

# FSUIPC4 for Advanced Users (for FSUIPC4 Version 4.57, January 2010)

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**For changes since the previous version, please review the History document**

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## Options in the FSUIPC4.INI file

In a user-registered FSUIPC4 installation, all of the interesting options can be controlled through the Options and Settings window obtained by selecting the FS Add-Ons menu, then FSUIPC (ALT, D, then F). This is the recommended way, and allows changes ‘on the fly’. Changes made in that dialogue are recorded in a file so that they are retained for the next re-load.

Almost all of these options are all recorded in the [General] section of FSUIPC4.INI, which is an editable text file initially created for you in the Modules folder (or, under Windows Vista, in the Flight Simulator X Files folder, in Documents). Only those parameters shown **underlined** are *not* adjustable within the Settings window (for a registered user).

### Message Window Options

Unlike almost all of the other parameters here, these are all available to unregistered users as well as those who have registered.

**ShowMultilineWindow:** This will be “Yes” if the relevant checkbox on FSUIPC4’s front page (About+Register) is checked. Multiline messages are directed to a translucent window like the one used by FS’s ATC.

**SuppressMultilineFS:** Determines whether multiline messages are forwarded on to FS for its message window. If the above option is ‘Yes’ then this setting isn’t relevant.

**SuppressSingleline:** Operates the option to prevent all single line messages in FS’s (or AdvDisplay’s) message window. Such messages are simply discarded if this option is selected.

See also **WhiteMessages** and **AdvDisplayHotKey**, both covered in the ‘Other Options’ section.

### General weather options

**ClearWeatherDynamics:** FSX implements a weather changing algorithm, “weather dynamics”, which allows the weather to change individually at each weather station with time. FSUIPC4 will, by default, try to turn off the dynamic action when requested via the New Weather Interface, or automatically when weather is set via the FS98 or FS2000-based ‘Advanced Weather Interface’. In actual fact it appears it cannot turn it off completely, only slow it down. The option is set in FSUIPC’s **Miscellaneous** page and by this INI parameter.

**OwnWeatherChanges:** This is defaulted to ‘No’. When set ‘Yes’ it allows the weather filtering options for clouds, winds and visibility to be applied to FS’s own weather. This allows the wind smoothing and the (still experimental) graduated visibility options to be set. The option is controlled by check boxes on the Winds, Visibility and Clouds tabs.

**WeatherReadFactor:** FSUIPC4 is reading the weather at the aircraft (interpolated from three stations), the weather at the nearest station, and the global (or default) weather, all at regular intervals—with the aircraft weather being read at intervals determined by the ‘WeatherReadFactor’ value. Currently this directly sets the minimum interval in half seconds, defaulting to 2.

Since version 4.20, this parameter also, controls the frequency of FS weather updates when the “allow changes to FS own weather” option (**OwnWeatherChanges** above) is set.

There shouldn’t be any need to change this, but if you think it may be overloading your system too much you can try a longer interval, up to 30. Alternatively, if you have no need for any weather reading or writing activities in FSUIPC4, you can stop them all by setting this parameter to 0.

In the options on-line this parameter is currently changeable on the Winds tab.

**WeatherRewriteSeconds=1:** This specifies the number of seconds for SimConnect to “blend” re-written weather into the current weather. Theoretically the changes should be smoother with this delay, though in experiments not much difference is really seen between 1 and 30 seconds. Ideally, for wind smoothing and graduated visibility the value 0 (zero) would be best, and you can try it—but be warned. It then creates a lot of stuttering!

**SmoothBySimTime=No:** Set this to ‘Yes’ to make all the weather smoothing operate based on the elapsed time in FS, instead of the real system time. This has the advantage that it stops whilst FS is in menus, or paused, and runs faster or slower according to the FS Simulation Rate. To use this way of smoothing, change this [General] parameter:

Note that the smoothing is still reset when you load a new flight, or move the aircraft location via the menu, or change the weather mode (theme / user / real, etc).

## Winds

**MaxSurfaceWind:** This allows the surface wind to be limited to a specified maximum wind speed, in knots. This facility is disabled if the value assigned here is 0.

**WindDiscardLevel:** This parameter sets a wind speed above which inputs from an external weather control program, using the FS98 interface (*not* the Advanced or New Weather Interfaces) are ignored. The default for this value is 400 knots. If a weather control program tries to set a wind speed above this, it is ignored and the previously set speed for this wind layer is retained. (This parameter is provided specifically to prevent problems occurring with programs using corrupted data from an Internet download or other problems). Set this parameter to 0 to disable this check altogether.

**WindLimitLevel:** This parameter sets a limit on the wind speed which can be accepted from an external weather control program, using the FS98 interface (*not* the Advanced or New Weather Interfaces). The default for this value is 200 knots. If a weather control program tries to set a wind speed above this (but below the “WindDiscardLevel” above), it is ignored and 200 knots is set instead. Set this parameter to 0 to disable this check altogether.

**UpperWindGusts:** Set to ‘Yes’ to make FSUIPC4 retain any upper wind gust information provided by FS or an external weather control program. These are normally suppressed by FSUIPC4 because upper winds aren't gusty. *Note: this parameter is not operational if SuppressAllgusts has been enabled.*

**SuppressAllGusts:** Set this to ‘Yes’ if you feel that FS’s simulation of wind gusts is unrealistic, or you simply want things easy. If this is set to “Yes” then the **UpperWindGusts** parameter is ineffective.

**WindTurbulence:** Set this to ‘Yes’ to make FSUIPC4 generate some random turbulence in all wind levels. This will range from none to extreme, but it will normally stay fairly mild. It will vary over time as well.

**SuppressWindTurbulence:** Set this to ‘Yes’ to prevent any wind turbulence (but not Cloud turbulence—there’s a separate parameter for that).

**SuppressWindVariance:** Set this to ‘Yes’ to prevent any wind variance (i.e directional instability). This affects both “Variable winds” as set from the incoming METAR settings, but also the directional variation components of both wind and cloud turbulence.

### **TurbulenceRate=1.0,5.0**

### **TurbulenceDivisor=20,20,40,40**

These control the Wind Smoothing wind effect emulations. The first **Rate** number is a multiplier for the turbulence wind directional range, and the second is the multiplier for the turbulence wind speed range. The range of both is 0.0 to 10.0.

The first **Divisor** number is the number of steps needed to change the turbulence wind direction from one extreme to the other (something most unlikely ever to actually happen, but this controls the speed of all changes), the second number is for the turbulence wind speed, the third number is for wind direction variability (variance), and the fourth number is for wind gusts (the range from 'normal' to 'max gust').

