilst the switch is held in the appropriate position. It is defaulted off, which means you have to operate it repeatedly for each flap détente you want to move to, but this is the more accurate option without a genuine flap lever with specific détentes.

Trim/shaker motors fitted: Only check this to enable the facilities in PFC.DLL which driver the stick shaker motor (on stall or overspeed warnings) and trim motor (to turn the trim wheels), if you have these fitted. Do not enable them otherwise, as there is a possibility that the version of firmware in your console might then cause odd things to happen, most noticeably flashing of the gear indicator LEDs when trim is adjusted.

Electric Trim Switch (on Yoke): the options here allow you to decide what happens to the autopilot when you operate the electric trim. The reason there are options here is that there seems to be quite a lot of variation in real life as to what happens, and you will no doubt want to match the simulator operation to your real flying experience as closely as possible.

The options more or less speak for themselves, but a few words here may be useful:

You can have the simulator completely ignore the operation of the electric trim buttons when the autopilot is controlling vertical mode (as in Alt, VS or APR modes). This is the documented action on the Bendix King KFC150 and KAP150 autopilots. You can always and easily either completely disconnect the Autopilot (a pre-programmed button on all the yokes), or temporarily override it with the CWS (Control Wheel Steering) button (programmed on one of the user-programmable buttons on the Jetliner).

Alternatively you can have the autopilot automatically disconnect its vertical control modes, without affecting the lateral control (Heading, NAV). This is said to be implemented in some aircraft. (This option is *not* usable when flying the Wilco 767 PIC, since the driver cannot read the A/P modes in order to know what to change).

Finally, you can choose to have the electric trim totally disconnect the autopilot, with the usual warning beeps. This is also said to be implemented on some aircraft, but it seems rather extreme to me, and even redundant with the AP disconnect button available already, right next to the electric trim.

Trim sensitivity: The electric trim (from the yoke, or assigned buttons) operates by altering the pitch trim by a fixed small amount, but doing this something like 18 times per second. The 'small amount' actually used can be adjusted to give the trim a faster but less sensitive action, or, vice versa, a slower and more sensitive action. The value defaulted is 16. This is about half of the trim change you get by one short tap on the Number Page 1 or 7 key when using keyboard trimming.

On the keyboard, a quick double tap on the trim keys gives a change in trim amounting to some 256 units. With the default sensitivity setting of 16 this would take nearly a second to achieve on the electric trim buttons (256/16 = 16, at 18 repeats per second). So, to allow fast massive trim corrections the electric trim is programmed to go much faster if the trim button is held down for longer than a certain time. By default this is 8 times the normal trim (i.e. 128 units) and kicks in after the button is held for 2 seconds (20 tenths of a second). You can adjust these two values if you like, but only in the PFC.INI file, which means closing down FS, editing the file, then re-loading FS. PFC.INI file entries are described at the end of this document.

Jetliner Console

The table below is in order from top left, row by row to bottom right, looking down on the Jetliner Console. (The six buttons on the front upright are the **Simulator Buttons** as described earlier, not here).

Engine Start switches (1–4)	These operate the engine starters, with OFF, GEN and START positions. The 'Start' position is spring-loaded and, for genuine FS2000 aircraft models needs to be held on till the Engine starts (*unless the auto-latch option is selected*). Jet engines are started by using the starter to turn the turbine until N2 reaches about 20%, and then switching on the fuel. There are no separate fuel switches on the console, so there is an option (defaulted on) to switch the fuel on automatically when N2 reaches 20% or more. The same option switches the fuel off when you set the starter switch to off. This stops the jets—normally the 'off' position would only turn the generators off.

	A separate option can be enabled which changes the starter switches for engines 3 and 4 into fuel switches for engines 1 and 2. This is obviously only operational for 1 and 2 engined jets.
Landing Gear	Operates the landing gear where applicable. Note that the driver synchronises the state of the landing gear in FS with the position of this switch. This can prove embarrassing if you ever reset your FS flight from one flying with gear retracted to one on the tarmac or runway—the aircraft may immediately do a belly flop on loading! Be sure to lower gear before selecting any new flight that starts on the ground!
Autopilot	The whole of this section is described earlier, in the table for the Avionics.
Pitch Trim	This is handled within the Console and is not subject to any driver programming. For normal trimming use the electric trim rocker on the yoke.
Parking brake	Controls the parking brake. This is a pull/push switch. It may need synchronising when starting a flight.
Autobrake	This operates the B737 style autobrake switch included in the default FS2000 panel. It works with standard panels and with Project Magenta, but note that the Wilco 767PIC autobrake is more complex. The driver attempts to synchronise matching settings for the 767PIC, but it relies on keystrokes for incrementing or decrementing the switch position, and these seem to be problematic with that panel—the same problems, skipping some positions, occur even when using the keyboard directly. Consequently, you may sometimes need to use the mouse for this switch in the 767PIC.
Flaps	Operates the flaps. There's an option for making this a one-hit switch, or repeat whilst held. See below.
Auto-Throttle	This operates the auto-throttle 'arm' switch. The auto-throttle needs arming for all speed, TO/GA, N1/THR and VNAV operations.
Throttle Quadrant (with optional attached TO/GA or A/T disconnect buttons)	The throttle quadrants are described elsewhere. The optional button on the levers normally operates TO/GA ("Take-Off/Go-Around") on standard FS panels, N1/THR on Project Magenta, and either N1 or GA on Wilco's 767PIC. The one chosen in the latter case depends on whether the aircraft in the air or on the ground and, in the latter case, whether the IAS is below 50 knots or not. Optionally, you can have the button operate as an Auto-Throttle Disconnect. The choice in made in the Main Options page. When you use A/T disconnect what actually happens is that the A/T is disarmed, which disconnects all possible auto-throttle actions, and then re-armed a short time afterwards. This ensures that the toggle switch indicating AT arming status remains consistent.
Adjusters for DH, CRS, HDG, BARO and ND mode/range	See the table for the 'RIC' earlier.
Rudder Trim	This is handled completely within the Console.
Aileron Trim	This is handled completely within the Console.
Radio navigation aids	The NAV, COM, DME, Transponder and ADF devices are all described earlier.
Avionics Master	Operates (simultaneously) the avionics, alternator and battery switches, where these are provided. Note that when this is off the PFC avionics are also off (unpowered). When it is turned on the driver discards further input for about one second, so that spurious signals from the avionics do not upset things.
EICAS	This is user programmable, but by default it is used on Project Magenta to switch EICAS displays. Note that although it has a double action, up and down, these are indistinguishable

	to the driver as they give the same code. Therefore only one action can be programmed for it.
Fuel X-feed	This operates the fuel crossfeed switch in FS. The central position is normal, enabling fuel feed from all tanks. 'Left' selects Crossfeed Left-to-Right and 'Right' selects Crossfeed Right-to-Left. Note that the earlier default FS jet fuel switch gauges indicate crossfeed incorrectly, or at least ambiguously—"Left-to-Right" is indicated as "Right"! If you want to check the selected setting, look in the Aircraft–Fuel menu in FS.
APU Starter	This switch is intended for the APU engine, with Off, Gen and Start positions just like the main engine Starters. However, there are no standard FS aircraft with APU facilities that can be operated by the driver. Therefore the switch is completely user programmable.
Pitot Heat	Controls the pitot heat switch in all panels and aircraft so equipped. Always fly with pitot heat enabled, or risk suffering AirSpeed Indicator (ASI) failures and consequent auto-throttle errors.
De-Ice	Operates the anti-ice facility in FS. This should always be used when flying through clouds, and, in cold conditions, prior to take off.
Lights	The four light switches are active as applicable to the various aircraft or panels. The four switches operate the following lights, as available: TAXI Taxi, Logo LDG Landing STROBE Strobes, Beacon NAV Navigation, Wing, Recognition, Instruments

***Note:** All of the console buttons and switches can be re-programmed in FSUIPC's "Buttons" section when using FSUIPC version 3.30 or later. See the section about **Button and Switch Re-programming** later in this document.*

JETLINER CONSOLE OPTIONS

Operate fuel switch and cut-off automatically: There are no separate fuel on/off switches on the console. Therefore, by default, the driver automatically switches the fuel on when the starter is operated and the N2 reading is over 20% and it cuts the fuel when the starter switch is set to Off. If you are using fuel switches elsewhere, or have programmed them on other Jetliner switches, then disable this automatic action here.

For 1/2 engined jets use 3/4 switches for fuel: If you fly single or twin jets then the starter switches for engines 3 and 4 are superfluous and so can be brought into use as fuel on/off switches for engines 1 and 2. That's what this option enables. In this mode the upward "start" position is not used. If you load a 3 or 4-engined jet the switches automatically (and temporarily) revert to their normal operation.