The maximum range of wind direction and speed changes to be experienced in turbulent conditions is obtained by multiplying the relevant **TurbulenceRate** value by the FSX turbulence severity setting in FS (0-4), and, for wind speed only, by 2% of the intended (‘normal’) smoothed wind speed. So, for a 50 knot wind, moderate turbulence (2), the default Rate parameter of 5.0 gives +/- 10 knots for speed changes.

This value is the extreme range. FSUIPC4 then computes a random target using a Normal, or Gaussian, approximation, giving values clustering strongly close to the ‘norm’. The increment computed from the maximum range and the relevant Divisor parameter is used to move the current value towards the new value. When reached, a new target is computed, and so on.

Note that this is all done independently for wind direction, speed and vertical effects, and separately too for gusts and variance (which both have an imposed range, of course). The gust and variance effects are emulated using targets with a normal distribution of greater standard deviation, so allowing the METAR-stated extremes to actually be reached occasionally.

The increment rate is based on the frame rate for turbulence, but on an average of 5–10 Hz for gusts and variance.

**WindAjustAltitude:** (Apologies for mis-spelling). Set to ‘Yes’ if FSUIPC4 should add the value specified in **WindAjustAltitudeBy** to all the wind layer boundaries specified by an external weather control program using the FS98 interface (*not* the Advanced or New Weather Interfaces).

**WindAjustAltitudeBy:** See previous parameter. This is in feet and defaults to 2000.

**WindSmoothing:** This option controls the experimental wind smoothing option.

**WindSmoothness:** This parameter defines the targeted degree of wind smoothing, with changes intended to be restricted to a maximum of so many knots and so many degrees per second. The default is set to 5 (knots or degrees).

**WindSmoothAirborneOnly:** The option to smooth only when airborne allows the winds at the airport to be changed and set as desired, before take off.

## Visibility

**VisibilityOptions:** This determines whether the visibility options are enabled or not. The default (“No”) disables all of these options and also hides the relevant Tab in the on-line options dialogue.

**MinimumVisibility:** This parameter, which defaults to 0 (meaning it is inactive), is used to prevent *any* weather source setting a visibility below a specified minimum. The value is set in hundredths of a statute mile (i.e. 100 = 1 mile). Note that there may be a short delay (possibly a second or so) after a new low visibility has been applied before it is detected and corrected by FSUIPC4.

**MaximumVisibility:** This parameter is used to prevent *any* weather source setting a surface visibility above a specified maximum when there is any cloud layer with more than 2/8ths cover. The value is set in hundredths of a statute mile (i.e. 100 = 1 mile). Note that there may be a short delay after a new high visibility has been applied before it is detected and corrected by FSUIPC4. The parameter is only effective if the value is greater than the MinimumVisibility parameter.

**MaximumVisibilityFewClouds:** This is the same as the previous parameter, except that it gives the maximum to be used when there are no cloud layers of more than 2/8ths cover. The idea is that the extended visibility gives bluer skies by day and more stars by night (but lower frame rates. Sorry, you can't win every way <G>).

**MaximumVisibilityOvercast:** This is the same as the previous parameter, except that it gives the maximum to be used when there is at least one cloud layer of more than 6/8ths cover.

**MaximumVisibilityRainy:** This is the same as the previous parameter, except that it gives the maximum to be used when there is any rain or snow. If it is raining and cloudy the lower of the applicable limits is used.

**GraduatedVisibility:** With this enabled FSUIPC4 attempts to provide a smooth change in visibility from the upper altitude of the surface level visibility to a specified upper visibility at another, specified, upper altitude. The two parameters, UpperVisibility and UpperVisAltitude, control this.

**UpperVisibility:** On FS2000 and FS2002 this parameter, which defaults to 6000 (60 statute miles), is used to prevent *any* weather source setting a visibility above a specified maximum. The value is set in hundredths of a statute mile (i.e. 100 = 1 mile). If GraduatedVisibility is enabled, it is used in conjunction with the next parameter (on FS2004 too).

**LowerVisAltitude:** This is only used when GraduatedVisibility is enabled, and sets the altitude from which the graduation should operate. Normally you leave this set at 0, which starts the graduation at the top of the surface visibility layer.

**UpperVisAltitude:** This is only used when GraduatedVisibility is enabled, and sets the altitude by which the UpperVisibility should be attained. Above this altitude the visibility stays fixed at this value. The default UpperVisAltitude is 25000 feet.

**ExtendMetarMaxVis:** This checks the visibility being set and adjusts it in three specific circumstances, as follows:

1. If it is set to a value between 99.95 and 100.04 miles, it is reset to 6.20 miles. This is in order to rectify the results from any programs that take the 9999 metre maximum METAR visibility and transmit it literally as a number of 1/100ths of statute miles.
2. If the value is then in the range 6.15 to 6.24 miles (i.e. close to the 9999 metres maximum of a metric METAR), it is adjusted to a random value between 6.20 miles and the current maximum value (which will either be the MaximumVisibility parameter value, or 150 miles).
3. If the value is between 9.95 and 10.05 miles (i.e. close to the 10 statute mile maximum of a U.S. METAR), then it is adjusted to a random value from 10 miles to the current maximum (which will either be the MaximumVisibility parameter value, or 150 miles).

Note that the random addition is computed only once every five minutes, to avoid constant changes in visibility should the weather control program re-write the value from time to time.

**SetVisUpperAlt** and **VisUpperAltLimit** control the option to impose an upper limit on the surface visibility layer.

## Clouds

**GenerateCirrus:** Creates an occasional extra cirrus layer when enabled.

**OneCloudLayer:** This defaults to 'No'. Set it to 'Yes' to prevent there ever being more than one layer of clouds. This may help get better performance on slower machines. It won't help much on faster machines.

**CloudTurbulence:** Set this to 'Yes' to make FSUIPC4 generate some random turbulence in all cloud layers. This will range from none to extreme, but it will normally stay fairly mild. It will vary over time as well.

**SuppressCloudTurbulence:** Set this to 'Yes' to prevent any cloud turbulence from any source.

**CloudIcing:** Set this to 'Yes' to make FSUIPC4 generate some random icing in clouds. This will range from none to extreme, but it will normally stay fairly mild. It will vary over time as well.

**MaxIce:** The value here is 0–4 to limit the icing to that level (0 = No icing, 4 = Any icing), with the default set to 3 (just preventing "severe" icing, level 4). If the option is actually disabled the value is retained by saved as a negative number. In this case –1 represents 0 but disabled, to –5 representing 4 disabled.