Jet starters auto-latch till combustion: In a real airliner cockpit the jet start switches are normally spring-loaded, as in the Jetliner, but they also usually latch automatically in the "start" position and are released to spring back to the central position when the starting sequence has completed. To simulate this you can enable this latching option. The program will continue the starting sequence even if you release the switch—to cancel it you can press the switch in the other ("off") direction. The starter will remain engage until the jets are running (as indicated by the "combustion" flag in Flight Sim).

Flaps switch repeats when held: Same as for the Cirrus II Console—see earlier.

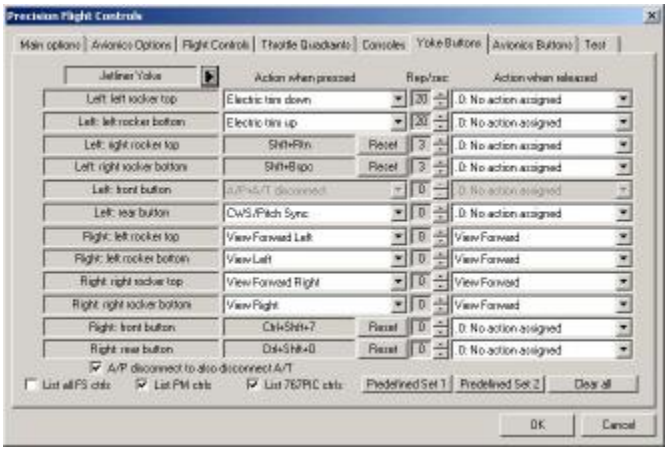
Trim/shaker motors fitted: Only check this to enable the facilities in PFC.DLL which driver the stick shaker motor (on stall or overspeed warnings) and trim motor (to turn the trim wheels), if you have these fitted. Do not enable them otherwise, as there is a possibility that the version of firmware in your console might then cause odd things to happen, most noticeably flashing of the gear indicator LEDs when trim is adjusted.

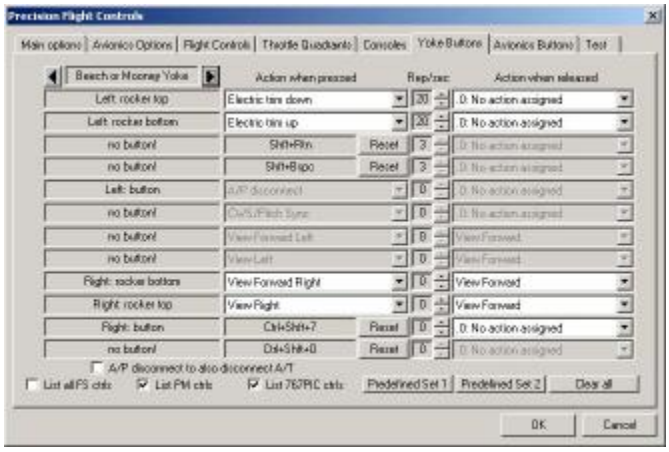
Electric Trim Switch (on Yoke): Same as for the Cirrus II Console—see earlier.

Trim sensitivity: Same as for the Cirrus II Console—see earlier.

There is also the option to treat the button on the throttle lever as A/T disconnect instead of TO/GA. Please see the Main Options page for this.

Yokes Page





This page provides the programming facilities for the Jetliner, Beech/Mooney or Professional Console style of yoke. Shown above are the Jetliner and Beech/Mooney pages. For a Professional Flight Console with the built-in hardware trim option, use the third page which specifically shows the right-hand rocker on the left handle reserved for the hardware trim mechanism. More on this below. For a Professional Console without the hardware trim action, refer to the most appropriate one of the above two pages—most probably the Jetliner Yoke page (two rockers and two buttons on each handle).

The Jetliner has 12 buttons (8 paired in rocker switches) and the Mooney and Beech yokes each have 6 buttons (4 paired in rocker switches). Of these, three are actually pre-assigned in the hardware/firmware: electric trim down and up on one rocker, and AP Engage/Disconnect on one button. To the driver, the latter is actually indistinguishable from the AP Eng button on the Avionics autopilot, so it cannot be user programmed. But the electric trim actually provides a different code to the driver from the trim rocker on the autopilot, so is re-programmable.

Note that there's an option for the A/P disconnect button to also disconnect the Auto-Throttle (A/T). If you apply this option, it actually changes the control in the dropdown list from "A/P disconnect" to "A/P+A/T disconnect", so it will affect anything else you've programmed to operate this control. It will also affect the A/P Eng button on the Avionics, since that it indistinguishable from the yoke button. This dual action applies to FS auto-throttle and to Project Magenta, but not to 767PIC.

Entries in the Page representing buttons that are not programmable are greyed out. So are those lines in the "Other Yokes" page which represent buttons not provided on the Beech and Mooney yokes.

The method of programming the buttons and the choices available to you are described fully in the **Button assignments** section, later in this document. Note that yoke button actions can be programmed for different actions for when the button is *pressed* and *released*. This is mainly of use in the settings using the twin right rockers on the Jetliner yoke as a 'view' hat, where pressing the button lets you look out a side window, and releasing it returns you to a forward view automatically. The **Predefined Set 2** option sets these defaults, and this set is shown in the illustrations above. The **Predefined set 1** assignments (defaulted on initial installation) give you panning controls instead.

Note that for the separate view controls to work properly in FS2002 you may need to add the line

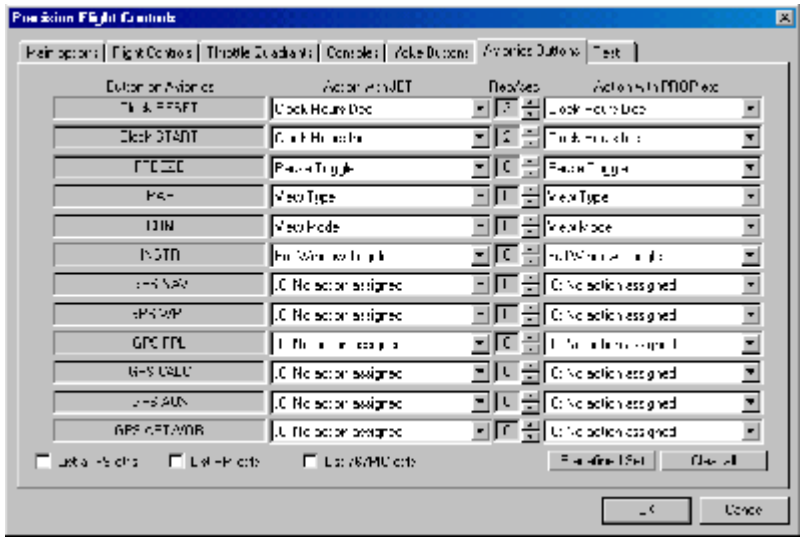
pan_in_cockpit_mode=1

to the [CONTROLS] section of the FS2002.CFG file.

NOTE on Professional Console with hardware trim: On this yoke the right hand rocker on the left handle is not detected by the driver and does not adjust the trim in the simulator. To adjust that trim use the 'electric trim' facilities, by default programmed on the left rocker, but also available in non-autopilot control modes on the autopilot (as described elsewhere). PFC recommend that you use both the rockers on the left handle is unison, thus adjusting both the simulator's trim and the yoke centering together. Practising will no doubt allow you to develop the best technique for achieving correct trim smoothly and precisely.

***Note 2:** All of the programmable yoke buttons can also be re-programmed in FSUIPC's "Buttons" section when using FSUIPC version 3.30 or later. See the section about **Button and Switch Re-programming** later in this document.*

Avionics Buttons Page



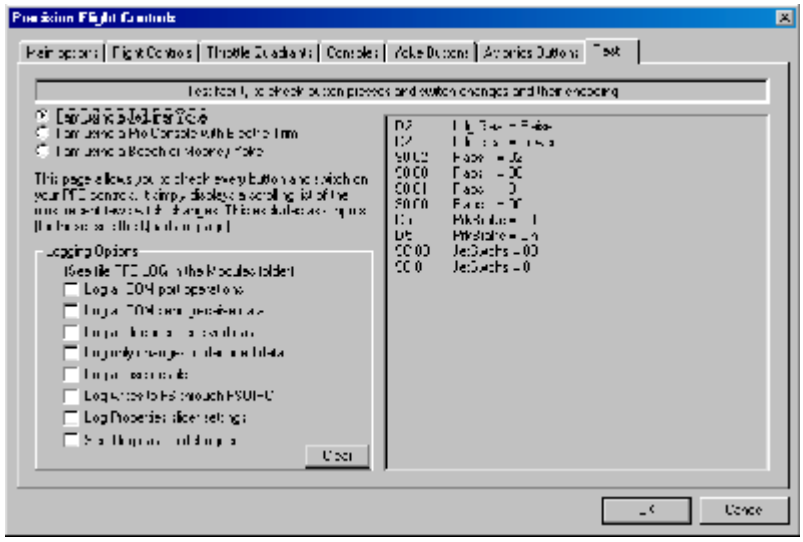
This page allows you to make your own button assignments for 12 different buttons on the Avionics stack (or in the avionics sections of the Jetliner Console). These are the six buttons along the bottom of the stack (or on the front upright of the Jetliner), concerned with simulator settings, and a row of 6 buttons in the GPS section (or, on the Jetliner, the buttons marked VOR/NDB through to Std Baro SET).