**MinIce:** The value here is 0–4 to ensure that icing is never below a given level ( $\leq 0$  = No icing, 4 = Max icing). A value set greater than MaxIce will operate only to make all icing the same as the MaxIce level.

## Other general user options

**PressureSmoothness:** This sets the number of hundredths of hPa allowed to change per second. When this parameter is set to 0 the pressure smoothing option is disabled.

**TemperatureSmoothness:** This sets the number of hundredths of degrees Celsius allowed to change per second. When this parameter is set to 0 the outside air temperature smoothing option is disabled.

**AdvDisplayHotKey:** This allows you to assign a key press which, when used, will hide or (if there's no other reason it is hidden) display the multiline message window. The keystroke is defined as in Flight Simulator's own controls, and listed below, in the Button Programming section. For example, I use (and recommend) "CTRL+SHIFT+A" which would be

AdvDisplayHotKey=65,11

**AllEngHotKey:** This allows you to assign a key press which, when used, will re-select all engines on the currently loaded aircraft. It is effectively the same as using the keypress E plus 1, 2, 3, 4 on the main keyboard, depending on the number of engines, but the hot key will work when, apparently, the proper key sequence does not (on three engined aircraft it seems). See the preceding entry for details of how the key is defined.

**DisconnTrimForAP:** When this option is enabled, FSUIPC4 disconnects the analogue elevator trim axis input to FS whenever either the FS autopilot is engaged in a vertical mode (altitude hold or glideslope acquired), or a program, gauge or module has disconnected the elevator axis via FSUIPC4 (offset 310A).

Note that the setting can be overridden for specific aircraft which have specific FSUIPC joystick calibrations by setting this parameter differently in that [JoystickCalibration ...] section.

**ZeroElevForAPAlt:** controls the option for FSUIPC4 to automatically centre the elevator input each time the Autopilot altitude hold mode is changed (switched on or off, including AP engaged changes too).

Note that the setting can be overridden for specific aircraft which have specific FSUIPC joystick calibrations by setting this parameter differently in that [JoystickCalibration ...] section.

**MagicBattery:** This reduces the discharge rate on the battery, keeping the voltage from dropping. If this is set 'Yes' or 0 then no drop is allowed. If set 'No' or 1 then the battery discharges normally. Any value from 2 to 999 acts as a divisor on the discharge rate, so 2 makes the battery last twice as long, and so on. This is designed to assist in getting over the apparent error in the airliners, which makes it discharge far too quickly before engine start.

**SetStdBaroKey:** This allows you to assign a keypress which, when used, will set the 'Kollsman' window on the Altimeter to the standard pressure, 29.92" or 1013.2mb. This is used when flying 'flight Levels'.

The keystroke is defined as in Flight Simulator's own controls as listed below in the Button Programming section. For example, I use (and recommend) "CTRL+SHIFT+B" which would be

SetStdBaroKey=66,11

**TCASid:** FSUIPC supplies data on the additional AI aircraft flying in the neighbourhood, for external TCAS or mapping programs to display. Normally such aircraft are identified by Airline and Flight number, if there is one, otherwise by the Tail number.

However, other types of identification string can be chosen instead. In particular, the optional labels placed on the aircraft by FS in the scenery view only shows tail numbers, so if you want to match them up you'd want to set this parameter to "Tail". The utility "TrafficLook" can show these differences in its display. The full list of options here is:

Flight	for airline+flight, or tail number, as available (default)
Tail	for tail numbers only
Type	for the "ATC type", generally only the Make
Title	from the aircraft title (in the .CFG file), truncated to 17 characters
Type+	for the type as above, truncated if necessary, plus the last 3 characters of the tail number
Model	for the model description

**TCASrange:** Sets the maximum range at which AI aircraft will be added to the tables for external TCAS applications. This defaults to 40 nm. A value of 0 turns off the limit altogether.

**FixedTCASoptions=Yes** can be added by the User if the above two settings are to remain locked, unchangeable except by editing here, in the INI file.

**SetSimSpeedX1:** optionally sets a Hot Key which when used resets the simulation rate to x1 (i.e. normal). The keystroke is defined as in Flight Simulator's own controls, as listed below in the Button Programming section. As an example, for "CTRL+SHIFT+S" this would be

```
SetSimSpeedX1=83,11
```

**ThrottleSyncToggle:** sets a Hot Key which operates a facility to make all throttle inputs, for any engine, affect the throttle inputs to all engines. It's a toggle function—if it is on then using it again turns it off. If you are only using a single throttle then this won't make a lot of difference except that *every* time you use toggle it FSUIPC4 will make the throttle selection (i.e. the keypress E+1 ... etc) apply to all engines. The keystroke is defined as in Flight Simulator's own controls, as listed below in the Button Programming section. As an example, for "CTRL+SHIFT+E" this would be

```
ThrottleSyncToggle=69,11
```

**ThrottleSyncAll:** controls whether the Throttle Sync Hot Key operates on the Prop Pitch and Mixture values as well as throttles. This has no effect on jets and helicopters.

**FixControlAccel:** This, if enabled intercepts all controls, and changes the elapsed time location inside FS before forwarding every *different* (non-axis) control, so that the time elapsed looks large enough for the control not to be accelerated. If it sees successive identical controls then it leaves them, so they can be accelerated as normal. [**This should not be used by keyboard flyers!**]

For a fuller explanation, please see the User Guide.

**TimeForSelect:** This specifies the number of seconds for which the SELECT controls (normally assigned to main keyboard keys 1-4) should remain operative for controls that need them (like Engine select, or Aircraft Exit toggle), despite the intervention of other, different, controls. To disable this, set the time to 0. Also note that whilst the time set does not influence the similar automatic facility for the FS pushback (which ensures that the pushback direction remains selectable), the latter will be switched off too if 0 is specified.

**SpoilerIncrement:** This controls the amount the FSUIPC4 "Spoiler inc" and "Spoiler dec" change the spoiler position on each use. The default is 512, giving 32 steps from spoilers lowered (0) and fully deployed (16383).

#### **AileronSpikeRemoval**

#### **ElevatorSpikeRemoval**

**RudderSpikeRemoval:** These control the options to ignore any aileron/elevator/rudder signals specifying maximum possible deflection.

**ClockSync:** This facility synchronises the seconds values with that of your PC's system clock. It is defaulted off (=No). Note that the synchronisation can only operate when the seconds = 0, and then it also has to set the minute. Consequently, it will only attempt to make an adjustment when the minutes difference is less than that set by the next parameter:

**ClockSyncMins:** The minutes difference within which FSUIPC4's **ClockSync** facility will operate. This defaults to 5, but note that if you want to reduce the occasions that FSX reloads textures, you will need to set this less. Conversely, if you want the exact minutes value to be maintained as well as seconds, set this to 59 or 60.

**WhiteMessages:** This controls an option to forward external application to FS for display in **white** on green instead of **red**. This only applies to non-scrolling messages. [*I'm not sure this works at present*]

**UseProfiles:** By default this will be set to 'No', for backward compatibility, but set it to 'Yes' if you want to use the User Profile facilities rather than individual aircraft specific assignments and calibrations. The Profile facility has its own chapter in the User Guide.

**ShortAircraftNameOk:** This is normally set "no" to make sure all aircraft- or profile-specific Keys, Buttons and Joystick Calibration settings only apply to the specific aircraft which was loaded at the time they were assigned. However, if you have several "paints" and which the settings to apply to all, you need to set this parameter to "yes" then shorten the aircraft name either in the [Profiles] section, if you are using profiles, or else in the [Axes.<name>], [Buttons.<name>], [Keys.<name>] and [JoystickCalibration.<name>] section headings in the INI, as needed. The same facility could, for example, give all aircraft starting "Boeing" one set of assignments and all those starting "Airbus" another.

Further, you can set **ShortAircraftNameOk=Substring** to make FSUIPC4 match the shortened <name> in the INI profiles or section headings in *any* part of the full aircraft name, not just at the beginning.

**ShowPMcontrols:** This merely remembers the Project Magenta option setting for the assignment drop-downs.

**ReversedElevatorTrim:** This is probably not of any real use nowadays, as all the axes can be reversed in FSUIPC4's joystick calibration facilities. Best left set to 'No'.

Note that the setting can be overridden for specific aircraft which have specific FSUIPC joystick calibrations by setting this parameter differently in that [JoystickCalibration ...] section.

**PauseAfterCrash:** This is the Miscellaneous option to set FSX into Pause mode after it has reloaded a flight after an aircraft crash. It allows the aircraft to be moved away from danger, getting out of a continuous loop.

**LoadFlightMenu**, and **LoadPlanMenu** merely record the choice on the Miscellaneous options page for Add-Ons menu entries to load flights and plans, respectively.

**ZapSound:** This defines the sound to be used when the FSUIPC control for AI traffic deletion (the "Traffic Zapper") is successfully applied. This must be the name of a WAV file in the FS sound folder, the default being 'Firework'.

If you do not want a sound just set it to **ZapSound=None**. However, the reason for the sound is so that you know something has been Zapped. FSUIPC cannot tell what you can see, and the aircraft which is zapped may not be in your display so you may not see it disappear.

**ZapAirRange=1.5**

**ZapGroundRange=0.25**

These control the range of operation of the AI aircraft zapping facility. The units are nautical miles. Air and Ground refer to the user aircraft position, not the target. Note that you cannot change the acceptance angle explicitly. It is adjusted automatically, in linear inverse proportion to the change in the range—so with a larger range you would need to point the aircraft nose more accurately.

**ZapCylinderAltDiff=n** (where n is the maximum altitude difference), can be added to change the mode of the airborne Zapper. With this added, the target for zapping is the nearest aircraft to the airborne user which is within the upright cylinder of radius ZapAirRange and has a difference in altitude of n feet or less, including those on the ground below.

**MouseWheelTrim:** This records the setting of the 'Use mousewheel as trim' option on the Miscellaneous options tab. By default it is set to 'No'.

**SaveDataWithFlights=Never:** This records the "Miscellaneous" tab option, telling FSUIPC whether to save "offset" data when flights are saved, or not, and when to reload it. The options are **Never**, **Menu**, **Auto**, and **Yes** ("Yes" being the option displayed as "always" in the options tab). IPCBIN files are always saved with flights in all except the **Never** mode.

For a complete explanation of the differences in the options, please see the User Guide. For technical folks and programmers, note that the IPCBIN files produced contain a snapshot of the entire 65536 range of FSUIPC "offsets", so all sorts of data can be read from it using a hexadecimal editor.

**BrakeReleaseThreshold=75:** This controls a "brake release threshold", for when your braking is controlled by toe pedals rather than by using the keyboard or joystick buttons assigned to non-axis brake controls. In the latter cases, operating the brakes automatically releases the parking brake (and possibly may also cancel autobraking action). This doesn't normally happen with brake axes being used for braking, as they are separate controls. That could be viewed as a drawback of having proper toe brake action, so this parameter is provided to set the amount of braking needed to release

the parking brake. The number is a percentage of total braking -- so the default is 75%. If you set 0% it turns the facility off. Pressure on *both* brakes to at least the set level is required, and the release action is not "re-armed" until both brakes have returned to "off". The toe brakes must both be calibrated in FSUIPC4.

**JoystickTimeout=15**: This timeout operates during the joystick scanning used within the Button and Axis assignment options. If any joystick device takes more than 15 mSecs to respond, FSUIPC4 stops polling it on the assumption that it is either faulty, or has a bad driver. The ban on that device stays operative for the rest of the FS session. This is intended to prevent the odd hangs some folks get in the Buttons options which are thought to be due to rogue joystick drivers without connected joysticks. The timeout used (15 mSecs by default) has a minimum of 5 and a maximum of 5000 milliseconds.

## Less used technical options

**AutoTuneADF**: This controls an option to 'auto-tune' the ADF radio. If this is enabled, when FSUIPC detects no NDB signal being received it alternates the fractional part of the ADF frequency between .0 and .5 every seven seconds or so. This allows external cockpits built with only whole-number ADF radio facilities to be used in areas like the U.K. which have many NDB frequencies ending in .5.

**AxisCalibration**: This facility deals with inputs to the rudder, aileron and elevator axis offsets, via the IPC offsets. It is intended for use with hardware drivers which, instead of sending normal axis inputs to FS, control the main flight surfaces by direct writes to FSUIPC's offsets, thus bypassing assignments, calibration, etc. The only such hardware driver known to me is the one for the Aerosoft GA28R console. *In FSUIPC4 this facility still operates for compatibility with FSUIPC3 and before. However, you are advised now to set this to "No", and instead use the new facility 'DirectAxesToCalibs'*:

**DirectAxesToCalibs**: Setting this to 'Yes' makes FSUIPC4 assume that any direct writes to FSUIPC4's offsets for rudder, aileron and elevator are from a hardware driver and are really meant as axis inputs. FSUIPC4 directs the values to its Joystick Calibrations section, where you should then calibrate the inputs exactly as you would for a normal flight control. The only hardware known to me which benefits from this is the one for the Aerosoft GA28R console. Do not set this option if you use any sophisticated panels or external programs with their own autopilots, as it is possible that they route their control values the same way. FSUIPC4 cannot distinguish the source.