Five of the six buttons have fixed uses with Project Magenta, and cannot be programmed when the PM MCP is running.

The method of programming the buttons and the choices available to you are described fully in the **Button assignments** section, later in this document.

***Note:** All of the avionics buttons, knobs and switches can be re-programmed in FSUIPC's "Buttons" section when using FSUIPC version 3.30 or later. See the section about **Button and Switch Re-programming** later in this document.*

Test Page



This page provides a way for you to check out your connected PFC equipment. For every button, dial, knob or switch this page displays the actual codes returned (in hexadecimal) and the driver's understanding of what it means. The only parts of your PFC equipment it does not show are the returns from the analogue axes (throttle levers, rudder and toe brakes, aileron, and elevator)—to check those refer to the Flight Controls and Throttle Quadrants pages.

If the button, knob or switch has been re-programmed in FSUIPC (version 2.93 or later), then the labelling here will show "(to FSUIPC)" after the function is identified. This is one way to double-check whether you've re-programmed any of them.

The choice at top left in this page, between the Jetliner and other yokes is simply so that the decoded descriptions can match your yoke correctly, when you use the Test page to check your yoke buttons. There's no other significance in this choice, although it will also decide which yoke button page is shown to you first. It is remembered (in the PFC.INI file) so you don't need to set it correctly each time you visit the page.

One thing this page will illustrate well: the short spate of invalid or misinterpreted codes seen from the Avionics stack when it is first switched on (either by application of power directly, or by use of the Master Battery or Master Avionics switches). This is because it comes on in "Elite" mode rather than using PFC's own protocol. The driver sets it into the correct mode as soon as it can, and discards everything received for over a second immediately after seeing the switching, but it is still sometimes possible for some Elite codes to get through. On the whole these do no harm as subsequent interactions sort out any discrepancies. (Note that the discard period is not operating in Test mode).

Logging

The PFC driver always creates a small text file in the Modules folder, alongside the PFC.DLL and PFC.INI files. This is "PFC.LOG" and normally simply provides a start and end message. If there are problems that need investigation, various other messages can be sent to this file. When displaying the Test page, any messages shown in the window are also sent to the log—otherwise, in this page nothing else is logged. The options for logging are shown bottom left on the Test page. If any of these are needed, to assist in determining the cause of your problem, you will be asked to enable the appropriate ones, re-create the problem, then close down FS and ZIP up the PFC.LOG file, and the PFC.INI file, and send them to me. Don't forget to Clear the logging options afterwards (press the "Clear" button on the Test page), otherwise you might find some very large PFC.LOG files being produced!

Button Assignments (in PFC options)

The PFC driver provides for user assignments to a number of buttons on the yoke, the Cirrus II console, the Jetliner Console, and the Avionics stack. Note that since version 1.46 of the PFC.DLL and 2.93 of FSUIPC, *all* the PFC buttons, knobs and switches can be re-programmed in FSUIPC's "Buttons" section. This way of doing things can provide more opportunities, but is really only suited to the more experienced user. For more details, see the section below (**Button and Switch Re-programming)**.

Back to the PFC options for programming. For the yoke these assignments can be different for the button *press* and button *release*, but all the others are separately programmable for *Jet* and other aircraft.

Each button assignment section operates the same, with the button description on the left, then a column for the *Press* or *Jet* assignment, a column to specify the repeat rate per second, if any, and a column for the *release* or *non-jet* assignment. In the *Press/Release* situation the repetition rate obviously only applied to the *Press* action, but in the *Jet/non-jet* cases the repeater is applied to both.

In case the button description is not clear, or you just want to check its operation, when the driver detects that a listed button is pressed you will see a mark 8 to its left.

To assign an action to any button, click on the drop down button in the appropriate column. If a keypress has been assigned you'll need to click the 'Reset' button instead, which will be visible against the keypress currently assigned.

The list of controls you get in the drop-down can be very long. If you have checked the 'List All FS Controls' checkbox in the bottom left corner then the list will include *all* the controls listed in Flight Sim's CONTROLS module. Similarly there are options to include extras for Project Magenta (PM …) and, if you selected Wilco 767PIC support in the Main Options, all those "B767PIC" controls too. (Many of the FS controls will be useless or meaningless in this context, which is why, by default, only a selected list of more useful ones is provided).

For details of most of Flight Simulator's controls, please refer to my FS2000 Controls document, available from www.schiratti.com.

Assignment of a control to a button here is similar to assigning them to Game Port joystick buttons in the FS CFG file. The end result, at least for all the FS controls, is the same. The extra, non-FS controls, listed are:

.0: No action assigned	As it says, this means that the button will do nothing. The odd numerical prefix here is merely to make sure this item comes at the top of the list which is sorted alphanumerically.
.1: Use Key Press …	Select this if you want the button to send a keypress combination to FS. Any single combination of Shift, Control and almost any other

	key (but *not* all, and certainly not *Alt*). After making this selection you make the choice by actually pressing the keys. To undo this and get back to the regular controls list, press the 'reset' button. *This will not work on Windows 95 or earlier, nor on versions of NT before SP3.*
CWS/Pitch Sync	This is "control wheel steering" in AP controlled modes and "Pitch Sync" when the autopilot modes are not engaged. For a full explanation of these actions please see the Note below.
Pitch trim reset	This is a simple control which zeroes (centres) the elevator trim value.
PTT Roger Wilco (local)	This is for use with a copy of the Roger Wilco program running on the same PC as FS. The control sends the "Transmit" command to RW when pressed and turns this off when released. You do not (and should not) program an action for button release—the driver does this part automatically for this control. [*This is known to work with RW Mark 1 and Mark 1c but has not been tested with any others*]
PTT Roger Wilco (via WideFS)	This is for use with a copy of the Roger Wilco program running on a separate PC under WideFS. You do not have to configure the WideClient.ini file specifically for this function. The control sends the "Transmit" command to RW when pressed and turns this off when released. You do not (and should not) program an action for button release—the driver does this part automatically for this control. [*This is known to work with RW Mark 1 and Mark 1c but has not been tested with any others*]
Electric Trim Down Electric Trim Up	This is a specially programmed smooth pitch trim with adjustable sensitivity, and pre-defined autopilot interaction. This is all described earlier in this document (see Console Options).
A/P disconnect	Unlike the normal AP Eng control, this disconnects the autopilot only
Carb Heat/Anti-Ice	Operates this FS control on all 4 engines at the same time.
Throttle/Prop/Mix Sync	This toggles a facility to synchronise the settings of throttle, propeller pitch and mixture on all engines. Basically, when enabled, it uses the Engine 1 values* for all the engines and ignores the inputs from the other axes. When toggled off, the current settings for the other axes are re-instated. This is *not* related to the "Prop Sync" switch fitted to some aircraft. * There is an option, in the INI file only, to have the settings based on the Engine 2 values instead. Only change this if you think your engine 2 axes behave better than your engine 1 axes.
PM MCP …	A complete set of push button facilities to control the Project Magenta MCP
PM ND …	A complete set of selectors and buttons to control the assorted display modes on the Project Magenta ND
PM PFD Decision Ht Dec PM PFD Decision Ht Inc	Controls for adjusting the Project Magenta PFD decision height.
PM_EICAS …	Controls for selecting Project Magenta EICAS pages and display options.
B767PIC …	A complete set of controls linked to keyboard shortcuts defined for Wilco's "767 Pilot in Command" panel. Use these control names rather than define the keystrokes explicitly, so that the PFC driver can automatically track any key re-assignments you may make in future (provided you reload a Flight or change aircraft after making such re-assignments). *These will not work on Windows 95 or earlier, nor on versions of NT before SP3.*

Note on CWS/pitch sync: This control is probably the most complex one provided. Its job depends on whether you are flying with autopilot control or not.

If you are flying without A/P control, but using the Flight Director (FD), then the control is a "pitch sync". When you press the button the vertical speed setting is changed to match your actual vertical speed. The idea is that the FD command bars synchronise to your current flying mode and thereafter allow you to keep doing the same by following the bars.

This works moderately well with some aircraft, but it isn't entirely satisfactory due to the way the FS2000 flight director works. Hopefully this may be improved in later drivers, possibly for FS2002 in due course.

Under A/P control, the CWS action allows you to fly freely with the yoke and rudders, ***without*** disconnecting the autopilot. You have to keep the CWS button pressed for the whole time you want this control—this is why, by default, it is provided on the Jetliner yoke.

When you finally release the CWS button, the A/P once more takes control. It will attempt to resume the lateral modes (heading, LNAV) as if you never took over, but the vertical mode is altered to the way you left it upon releasing the CWS. In ALT hold, or FLCH, the altitude you achieved will become the new hold and target value. In V/S climb and descent modes the vertical speed you set will become the set target value.

This works very well for most light aircraft, but take care with the more complex airliners, and, indeed, Project Magenta. The interaction between V/S, VNAV, FLCH and even SPEED/N1 modes are very complex and you may not get the result you expected. It may not work at all with some aircraft, even Wilco's 767 PIC for which other provision have been made in this driver.

Button and switch re-programming (with FSUIPC "Buttons" page)

With effect from PFC.DLL version 1.46 and FSUIPC 2.93, all buttons, switches and digital rotary knobs on the PFC devices (but not the potentiometer or electromechanical trim adjusters) are detected as "joystick buttons" in FSUIPC's Button programming page, and therefore can be re-programmed there.

The PFC joystick numbers, seen in FSUIPC, will be 16 and higher, with button numbers ranging from 0 to 31 just like any 'real' joystick button set. The assignments of hardware buttons or switches to these joysticks are based on programming expediency and are not otherwise meaningful. To re-program a button or switch or rotary in FSUIPC, just go to FSUIPC's "Buttons" page and press, operate, or turn the PFC device to see the joystick and button number come up on the screen ready for programming.

Please refer to the FSUIPC User Guide (available with the full FSUIPC ZIP package) for more details of how to program buttons there.

Note that rotary switches such as those on the avionics unit emulate a digital button that is being pressed and released as you turn the knob. Each 'click' is one press or one release. Therefore, to make the assigned action repeat once per click you need to program that action both on 'press' and on 'release'.

When any switch position, button, or rotary action has been successfully programmed in FSUIPC, the normal, documented action in the PFC driver is bypassed. This is important to realise. However, all is not lost. Just delete the programming in FSUIPC's Buttons page, and the previous PFC action on that button or whatever will be instantly restored.

You can check whether FSUIPC has control of any particular switch by using PFC's Test mode. Select the Test page in the PFC options and operate the switch. In the log of its action in the right-hand part of the display the annotation "(to FSUIPC)" will be present if the action is programmed in FSUIPC.

Note that there is no record of FSUIPC programming in anything concerned with PFC.DLL. All of the programming details are included in FSUIPC's INI file, so if you delete that you will find that all of the PFC actions revert to the normal ones as documented here.

The PFC.INI file

You should not need to edit this file in any normal circumstances. Nearly all of it is created and updated solely by the PFC.DLL, from choices you make in the Options and Settings pages. However, there are a few parameters not accessible in the on-line pages and these are shown below:

[Connection]

Debug=0

This parameter sets up debugging options, producing immense details about the interaction between the DLL and the PFC control system. These details are sent to a debugger that has to be running also. There are some viewers that will show the details on screen (one good one is DBGVIEW.EXE). If any debugging is needed on your system, details of how to do all this will be provided.

Port=COM1

This records the COM port in use (COM1–COM8). It cannot be changed whilst FS is running, but you can configure it here if you like, rather than in FS. This may be necessary if the port assigned belongs to something else and this is preventing FS from running well enough to get into the PFC dialogue.

Speed=9600

This parameter is normally omitted. All current PFC consoles connect at the fixed speed of 9600 bps. The exception is the PFC MCP—by default this connects at 19200, but has to be changed to operate at 9600 if you connect a console through it When using an unaltered MCP alone with PFC.DLL you will need to edit this parater to read 19200.

SyncInit=Yes

[*Win2000/XP only*]: The driver will normally 'auto-restart' the serial port operations soon after initialising when FS is first started. This has the advantage of synchronising most of the switches and the FS panel settings. For the original operation, add this parameter but set it to 'No'. It is set to 'No' automatically under Windows 98 or Me.

AutoRestartTime=3000

[*Win2000/XP only*]: This controls the automatic restart facility. If the driver sees no data from the PFC devices within the given number of milliseconds (amounting to 3 seconds, by default), then it will automatically restart the serial port connection. All such restarts are logged. If you get too many, increase this value. You can stop the automatic action by setting this parameter to 0. It is set to '0' automatically under Windows 98 or Me.

ClearOnRestart=No

[*Win2000/XP only*]: Set this to Yes if you want the avionics displays to clear and be refreshed on all restarts.

ReadSleepTime=20
WriteSleepTime=20

These control the polling rate for serial port input, and the frequency with which the serial output is re-charged when there's any data to go out. The defaults of 20 (milliseconds) amount to 50 checks per second (1000/20). Users should not really change these except under advice.

[General]

ElevatorTrimMult=8

The electric trim fast rate (in this case 8 means 8 x 16 = 128)

ElevatorTrimDelay=20

The electric trim delay till fast rate, in tenths of a second

ElevatorTrimLatency=1024

Trim motor control: this value is how close the incoming trim gets to the FS set trim when the motor is turned off. it is the amount it is assumed the trim will still change after the off command is sent. The units are FS units (of a complete trim range -16384 to +16384)

IgnoreTrimDifference=257

Trim motor control: the difference between the FS setting and the axis setting is monitored. If the difference is less than this value, the motor isn't actuated.

MaxTrimMotorTime=60

Trim motor control: this value simply limits the time the motor is kept going. It is in seconds, and is a safeguard in case the axis is reversed or not correctly connected

AxisSmoothTime=500

This controls the small jitter smoothing interval, in milliseconds. Jitters in axis readings of less than 5 PFC units are ignored if they cause reversals (up-down or down-up) within this time. Set this to 0 to switch this smoothing off, or increase it for more effect but possibly less responsiveness.

ThrottleSyncEngine2=No

Set this to "Yes" only if you wish to use the Throttle/Prop/Mix Sync option but have the values used based upon the engine 2 axes rather than the axis 1 values.

Axis3Equalise=Yes

Set this to "No" only if you want the centre engine (#2) on a three-engined aircraft to be excluded from the option to equalise nearly-equal axis settings.

BeepWave=Sound\caapdis

This provides the sound used for A/P disconnection (and the beeps heard at the end of an A/P test). The sound should be capable of being repeated smoothly to provide the 12-13 beeps at the end of the test. The default is part of a standard FS installation and contains 4 beeps, repeated 3 times and a bit. The path is within the FS path.

BellWave=Sound\caapdis

This provides the sound used for the FireBell in the jet cockpit. The default is the same beep as used for the Autopilot, but should be replaced by a suitable bell wave. The path is within the main FS path.

SpoilerFlightPercent=75

Sets the percentage of spoiler (speed brake) deployment to be activated by the Flight détente on the "**SpoilersD**" calibrated axis setting.

ThrEqLimit=512
PropEqLimit=512
MixEqLimit=512

These parameters relate to the scaled axis values seen for Throttle, Propeller pitch and Mixture, respectively. They set the limit below which values for Engines 1 and 2 are equalised if the axis equalisation option is enabled.

Note that the limit operates on the scaled values, the ones related to the range expected by Flight Sim. The default of 512 is effectively twice the expected resolution of the actual axes in the PFC quadrant.

PMsixpacks=Yes

Set this to 'No' only if you are running Project Magenta's pmSystems and you do not want the PFC driver to handle the MCP's sixpack annunciator lights (on Boeing airliners).

Serial Port Thread Monitor

The PFC DLL updates four separate counters in FSUIPC's address space to indicate the thread activity. The offsets are viewable using FSUIPC's "Monitor" facility (see its Logging page), or via something like FSInterrogate. These are the offsets and uses:

3370	1 byte	Updated whilst the serial port READ thread is alive and working
3371	1 byte	This now actually indicates trim motor operation (0 off, 1 up, 2 down)
3372	1 byte	Updated whilst the serial port WRITE thread is alive and working
3373	1 byte	Updated whilst PFC.DLL is receiving calls from FS (unless this is happening, none of the other three will be seen even if the threads are working).