**AxisIntercepts** can be set to 'Yes' to force the intercepting and forwarding of axis controls by FSUIPC4, even if this action is not needed for FSUIPC4 calibration (where it will be done automatically in any case). This action will be needed for some "fly-by-wire" aircraft only.

**StartImmediately** is not expected ever to be used directly by the user. When it is set to 'Yes' it makes FSUIPC4 initialise the data interface with SimConnect immediately it is started, rather than wait for SimConnect to indicate "SimStart". This is the default for FSX + SP1 or later. In order to avoid the earlier SimConnect problems which occur when more than one Client initialises at the same time, the setting defaults to "No" on a pre-SP1 FSX installation.

**SimConnectStallTime** can be used on poorer performing systems, very heavily loaded, to attempt to stop FSUIPC4 re-initialising the SimConnect interface to FSX when it finds itself starved of information which should be arriving all the time. This time defaults to one second (1), which should always be adequate for systems which can maintain an FSX frame rate of 2 fps or more, never dropping to 1 or less. This does not include times when FSX is engaged reloading scenery or inside Menus and the like, which are not checked.

The range of values that can be set from this parameter is 1 to 9, with 1 being the default.

**UseEpsilon** is normally omitted altogether. If needed, it can be added, in the [General] section of the INI file, set to "Yes". This will impose change limitations on most variables sent to FSUIPC4 by SimConnect. These restrictions were in place in FSUIPC4 before version 4.069, but were removed by default when it was determined that the performance improvement gained was negligible or non-existent.

**FiddleMachForPM=Yes** is, hopefully, a temporary fix for Project Magenta users who suffer the problem of high speed descents under MCP control as a result of PM incorrectly setting a Mach speed in the wrong mode. This only affects FSX because of the odd way FS9 and before work. To enable this fix add this parameter (it won't appear in the INI by default).

By way of explanation, when the PM MCP sets the IAS for the A/P it also sets the Mach value. This would be okay, except for three things:

1. The Mach value it sets after cruise is ALWAYS the last one it set in cruise, not a correct one related to the IAS and altitude/temperature/pressure.

2. The Mach is written after the IAS
3. In FS9 and before, the Mach setting did not affect the IAS setting nor vice versa until and unless you switched IAS/Mach modes. However, in FSX the last-written value applies and is converted to the equivalent IAS/Mach no matter which mode you are in!

This FSUIPC4.INI parameter simply makes FSUIPC4 discard any MACH writes whilst the PM MCP is in IAS mode.

**FiddleAppAltForPM=Yes** is another hopefully temporary fix for Project Magenta. It makes FSUIPC4 automatically replace any altitude written during PM MCP APP mode by zero. It also sets the FSX MCP altitude to zero in PM MCP APP mode when a negative VS is set, and it does both these things even if Altitude Hold is enabled.

The intention here is to avoid any unwanted climbs when descending on the GlideSlope due to the fact that FSX seems to be different to FS9 and before in that writing to the FS MCP's altitude register can affect the requested vertical speed even though FS's altitude hold option is not enabled.

**AutoGlobalWeather=Yes** controls whether FSUIPC4 attempts to change the internal global weather structures in FSX when applying the assorted weather options. Generally this seems to do no harm left enabled, but whether it really does any good is not too clear either.

**CustomWeatherModify=No** stops FSUIPC4 re-writing weather station METARs in an attempt to correct for excessive wind and temperature layers and also to apply selected user weather filters when "custom weather" mode is enabled—as when the user selects specific weather settings (i.e. not thematic or downloaded) or when external programs such as ASX controls the weather.

**AutoDeleteAI**: this controls a facility to make FSUIPC4 automatically delete AI aircraft with given call signs (ATC IDs). The parameter provides a list of call signs, optionally enclosed in " " and separated by commas (,). Up to 16 such names can be listed. As glider tow planes were the reason for adding this facility, and their call sign appears to always be EC-527, the line could be:

```
AutoDeleteAI=EC-527
```

Note that, for tow planes, this deletes the AI aircraft, but NOT the tow rope. Apparently you would need to remove that (Ctrl Y?) in order to get another tow plane called up.

The action of deleting these aircraft is Off initially, by default, but can be set to be On by default by making the first name in the list "ON", so:

```
AutoDeleteAI=ON,EC-527
```

This might be used on a multiplayer server, where others tow planes are presumably never required. Run-time control of the state of this option is by use of three new assignable controls, added to FSUIPC's dropdowns for Keys and Buttons.

**UseAxisControlsForNRZ=No**: This is a facility for the **[JoystickCalibration]** section(s) of the INI file, *not* [General]. It is a special option provided to try to cope with some different add-on practices (notably, in this case, the Wilco A320). Normally, the 4-Throttles, 4-mixtures and 4-Prop pitch calibrations result in an output with either a range which includes the reverse zone, or, if the "**no reverse zone**" option is checked, a range from 0 (idle) to 16383 (max). These are sent to FS using the older "????n\_SET" controls (THROTTLE1\_SET, etc), since these are the ones providing the reverse zone below zero.

If you set the [JoystickCalibration] INI parameter **UseAxisControlsForNRZ** to "Yes", then the NRZ (no reverse zone) option for all three axis types will use the AXIS\_????n\_SET controls (e.g. AXIS\_THROTTLE1\_SET) instead, with a range of -16363 (idle) to +16383 (Max). This will be Aircraft or Profile-specific if you set it in the appropriate calibration section of the INI file.

## AUTOSAVE: INI-file only options

Some add-on programs produce files when Flights are saved separately from the usual ones in the FSX flights folder, so that the AutoSave option fails to manage their numbers, deleting older ones when the FLT files are deleted. The types handled by default are FLT, WX, FSSAVE, PSS, FMC, ABL, RCD, SPB and IPCBIN. For any others, and files in other folders, you have to manually add some lines to the [AutoSave] section of the FSUIPC4.INI file. As an example, for the PMDG 747X these would be:

AlsoManage1=PMDG\747400\PanelState\\*.FLT.sav  
AlsoManage2=PMDG\747400\PanelState\\*.0.rte  
AlsoManage3=PMDG\747400\PanelState\\*.1.rte

The path given in these lines is *within* the main FSX path. If you have anything installed outside the FSX path you'd need to give the complete pathname, from the drive (e.g. C:\ ...) onwards (or the computer name for a Network in the usual form, i.e. \\<name> ...).

Up to nine “AlsoManage” lines can be given, numbered 1 to 9.

## Logging facilities

These options can be controlled ‘on the fly’ from the FSUIPC4 dialogue window (select the Add-Ons menu then FSUIPC, or ALT, D then F).

FSUIPC4 always produces a text file called FSUIPC4.LOG in the Modules folder. Entries in the log are timed, from the start of the FS session. The time is in milliseconds and appears on the extreme left of each line.

Please use the logging facilities to check things before reporting problems or omissions in FSUIPC4, and supply an appropriate log file (or extract) properly zipped up with such reports.

Note that log files can get very large if all the options are turned on. Keep test flights short. You can read log files whilst flying provided you use a reader which shares access (like recent Notepad programs), or use the ‘NewLogKey’ described below to close logs and start new ones.

All Log control parameters go into the [General] section of FSUIPC4.INI. None are included by default.

**LogWeather=Yes:** Logs weather data. This will log incoming data, set by a weather control program and the actual weather data constructed by FSUIPC4 in FS terms. Then you get the weather read out by FSUIPC4 and lastly placed back into the Offsets for applications to read. Incoming weather control data on the Advanced Weather and New Weather Interfaces is also logged in full.

**LogWrites=Yes:** Logs the offset ‘writes’ received from applications, with global offset address and data size, plus all bytes of data. The offsets shown are the ones used by the application. [Take care: the Log file may get very large!]

**LogReads=Yes:** Logs the offset ‘reads’ received from applications, with global offset address and data size, plus all bytes of data. The offsets shown are the ones used by the application. [Take care: the Log file may get very large!]

**LogEvents=Yes:** This option logs all FS “key events”, other than those from axis controls. This can be very useful to those seeking to understand the actions of their buttons and keys, or to view the sorts of things some of the more complex panels do, repeatedly, every second.

**LogAxes=Yes:** This logs just the axis input events.

**LogButtonsKeys=Yes:** This logs most Keyboard events (KEYUPs only when programmed), and all button operations. The logging can get quite long, but it will be very useful when trying to analyse exactly what your complex FSUIPC4 button or key programming is doing.

**LogLua=Yes:** Enables extra Lua plug-in logging, and causes each running Lua plugin to use its own Log file. These files are cumulative, though—each time the same plug-in runs it adds to an existing Log file.

**LogExtras=Yes:** This logs additional technical data about the inner workings of FSUIPC4, the nature of which will vary from time to time according to needs. There is nothing here that would be of interest to the user, but when investigating problems users may be asked to enable it so that the logs returned can be more meaningful in solving them. Do not fly extensively with this option enabled or you will fill up your disk and probably compromise the simulator’s performance!

Additional “Extras” logging facilities are available if the parameter **Debug=Please** is incorporated into the INI file. This changes the Extras logging flag into a numeric value that can be in hexadecimal and may extend to two 32-bit parts (x.....,x.....). This facility is for use under instruction only.

**LogSimC=xxxx,xxxx ...** (where each ‘xxxx’ is either an offset, or a range xxxx-xxxx): whenever the values associated with offsets listed or included here are read from or written to a SimConnect Variable (“SimVar”) those values are logged. The list can request several disparate offsets or ranges—the limit is imposed only by the INI file maximum line length (255 characters).

**NewLogKey, StopLogKey:** These allow you to assign keypresses to close the current Log file (if logging was enabled), and start a new one. The ‘NewLogKey’ will carry on with the same logging options, whilst the ‘StopLogKey’ will revert to default logging (the minimum). Between them these two keys give complete control over the logging. (Note that both actions are also available in the FSUIPC4 dialogue window).

The current log file is always called FSUIPC4.LOG. The others are named in numerical order FSUIPC4.1.LOG, ... 2.LOG, ... etc. The keystrokes are defined as in Flight Simulator’s own controls, and listed below in the Button Programming section. For example, I use “Shft+Ctrl+L” and “Shft+Ctrl+O” (for “Log” and “Off” respectively) which would be

NewLogKey=76,11

StopLogKey=79,11

## Monitor facilities

FSUIPC4 can monitor, on every FS frame, up to four values (or the same values in different formats, if needed), and display or log them when they change. For each value to be logged you enter or select four things:

**Base:** which will normally be fixed at ‘IPC’. The base is the name of the area of data from which the value shown will be taken. All the variables supported by FSUIPC through the IPC interface are at offsets relative to the IPC base.

**Offset:** which identifies the position of the value relative to the Base. This is a hexadecimal number, normally in the range 0000 to FFFF. Some of the non-IPC bases may allow larger offsets. For offsets to standard IPC variables see the Programmers Guide in the SDK.

**Type:** this defines the type of variable, so that the formatting in the display will show something meaningful. The types currently supported are tabulated below.

Type	Description	C type
<b>S8</b>	Signed 8-bit value, -128 to +127	<b>signed char</b>
<b>U8</b>	Unsigned 8-bit value, 0 to 255	<b>unsigned char, or BYTE</b>
<b>S16</b>	Signed 16-bit (2 byte) value	<b>short</b>
<b>U16</b>	Unsigned 16-bit (2-byte) value	<b>unsigned short, or WORD</b>
<b>S32</b>	Signed 32-bit (4-byte) value	<b>int</b>
<b>U32</b>	Unsigned 32-bit (4-byte) value	<b>unsigned int, or DWORD</b>
<b>SIF16</b>	2 byte Integer & Fraction: 8-bit fraction followed by 8-bit signed integer	Uses a <b>short</b>
<b>UIF16</b>	2 byte Integer & Fraction: 8-bit fraction followed by 8-bit unsigned integer	Uses an <b>unsigned short</b>
<b>SIF32</b>	4 byte Integer & Fraction: 16-bit fraction and 16-bit signed integer	Uses an <b>int</b>