From version 3.09, FSUIPC provides a Hot Key facility for restarting the PFC driver. If ever the read or write threads seem inactive, or the PFC devices are unresponsive, try using the hot key. If this happens often, you should try another COM port or check the linking cables. Better, use a USB serial port adapter instead—with Windows XP in particular the USB operation is noticeably superior and much less likely to suffer errors.

Application program axis handling

When using FSUIPC version 3.30 or later, application programs or modules can access the raw PFC axis values at offsets 3BA8 onwards. One 16-bit word is allowed for each (although currently all PFC axes have a maximum range of 0 to 127, this may change in future). The axes are:

3BA8	0	Aileron
3BAA	1	Elevator
3BAC	2	Rudder
3BAE	3	Quadrant axis 5
3BB0	4	Quadrant axis 3
3BB2	5	Quadrant axis 1
3BB4	6	Left toe brake
3BB6	7	Quadrant axis 6
3BB8	8	Quadrant axis 4
3BBA	9	Quadrant axis 2
3BBC	10	Right toe brake
3BBE	11	Elevator trim
3BC0	12	Aileron trim
3BC2	13	Rudder trim
3BC4	14	Steering tiller
3BC6	15	*not used yet*

There are control flags (to disconnect these axes) at offset 3BC8. Each bit, 2^0 to 2^15 can be set to disconnect the equivalent numbered axis above.

Connection check progress indication

The progress of the connection checks are flagged in a 16-bit word at offset 556E. This is primarily so that the indications can be shown on other screens, particularly those maintained by Project Magenta. The bits are used as follows:

2^0	FSUIPC okay
2^1	COM port okay
2^2	Aileron controls okay
2^3	Elevator controls okay
2^4	Rudder controls okay
2^5	Throttle quadrant controls okay (at least two levers not parked)
2^6	Avionics / Radio stack seen (switches may need to be manipulated)
2^7	MCP detected (either the PFC hardware MCP, or PM's MCP program)
2^8	PM's CDU or RCDU detected
2^9	*spare* (=0)
2^10	'Quit FS' selected
2^11	Checks were aborted
2^12	Checks were bypassed (not possible with 737NG cockpit selected)
2^13	Checks completed bar further retries
2^14	Checking finished
2^15	= 0

737NG cockpit fire control system

The following FSUIPC offsets can be used to deal with the fire control subsystem in the Jet Cockpit.

Switch indicators: 16-bit word at offset 3BD0:

Bit	Meaning when set
0	Engine 1 Fire Handle Left
1	Engine 1 Fire Handle Right
2	Engine 2 Fire Handle Left
3	Engine 2 Fire Handle Right
4	APU Fire Handle Left
5	APU Fire Handle Right
6	Engine 1 overheat test a
7	Engine 1 overheat test b
8	Engine 2 overheat test a
9	Engine 2 overheat test b
10	Fault test inop
11	Fault test fire/overheat
12	Extinguish test left
13	Extinguish test right
14	Bell cutout*
15	not used

* The bell cutout indication is held on for half a second after it goes off to ensure it can be read. If any of the others are momentary they may warrant the same treatment, but at present I'm assuming they are either latching or held by the pilot.

Indicator controls: 32-bit dword at offset 3BCC: *(untested)*

Set bit to 1 to light the indicator, 0 to extinguish it. The bit arrangements match the assignments in the PFC control command for these indicators.

0	Left bottle discharge
1	Right bottle discharge
2	APU bottle discharge
3	Wheel well
4	Fault
5	APU DET INOP
8	Engine 1 overheat
9	Engine 2 overheat
16	Left green
17	Right green
18	APU green
19	Engine 1 fire discharge switch
20	Engine 2 fire discharge switch
21	APU fire discharge switch

If there's also a need to control the glareshield warning lights and six-pack indications, PM's offset 5530 should be used, as documented for Project Magenta. If PFC.DLL has control of the MCP it will action these changes, but otherwise it will have to be done by the PM MCP software or pmSystems.

737NG cockpit stick shaker operation

When PFC.DLL is running without Project Magenta it operates the stick shaker when FS indicates overspeed or stall. But if the PM MCP program is running it defers the control of the stick shaker to that program.

This is done via offset 556D (1 byte). When this is non-zero, the stick shaker will be activated. The value of this byte is decremented by 1 every timer tick (55mSecs), so that, if the MCP program suddenly stops the stick shaker action will also stop within approximately 14 seconds at a maximum. If the program wishes the action to continue it must keep writing a non-zero value to 556D.

History

Version 4.20 (for FSX) has been changed to work well under Windows Vista. Like FSUIPC4 on Vista, it now places its INI and LOG files into the Flight Simulator X Files folder, in Documents (alongside saved Flights and Plans).

Version 2.20 (for FS9 and before) has an improved and more foolproof way of entering the (optional) Connection Checks dialogue at FS start-up. Previously the "connection check" menu item was available too early and if manually selected would give an error, such as reporting FSUIPC version 0.000.

Versions 2.10 and 4.10 are consolidations of a number of minor improvements made internally over the last few weeks. There's nothing particularly changed from the user perspective except, hopefully, better running.

Versions 2.03 / 4.03 provide an option for disabling PMsystems support from the PFC driver, in case you want to run Pmsystems in parallel, with the PFC switches going direct to FS.

Version 2.02 is a fix for an error in **PFC.DLL** (only) which prevented the Connect Checks from being run, even if they are selected. Oddly a section of the resources file did a walkabout but has been re-captured and tied down correctly now.

Versions 2.01 / 4.01 are released with the only change being in the way the MCP 737 type "six pack" annunciators are driven when using pmSystems. The bit assignments now correspond to the latest SYSVAR.TXT assignments, and if the PM MCP program is used this needs to be version 413c or later.

Version 2.00 (PFC.DLL) and **Version 4.00 (PFCFSX.DLL)** were released simultaneously with joint updated documentation and some minor improvements but no new facilities. The version 4.00 release represents the first 'oficial' release for FSX.

Version 1.999b only contained some changes specifically for the Cirrus II Pro console.

Version 1.998 was released with an accumulation of changes over many intervening test releases. The main changes were:

- The initial connections checks have been improved, as follows:

  (a) They now work correctly first time on a new COM port connection
  (b) If there are errors, the COM port used can be changed without closing FS and restarting
  (c) The 'Quit FS' button now does what it says. Previously it tended to hang FS instead!

- The COM port in use can now be changed in the main options page, during an FS session, without the need to reload FS as before.

- The spoiler/speed brake implementation is now rather different. With the "notched" spoiler control (SpoilersD):

  (a) The zone from minimum to the start of the ARM notch area gives 0% spoiler, as before.
  (b) The ARM zone sets the ARM flag (and the FS internal Arm value), also as before.
  (c) The zone from the end of the Arm notch area to the flight detente provides spoiler extension from 7% (the minimum supported by FS) to the value set by the 'SpoilerFlightPercent' parameter. This should be around 60-70% for 737's, for example.
  (d) The zone from the flight detente to the maximim, and beyond, is now set according to FS's "on ground" flag: 100% on ground, but remaining at "SpoilerFlightPercent" in the Air.

  I think this represents pretty closely what the real thing does (well, except that you can't pull it back passed flight detente in the air).

  For the non-notched axis setting, the active spoiler values, above the ARM position, are also now scaled from 7% to 100% deployment.

- In conjunction with the FSUIPC release 3.537 or later, PFC axes which are read by the PFC.DLL driver can now be assigned in FSUIPC's 'Axis Assignment' facility. This greatly enriches the number of things you can do.

  Note that, as with FS, FSUIPC assignment does not override any use PFC.DLL makes of the axis. To avoid having multiple actions for the same control, be sure to disable (uncheck) in PFC's options all the axes you are assigning in FSUIPC. For the quadrant this applies to all possible quadrant and user configuration attachments -- FSUIPC is not aware of your choices there.

- Connection checks added, with option to turn them off once first loaded and set with operating COM port.

- Many changes have been made for the PFC 737NG cockpit, including major PMsystems support for the overhead panel and the six-pack warning annunciators.

- The 737NG cockpit configuration now cannot be enabled except with PFC installer assistance. This is to ensure correct set up. Once installed correctly by PFC-trained technicians, the driver is then not reconfigurable on-line. The user can run tests and view the action of the axes, but cannot reassign switches nor re-calibrate axes.

  [NOTE: If you have enabled the 737NG cockpit codes and now find yourself locked out of all of the setting up facilities, please delete your PFC.INI and start again].

- The motorised trim is now making use of the "move trim to position x" facilities included in the very latest 737NG firmware.