Type	Description	C type
<b>UIF32</b>	4 byte Integer & Fraction: 16-bit fraction followed by 16-bit unsigned integer	Uses an <b>unsigned int</b>
<b>SIF64</b>	8 byte Integer & Fraction: 32-bit fraction followed by 32-bit signed integer	Uses an <b>unsigned</b> then signed <b>int</b>
<b>UIF64</b>	8 byte Integer & Fraction: 32-bit fraction followed by 32-bit unsigned integer	Uses two <b>unsigned ints</b>
<b>FLT32</b>	32-bit (4-byte) standard floating point value	<b>Float</b>
<b>FLT64</b>	64-bit (8-byte) standard floating point value	<b>Double</b>
<b>ASCIIZ</b>	A string of single-byte characters terminated by a zero byte. A length an limited number of these is shown	<b>Char[], or ASCIIZ</b>
<b>SA16</b>	16-bit signed Angle in FS format (-180 degrees = max+1)	Uses a <b>short</b>
<b>UA16</b>	16-bit unsigned Angle in FS format (360 degrees = max+1)	Uses <b>unsigned short</b>
<b>SA32</b>	32-bit signed Angle in FS format	Uses <b>int</b>
<b>UA32</b>	32-bit unsigned angle in FS format	Uses <b>unsigned int</b>

**Hex:** For most numerical values the sensible display will be decimal. However, for the plain fixed point integer values (S8, U8, S16, U16, S32 and U32) you may want to view them in hexadecimal instead.

Then you have to select how you want the values to be displayed. There are four options, and any or all of these can be selected:

**Normal Log File:** Changes in the monitored values are listed in the FSUIPC4.LOG for later viewing. Additionally, for any monitored offset, the offset is also treated as a “LogSimC” offset (see above) automatically so that SimConnect reads/writes are logged.

**Debug String:** The same messages are sent to a debugger or debugging monitor such as DebugView, for viewing in parallel to the FS actions. Note that you may have difficulty running a debugger with SafeDisk-protected versions of FS (FS2000 and FS2004).

**FS Window:** The monitoring is done by using up to 4 lines in the FS message display window. This appears near the top of the screen.

**FS Title Bar:** The messages replace the FS title altogether. Only one is shown at a time, so this is only useful for monitoring one value.

If the value requested is not available at any time the result will show “<invalid>”. When looking at some Engine or other aircraft things, this can happen transiently, for instance whilst an aircraft is being loaded.

All the monitoring selections are saved in the FSUIPC4.INI file, in a section called [Monitor].

## JoyNames

The INI file section [JoyNames] is fully described in its own chapter in the User Guide.

## Profiles

If you opt to use the Profile facilities, to have different button, key, axis and calibration settings for a number of types of aircraft (rather than specific named aircraft), then FSUIPC4 will create [Profile.<name>] sections in your INI file. These take the name of the profile you request, for example “Jets”, “Props”, “Helos”, and simply contain a list, in the usual 1=<name>, 2=<name> ... format, of those aircraft names which belong to the particular profile, according to your assignments. Those aircraft names may be the full names, as when you assign in the FSUIPC4 options dialogue, or can be shortened or substring names, according to the “ShortAircraftNameOk” parameter already mentioned.

## Button Programming

FSUIPC4’s options dialogue provides a page for programming button in all the main ways. Here we look at how this programming is encoded in the FSUIPC4.INI file, and how the programming can be extended to provide multiple keystrokes and controls for a button, mixed if required, and to provide compound (conditional) actions—ones depending on other buttons, switch settings and even previous keyboard presses. There are even facilities to make Button actions depend upon values in offsets from the FSUIPC4 IPC interface, which really provides a wealth of possibilities (for that part you will need to get the FSUIPC4 SDK too, as the offset listings are provided in that package, in the Programmer’s Guide).

FSUIPC4 reloads all Button parameters each time the aircraft is changed in Flight Simulator, so you can edit theses and test them out without having to reload Flight Sim every time.

Before embarking on the programming itself, several global parameters need to be described. These won’t appear in the INI file unless you add them, and you only need to add them (in the main [Buttons] section) if you need something other than the defaults:

**InitialButton:** This controls a facility to make FSUIPC4 perform one-off actions when FS is first loaded and running (i.e. actually ready to fly). This is by programming a real or imaginary Button. Simply add the line “InitialButton=j,b” to the [Buttons] section. The values of j (0–255) and b (0–31) can specify a real joystick and button, or a non-existent one, it doesn’t matter. Real ones can have an action assigned on-line, in the Buttons option page, but multiple actions for any button, real or not, can be accomplished by editing the INI file as described here.

**IgnoreThese:** This can be used to list a number of buttons which are to be ignored by FSUIPC4 in the Buttons & Switches tab. This is to deal with faulty button signals which are repeating without control and thus preventing the others from being registered on the screen ready to program. The parameter takes this form:

**IgnoreThese=** j.b, j.b, ...

listing the joystick number (j) and button number (b) of each button to be ignored. To make it easy, you can edit the INI file whilst in the Button assignments dialogue and simply press “reload all buttons” to activate the changes.

Note that the action of ignoring buttons only applies to those numbered 0–31 on each possible joystick (not any “POV” hats), and they are only ignored in the dialogue—if they are already assigned the assignment will still be effective.

**EliminateTransients:** This can be added, and set to ‘Yes’, to eliminate short (transient) button press indications. This is intended to help deal with some devices which create occasional spurious button press signals. It operates only with locally-connected joysticks (but not EPIC or GoFlight devices).

Note that enabling this option may mean you have to consciously press buttons for slightly longer. It depends on the **PollInterval** (below). A “transient” button indication is one which only exists for one poll, so a real press would have to last up to 50 mSecs (twice the default poll interval) to be sure of being seen (more, allowing for variations in the polling due to processor/FS activity). You may find you need to adjust the **PollInterval**.

**PollEpicButtons=Yes:** Set this to No if you experience any difficulty getting FSUIPC4 to operate correctly on a system with an EPIC installed but which you do not want to program via FSUIPC4’s “Buttons” page.

**ButtonRepeat=20,10:** The first number here controls the button repeat rate, when repeating is enabled for a specific button. The range is 1 to 100 and is the number of repeats per second. Note that the higher rates may not actually be achievable. If you want no limit placed, allowing the repeats to go as fast as they can under each circumstance, set this parameter to 0. This can be *very* fast, so beware!

Note that it is unlikely that this rate will be exactly maintained as it is subject to FS performance variations, depending on the action being repeated, but it acts as a good target control value.

The second number gives an initial delay, before repetitions begin. This is in terms of how many potential repetitions to miss, so with 20 repeats per second, 10 would give a delay of half a second. This allows the same button to operate to increment/decrement a value just once, or, by holding the button down, repeat until released.

A value of 0 for the initial delay value means there will be no delay before the repeats start -- this is how FSUIPC has been until the delay facility was added.