- Squawkbox3's transponder control via FSUIPC offsets 7B91 and 7B93 is supported on the PFC transponder switches. The selector switch settings Standby, Off and Test are signalled as Standby and the On and Alt selections are signalled as 'normal'. The Ident key triggers but only in 'normal' modes.

- Support for SB3's Private Voice PTT (PVT) is added. This will work as and when the matching update for SB3 is released.

- COM ports above COM8 are now supported.

- Minor problems in the button displays in the axis calibration sections of the options are fixed. These did no operational harm (as soon as an axis is selected they correct themselves), but looked odd.

- A serious error causing corruption in the 1st slope selection for the main flight controls is corrected. This only happened when the dual throttle mapping was in use (i.e. Throttle1 & 2 and Throttles 3 & 4 each on one lever). The result was odd jitter in parts of the range on the main flight controls if the 1st flattened slope had been selected.

In **Version 1.922** the driver does not attempt to run the elevator trim motor when the Autopilot is not in a vertical control mode (Alt hold, GS/APP hold, V/S, FLCH or VNAV). This allows the trim motor to be exclusively controlled by the manual switches, or turned directly via the trim wheels themselves.

Version 1.921 includes a correction to a small long-standing bug. The Carb heat/anti-ice control, accessible in the assorted button assignment drop-downs, was wrongly classified as a "PM control" and so only appeared in the list if PM controls were enabled.

Version 1.92 is the first user release of the driver for some time. A large number of changes have been made, the most notable being the initial support for the developing 737NG cockpit. Many of the changes for the new hardware are still in need of thorough testing, but at least the main supporting elements are fully in place.

Apart from 737NG cockpit support, these changes will affect most users:

- Connection checks have been added. These operate as soon as FS is "ready to fly" and show as a new dialogue on screen. This can be turned off once the main options screen is reached—unless you configure the driver to support a 737NG cockpit, in which case the checks are mandatory. They will also occur if there is any problem with the version level of FSUIPC or the COM port itself.

  The same checks also provide a new way to specify the COM port connection should this not have already been configured.

- The digital filtering facilities are now available for all axes, but are separately selectable for the main control axes.

- The 2 engine axis equalisation facilities are now extended to deal with 3 and 4 engined aircraft. With 4 engines the equalisation operates with 1 + 4, and 2 + 3, separately—i.e. outboard and inboard balancing. With 3 engines the equalisation is between engines 1 and 3, but a close value of the centre engine (2) will bring that in too. The centre engine action can be disabled in the INI file if desired.

- General improvements in serial port handling and minor bug fixes are also incorporated.

Version 1.90 is a fairly major update, including:

- Full decodes of all the new protocol codes for the PFC jet cockpit are added. Where there are matching functions in default FS and/or PM these are implemented, but the majority are simply passed on to the pmSystems module, if it is running. The interface to pmSystems matches that defined for the 737NG in pre-release build 30.

- The new protocol for the PFC 737NG MCP and its associated EFIS switch panels is supported.

- Trim and steering tiller axes, as implemented in the Jet Cockpit, are supported.

- New outputs to control stick shaker and trim wheel motors are supported.

- Facilities are provided via new FSUIPC offsets to disconnect PFC axes and supply the raw values for application program use.
- A number of small improvements are made to the serial port handling, and should help prevent some problems with hangs or crashes when restarts occur in Windows XP systems.
- A bug in the user selection of the "PropPitch12" axis is fixed.

Version 1.844 includes just two changes:

- The heading changes from the RIC or Jetliner Console are now made to multiples of 10 degrees when turned quickly, and 1 degree when turned slowly. Previously the fast turning was incrementing the 10's digit, but odd slow indications input at the same time made it more difficult to set the value quickly and exactly. This applies to the FS default A/P heading and to Project Magenta.
- The limits for axis equalisation are now user configurable, in the INI file only. Separate limits are available for Throttle, Prop pitch and Mixture/Conditioning.

Version 1.84 includes a number of changes:

- A potential problem with the Auto-restart facility is fixed. If, for any reason, there were many of these occurring, the driver could get into a state when one is instigated before the other completes. That would probably crash or hang Flight simulator, or at least do some damage. Of course the problem would never have arisen in the first place if there were not some serious problem elsewhere in the system, as the restarts are only instigated on the lapse of incoming data from the PFC equipment for more than a certain time (3 seconds by default, 1 second at minimum setting).
- A digital filter option for quadrant and toe brakes axes is now provided. This is designed to eliminate short term jitter (at frequencies of 2 Hz or faster) more effectively than the earlier method (which is, however, still retained to deal with any longer term drifting). The filter is switched out by default, and is enabled in the main Options page.
- To try to eliminate small differences between engine 1 and 2 settings, causing short term asymmetric thrust, an option is now provided to equalise the throttle, propeller pitch and mixture settings on engines 1 and 2 whenever they are relatively close (basically, within twice the apparent axis resolution). This does not apply to three and four engined aircraft, and is switched off by default. The option is on the main Options page.
- An option is provided, via an INI file change only, to base the "throttle/prop/mixture sync" action on the Engine 2 values instead of the Engine 1 values. The only valid use of this would be where one of the engine 1 axes was suffering more jitter or drift than the equivalent engine 2 axis.
- Many additional switches are now recognised for passing through and programming in FSUIPC. These are mostly those related to extra PFC equipment associated with the 737NG jet cockpit, and are destined to be fully supported in due course. This part of the development is merely the first step. [*Note that these changes have not yet been tested due to lack of access to the needed equipment*].

Version 1.831 fixes an odd Altitude rounding difference which seemed to only affect the default Grand Caravan AP Altitude Pre-Selector display: it shows values like 1999 instead of 2000. The other displays for the same value, such as in the Radio Stack A/P and the airliner MCPs, were okay! The correction, determined by experiment, was by the addition of 0.0039 metres ($1/256^{th}$).

Version 1.83 fixes the User Configuration throttle quadrant naming facility. In versions 1.80–1.82 the new names were either not saved correctly in the PFC.INI file, or mis-assigned on reload.

Version 1.82 includes:

- Fixed broken multiple engine fuel selector operation;
- Improved and corrected operation of COM radio selection sequences using the on/off buttons;
- Option added to switch the PFC avionics according to the FS avionics switch.

Version 1.81 was released soon after 1.80 to correct an omission that results in bad quadrant assignments for those who use the specific aircraft assignment system. This was caused by the insertion of the 737NG quadrant as #7, renumbering all those after that up one—including the 15 User Configured quadrants.

The 'fix' in version 1.80 was to delete every assignment and re-assign, or alternatively just edit the PFC.INI and increment quadrant numbers over 6 in the [AircraftQuadrants] section by 1. However, a better solution was needed which avoids this happening again, and also to make the INI slightly less obscure. So, in this version both the QuadrantSet and all the [AircraftQuadrants] entries are now saved with the Quadrant shorthand name (P1N ... U15) as used in the calibration lines.

However, the DLL cannot do a blanket update of all the [AircraftQuadrants] entries. This is an INI file accessed using Windows' Profile API, and it has to know the parameter name to read/write the parameters. Since the parameter names are the Aircraft names, the DLL doesn't know any of them until you load the aircraft. So, the entries there will only be updated if you delete assignments and make re-assignments.

For those upgrading from *before* 1.80 direct to 1.81, the DLL fixes the [AircraftQuadrants] quadrant numbers on loading—if they are 7 or higher it adds 1. It does not re-write the parameters: that is only done when you assign. For those few who may have already used 1.80 and 'corrected' the parameters already, they will be best served if they do it again for 1.81—i.e. delete assignments and re-assign. Sorry about that—there is an alternative 'fiddle' explained in the IMPORTANT read me text file included in the ZIP.

Version 1.80 represents a significant development, encompassing just about all requests for changes received to date. Here is the list:

- The sounds (A/P test and disconnect) now work in FS2004.
- The throttle sync control, added in 1.72, now works well and has no relation whatsoever to the FS "prop sync" switch. This ill-considered link in 1.72 seemed to be responsible for some odd and unwanted behaviour.
- The PFC driver now works fine in FS2004 even if the user has added the (undocumented) "MakeItVersionFS2002" option to the FSUIPC INI file.
- A new calibrated axis type, "**SpoilersD**" is available for notched spoiler lever movements with two détentes, one for the Armed position and the other for the maximum Flight deployment.
- The PFC driver now automatically sets ground spoiler deployment (i.e. 100%) if reverse is engaged (with any of the defined reverser levers *only*) when on the ground at an airspeed of 60 knots or more.
- The new 737NG quadrant, with notched spoilers, notched flaps, and twin reversers, is now supported as a standard type, though it isn't subject to automatic selection.
- User configured quadrant calibration pages can now be re-named by the user.
- The COM2 radio in FS2002 and FS2004 is now fully supported, both on the separate Avionics stack with its two PFC COM radios, and even with the Jetliner console (on which the radio use can be easily exchanged between COM1 and 2).
- Standby frequencies in FS2002/4 COM1, COM2, NAV1 and NAV2 are now handled. When they change in FS they are reflected correctly in the PFC avionics. However, for efficiency the FS values are not updated when the PFC ones are adjusted *except* when the active/standby values are swapped over. At that time both frequencies in FS are corrected.

Version 1.73 fixed some problems with the new Throttle Sync implementation (mainly through it's ill-fated connection to the FS Prop Sync switch), but the release was never made public as it was soon superseded by the more significant **1.80** version.

Version 1.72 includes these important changes:

- The 'restart' facilities introduced in version 1.63, and augmented since then, do not work under Windows 98 or Me, only Windows 2000 and XP. In fact they crash FS to the desktop on Windows 98/Me. I have not been able to find a way to fix this, so the DLL now automatically switches the facilities off under those operating systems.
- The problems with re-programming some but not all buttons in a group present since 1.62 also applied to the Yoke buttons—if one was re-programmed in FSUIPC, they all had to be. This is now fixed.
- Small axis jitter (less than 5 PFC axis units) is now eliminated if it occurs within a specific timeframe. The time defaults to 500 milliseconds but is adjustable by a new parameter (AxisSmoothTime) documented above. "Jitter" is defined as a change in direction (up then down or vice versa) with a small difference (less than 5) within the specified time. The option can be turned off by defining a zero time.

  Note that PFC DLL has performed short-term jitter smoothing for any sized spiking for some time (since version 1.27), but to avoid responsiveness problems this was restricted to times of 150 milliseconds or less, and it is not adjustable. Setting the AxisSmoothTime to 150 or less will therefore revert the smoothing to the previous method only.
- A facility for throttle, propeller pitch and mixture setting synchronisation, for multi-engined aircraft, has been added. This is assignable as a new control (see the table of additional controls earlier in the document). On aircraft equipped with an FS "prop sync" control, this will do the same thing. The synchronisation works by applying engine 1 values to all engines, the inputs from the other engine controls being ignored whilst the sync switch is enabled.

Version 1.71 fixes some switch reprogramming problems introduced by the changes in version 1.62. These problems had the effect of treating two batches of switches as re-programmed in FSUIPC if any one or more in the batch was re-programmed. The batches affected are:

AutoThrottle, Anti-Ice, EICAS and G/A on the Jetliner Console, and
Taxi, Landing, Strobe and Nav lights on the Jetliner and Cirrus consoles.

Version 1.70 incorporates these changes (most of them based on experiments in 1.64):

- The RIC adjustments are now mostly implemented with dual speed operation—turning the knob faster accelerates the changes, typically ten-fold. This applies to FS and Project Magenta operations only, not including the ND range/mode setting nor any 767 PIC facilities.
- The 'restart' facility is operated automatically if no data is received from the PFC device within a specific time, defaulting to 3 seconds. The idea of this is to attempt automatic recovery from stoppages in COM port operation on some systems. So far, it seems these may be related to the Intel ICH5/ICH5R chipset, though this is simply based on the only similarities between the two machines on which it is known to have happened.
- The clearing of the displays on restart is made optional and defaulted off, and the "beep" sound is removed. A log entry is made on every restart instead, so that checking afterwards will suffice.
- The frequency of the thread-based COM port polling is reduced from 100 times per second to 50, and is also made adjustable by new "sleep time" parameters.
- A facility is provided to automatically restart the COM port operations soon after first initialisation. This has the benefit of synchronising most, if not all, of the PFC toggle and selector type switch settings in the simulation. This is enabled by default.
- Operation of the fuel selector is extended (on FS2002 and FS2004 only) to all aircraft engine fuel selectors.

Versions 1.64 and 1.65 were experimental test versions, never published widely.

Version 1.63 provides some serial port performance-related changes. First, there are found activity counters maintained in FSUIPC's offsets 3370–3373, as described in the previous section. Second, the PFC driver will respond to a "restart PFC driver" Hot Key message by closing the serial port and both read and write threads, and restarting them. This may be useful if there are any problems on the COM port or the PFC power supply. The hot key is supported in FSUIPC version 3.09 or later.

Version 1.62 fixes a problem which seems to apply only to the Gear switch. This can be re-assigned in FSUIPC, but then still retains its function in PFC. This is fixed now for this switch (and any others which may truly have been affected), so that assignment in FSUIPC's "Buttons" page really does override that in the PFC DLL.

Version 1.61 contains a minor change to eliminate any delay before it subclasses the FS2004 window. Apparently any sub-classing done later increases the probability of FS2004 getting an apparent freeze with a black screen when changing between windowed and full screen modes. This only applies to some systems, but it can be quite consistent on those.

Version 1.60 is an important release with the following fixes and additions:

- The methods used to deal with the serial port connection to the PFC equipment efficiently turned out to be very inefficient on the recent Pentium 4 processors with "Hyper-Threading". The method used in the DLL caused Windows to allocate one of the virtual processors completely to the serial port activity, thus wasting a considerably part of the power of the new systems. This has been fixed in this version by revising the timings in the serial port routines to be more co-operative.
- Support for quadrant axis flaps has been added. This is in anticipation of a new specialised jet quadrant with a flaps axis featuring proper détentes, but it can be used on any spare axis. It supports up to 9 positions including the "up" and "full" end positions.
- An option is provided on the Yoke pages to make the A/P disconnect button also disconnect the Auto-Throttle if it is engaged. Of course the A/T toggle switch will need re-cycling later to get it back into synchrony. Note also that, because the A/P Eng button on the Avionics is indistinguishable from the A/P button on the yoke, the option also affects that.
- The EICAS toggle switch on the Jetliner console is now user re-programmable even when Project Magenta is running.

Version 1.55 includes changes to deal with some unexpected inconsistencies in FS2004's Controls table in CONTROLS.DLL. These otherwise would make the key assignments to some of the new FS controls (including all the GPS ones) go wrong. Most of the problems were caused by a double entry in the table for "Add Fuel Quantity".

Version 1.54 is almost identical to 1.53, featuring only minor cosmetic changes.

Version 1.53 includes:

- A fix to allow the special programmable control for Roger Wilco PTT (via WideFS) to work with WideFS versions 5 and later.
- Addition of separate assignable Reverser axes for engines 1 and 2.
- Support for forthcoming Flight Simulator FS2004 "A Century of Flight". (This will need the appropriate version of FSUIPC when available).

Version 1.50 includes these changes:

- On the avionics stack (and the front vertical of the Jetliner Console), the two time adjustment buttons (the left most two) are now left unassigned by default. They are for user programming. This change is made because of FS2002's habit of reloading all the textures each time the actual time is adjusted, taking a long time for each attempt.
- An option is added for the Jetliner "ND Range" knob to be used for OBS2 (or CRS2) adjustment instead. This is primarily aimed at the PFC Jet Cockpit implementation.
- An error whereby the 'ADF' indicator light was only half lit is corrected. There are two actual LEDs behind that indicator and previously only one was enabled.
- The axis calibration facilities have been changed so that in normal manual calibration mode the button descriptions on the left are more specifically descriptive of the action they take for the particular axis. Also an "automatic" calibration facility has been added for the simpler cases, when records maximum, minimum and central readings and makes small adjustments on these to create the safety dead zones.
- An option is provided to suppress the flashing and beeping when the Autopilot is disengaged. This is a Bendix-King style action which is less applicable to jet cockpits.
- There is now an option to simulate the latching of the jet starter switches in the 'start' position until combustion has occurred and the jets are running. This latching can be cancelled prematurely by operating the starter in the opposite direction—i.e. to the "generator off" position.
- The Standard Baro option (programmed onto the Jetliner MCP by default) now operates as a toggle between the STD pressure setting (1013.2 hPa or 29.92") and the last QNH set. This is in closer accordance with the real cockpit action.
- On FS2002, the reverse throttle range is now automatically adjusted for differing maximum reverse settings for each aircraft model (they are not all –4096). The same applies to the Reverser lever.
- An FS "throttle decrement" control is sent when the reverse throttle range is first entered, in case any third party panels need this to get out of "flight idle" and into "ground idle". [This won't necessarily work, however—depending how the throttle control is programmed in the cockpit software].
- Some additional attempts are now made to try to get the COM port configuration message box brought to the front on screen. It still certainly isn't foolproof though. With Win2k/XP and FS set to start up in full screen mode, the warning message box can still sometimes appear ***behind*** the main FS window, so it appears FS has hung, whilst it is only PFC.DLL waiting for the "Ok" button to be pressed.

Version 1.48, the first release of 2003, added these facilities:

- The number of user configurable quadrant settings is increased from 3 to 15.
- Each individually named aircraft in your FS2000 or FS2002 installation can have any one of the 24 available throttle quadrant settings assigned, so that the correct one is selected every time you reload such aircraft.
- The optional throttle lever button(s) available with certain Jetliner Console quadrants can be used a auto-throttle disconnect buttons—by default these operate the TO/GA (take off/go around) or N1/THR thrust modes.

Version 1.47 includes these changes:

- This version is not so dependent on the version of FSUIPC installed. Due to an error, version 1.46 would crash FS if installed with a version of FSUIPC earlier than 2.93.
- The memory of previous quadrant axis settings is now erased whenever a different quadrant is selected, whether manually or automatically. This prevents odd things happening when quadrant axes are re-assigned without first "zeroing" them. For instance, brakes may get stuck on, and the reverse interlock may not be released because of the memory of the non-idle throttle axis now not configured.
- The operation of the Decision Height or MDA value in Project magenta is made rather more responsive and predictable by altering the value directly rather than relying on PM's increment and decrement facilities.

- Options are added to the Main page for different ways of controlling the OBI settings for the VOR indicators. The DH knob can be used to control OBI2 (or CRS2) instead, or the CRS knob can be made to keep both OBI1 and OBI2 (CRS1 and CRS2) settings synchronised and change them together.

Version 1.46 includes two new facilities and one bug fix:

- The buttons, knobs and switches can now all be re-programmed for any FS control or keyboard action through FSUIPC (needs FSUIPC version 2.93 or later).
- A "BothBrakes" axis control is provided, so if necessary a single throttle quadrant lever can be allocated for proportional and symmetric braking.
- The "prop" side of the Avionics AUX/POS button programming facility could not easily be used to assign a keyboard action, due to a windoing problem. This is fixed.

Version 1.45 fixes some odd behaviour with the Yaw Damper when Project Magenta is being used, and offers the option to leave the yaw damper alone when operating the AP ENG button (and the equivalent on PFC yokes). On Project Magenta it also turns all three autopilots off if any of them are on when the AP ENG button or yoke equivalent is pressed.

Version 1.44 includes much better integration with the MCP of Wilco's 767PIC *provided* you are using version 1.3 or later with FS2002. The update can be obtained from the Wilco site and from www.mcp747.com. As well as better MCP operations, this also gives a working autobrake switch. (However, there seems to be an elevator spiking action with the newer 767PIC drivers, so you may want to check the spike removal facilities in the recent versions of FSUIPC).

Version 1.44 also turns off the Project Magenta PFD, ND and EICAS displays when the Avionics switch is turned off, and vice versa. This is not synchronised initially, hoever, to avoid mistaken concerns that there is something wrong with the displays!

Version 1.43 includes a new facility and a small error correction. Version 1.42 never made it to a general release as it only had a 24 hour life. The new facility is the addition of axis assignments for engine combinations 1+2 and 3+4, usable in the quadrant "User configurations". The error correction is to the flashing of the decimal point in the NAV1 and NAV2 radio "use" frequency displays. Previously this (optional) flash did not occur if the received VOR signals did not include DME.

Version 1.41 includes only two relatively minor changes:

- The range of output values for throttle, prop pitch and mixture controls now extends to 16384 (100%) rather than 16383, which is just short of 100%. This apparently matters for some aircraft implementations.
- When using FS2002, the "fuel boost" switches on the Cirrus II console operate independent fuel pump switches, where they exist, on propeller driven aircraft. This follows discovery of how to access these switches on FS2002. Similar support is provided for FS2000 but this is not tested as no such aircraft could be located. This enhancement needs version 2.851 of FSUIPC, or later.

Version 1.40 included the following changes:

- Fixed an intermittent with button programming for keystrokes. The symptom of this was occasional mis-reading of the keys pressed when trying to assign them.
- Added the option for the external RIC "CRS/DG" adjuster to adjust the gyro compass for drift.
- Enabled the DME frequency adjusting knobs. These change the related NAV frequency when the DME is in the mode displaying same.
- Added details of the Professional Flight Console, to the options for the yoke and console programming. These don't make any actual change in the way the driver works, only in the way the options are presented.
- Added support for the upcoming FS2002 version of the Wilco 767PIC package, though this is still unfortunatel only using the keystroke interface provided.

Version 1.31 included relatively minor changes to make the operation of the V/S mode facility rather more friendly when used with FS aircraft panels other than 767PIC and Project Magenta. A full explanation is provided in the main section on the Extended Autopilot / Altitude Pre-selector, above.

Version 1.30 is the first official version supporting FS2002 (through FSUIPC 2.73 or later). The support for FS2000 continues unchanged.

Version 1.271 was issued on the same day as 1.27 to fix an error in the axis smoothing which could make the response poor on heavily loaded or slower PC systems.

Version 1.27 was preceded by a number of interim limited releases, culminating in this, which includes the following changes:

- Automatic axis smoothing has been added, to prevent much higher frequency jitter which can (presumably?) be caused by poorly smoothed power supplies.
- A revised multi-threading method is used, to prevent a crash occurring on Windows 2000 (and probably XP).
- Throttle settings are re-established after auto-throttle modes are disengaged. There is a small delay involved—half a second for FS autopilot and 1½ seconds for Project Magenta. This is to allow time for the dis-engagements to actually operate, as trying to restore throttle values too early doesn't work.

Version 1.25 performs some additional checks on the facility used to send keystrokes to FS (and thereby Wilco's 767PIC as well). It appears the feature needed in Windows didn't appear till Windows 98 and SP3 for Windows NT.

The Jetliner console's fuel crossfeed switch is, in the case that the console is being used with prop planes, made to operate the fuel selectors: Left/Both/Right (but no Off position).

The Jetliner console's Avionics switch is now also made to operate FS's main Battery and Alternator switches, as there are no separate switches for these actions.

Version 1.24 fixed a problem whereby multiple "Key Up" codes could be sent when running Wilco's 767PIC panel. The logging entry for "writes to FS through FSUIPC" now also turns on logging for 767PIC keystrokes (both key down and key up events), so that these can be checked in the event of any problems.

The discarding of spurious "Elite" type codes from the avionics is now improved further by ignoring all received codes until a reasonable number of good, recognised, codes have been seen with no intervening illegal ones. This check is in addition to the delay of a second or so after seeing "Avionics On" or "Battery On" switch operations.

Version 1.23 fixed a bug that could cause FS to crash if the "List All FS Controls" option was selected in any of the button assignments, and the drop-down then used on any button entry.

Response curves ("S" sensitivity changes) were provided for the main three flight control inputs.

It also contained some minor changes to make the NAV/VOR, APP and GS indicators in the Autopilot behave more like they do in a Bendix King Autopilot, even if Project Magenta's MCP is being used.

Version 1.22 contained just one important change: the automatic suppression of Game Port (or USB) connected throttle inputs was made optional and defaulted off. This was because it was found that some third party aircraft (Wilco's 767PIC in particular) use the same input controls to drive the auto-throttle. With previous versions of the PFC DLL, the auto-throttle in 767PIC was inoperative. The checkbox for the option is within the throttle quadrant section of the Main Options page.

Note that it is still just as important to avoid interference from other throttle inputs. Apart from re-enabling the PFC suppression, the only other way is to make sure Flight Simulator isn't trying to read any Game Port or USB throttles. This is down to the CFG file (in the main FS folder)—e.g. FS2000.CFG. Look for entries in the [JOYSTICK …] sections with "THROTTLE" names. The assignments have to be removed, and a LOCKED=1 parameter included to prevent Flight simulator adding them again.

Version 1.21 added Logging facilities, operated by extra checkboxes on the Test page. This version never went on general release.

Version 1.20 includes many changes to support the new Jetliner Console, as well as some other improvements. Users of previous versions should particularly note the following changes:

- The optional RIC assignment of IAS/Mach speed settings to the OBS1/2 knob and toggle switch is removed—that control is now used for ND map mode and range settings. The speed control is moved to the previously unused GPS section.
- All buttons and knobs in the erstwhile GPS section are now assigned autopilot related functions, or are user programmable as before.
- The spoiler lever facility in the throttle quadrant now includes a "centre" setting so that the spoilers can be armed for automatic deployment simply by positioning the lever correctly.

GOOD FLYING!

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