**PollInterval=25:** This parameter tells FSUIPC4 how often to read (“poll”) the joystick buttons. The time is in milliseconds, and the default, as shown, is 25 (40 times a second).

A polling rate of 0 will stop FSUIPC4 looking at buttons altogether, and in fact this will remove the Buttons & Switches tab from the FSUIPC4 options. This may come in useful for checking whether a rogue joystick driver is causing problems.

A polling rate of 40 per second is more than adequate for all normal button programming. It is only when you come to the more advanced uses that you may want to change this. Rotary switches, for instance, may give pulses so fast that some are missed at such a rate.

Any value from 1 millisecond upwards can be specified, but those from 50 upwards result in a specific number of “ticks” (55 mSecs) being used. i.e. 40–82 actually result in 55 (1 tick), 83–138 in 2 ticks, and so on. Ticks are also approximate, in that they depend on the other activities and loading upon FS.

Values 1–59 milliseconds are actually handled by a separate thread in FSUIPC4 and give more accurate results, but note that polling the joysticks too frequently may damage FS’s performance, and may even make its response to joystick controls more precarious. No truly adverse effects have been noticed during testing, but it is as well to be warned. If you think you need faster button polling, try values in the range 10–25, and make sure that FS is still performing well each time.

Note that PFCFSX’s “emulated” joysticks (those with numbers 16 upwards) are polled four times more frequently in any case—this is done because there is no overhead in doing so—there are no calls to Windows but merely some data inspections. GoFlight buttons (joystick numbers even higher) aren’t polled at all—FSUIPC4 receives a call from the GoFlight driver interface (GFDev.DLL) whenever an event occurs.

## FORMAT OF BUTTON DEFINITIONS

The button programming is saved in sections in the INI file. For globally operative buttons this is called [Buttons]. For aircraft-specific buttons it is [Buttons.<aircraft name>]. Up to 2048 separate entries defining button actions can be included in each section, normally numbered sequentially from 0, provided that the total of the definitions in the Global section and the largest aircraft-specific section is not greater than 2048.

If the [General] parameter **ShortAircraftNameOk** is set to **Yes** or **Substring**, the <aircraft name> part of the section heading can be abbreviated (manually, by editing the INI file) so that it applies to more than one aircraft. With the ‘Yes’ option, FSUIPC4 will automatically select the section with the *longest* match. The ordering of sections in the INI file is not relevant. However, with the ‘Substring’ option it will select the first section with a substring match – there’s no concept of “longest match” in this case.

The basic format of each entry in the Buttons section is as follows:

For keypresses: <Entry number> = <Action><Joy#>,<Btn#>,K<key>,<shifts>

For controls: <Entry number> = <Action><Joy#>,<Btn#>,C<control>,<parameter>

For macros (see the separate section on macros):

<Entry number> = <Action><Joy#>,<Btn#>,M<file#>:<ref#>,<parameter>

The format of the parameters becomes more complex for conditional actions, so they will be described later.

The <Entry number> is not material most of the time—except in sequences for single button presses/releases. It is just a sequence number from 0–2047 (but limited to a total of 2048 entries for the general section plus any one Aircraft-specific section).

Each entry must have a unique entry number, and the actual order is only important when multiple actions are defined for the same button. FSUIPC4 will retain the numbering, and hence the order which the number (not the line position) defines.

You can add comments following a semicolon (;) at the end of the line, and these will be retained. You can also insert lines containing only comments, but they need an <Entry number> too, otherwise they may not retain their relative position. Comments can contain up to 63 characters—longer ones will be truncated if and when the [Buttons] section is re-written by FSUIPC4.

<Action> is a single letter denoting the action being defined:

- P Pulse the key press or control: i.e. do not hold the keys down whilst the button is held down. This is always the case for controls, and should always be the case for any key presses involving ALT key usage, because once the FS Menu is entered FSUIPC4 cannot supply further changes like key releases.
- H Hold the specified keys down until the button is released. (This doesn't apply to Controls and will be treated like P in their case). Do *not* use this with key presses involving ALT, for the reason just given.
- R Repeat the key press or control whilst the button is kept held down. The repeat rate is approximately 6 per second and is not adjustable. Do *not* use this with key presses involving ALT, for the reason already given.
- U Pulse the key press or control when the button is released.

Any button can have a U entry as well as a P, H, or R entry. Provided the button only has one P, H or R, and/or one U entry, and that when it does have two they are either both key presses or both controls, then the button programming can be handled entirely in FSUIPC4's Buttons option page.

The <Joy#> identifies the joystick number (0–15 for normal joysticks, 16 upwards for PFC, GoFlight or other future 'emulated' joysticks) as displayed by FSUIPC4, and the <Btn#> identifies the specific button (0–39), again as in FSUIPC4's display. Of these buttons 0–31 are regular buttons and 32–39 are the 8 possible POV view angles, starting forward and going clockwise every 45 degrees. (There are no emulated POVs so for joysticks 16 and upwards the buttons numbers are always in the 0–31 range).

Note that the Joystick numbers 0–15 may be replaced by an assigned letter (A–Z, omitting I and O) if the JoyNames facility is being used to assign joysticks indirectly, in case their real ID numbers change.

When buttons on WideFS clients are programmed, the Joystick number also includes a Client PC number—1000 for client 1, 2000 for client 2 and so on. The client numbering is actually handled by WideServer, which keeps a record of Client PC names and assigns them numbers in the WideServer.ini file. You only need to worry about that when changing PCs or renaming them.

For key presses, the <key> value following the letter 'K' is the virtual key code for the key to be pressed. Here's a list for convenience (but note that not all of these will be usable):

0	Null (+ Alt, Shift etc alone) <i>(Can only be used to press these, not detect them!)</i>	20	CapsLock	45	Insert
		27	Escape	46	Delete
		32	Space bar	48	0 on main keyboard
8	Backspace	33	Page Up	49	1 on main keyboard
12	NumPad 5 (NumLock Off)	34	Page Down	50	2 on main keyboard
13	Enter	35	End	51	3 on main keyboard
16	Shift (needs shift value 9)	36	Home	52	4 on main keyboard
17	Control (needs shift value 10)	37	Left arrow	53	5 on main keyboard
18	Menu (needs shift value 72)	38	Up arrow	54	6 on main keyboard
19	Pause	39	Right arrow	55	7 on main keyboard
		40	Down arrow	56	8 on main keyboard
		44	PrintScreen	57	9 on main keyboard

65	A	97	NumPad 1 ( <i>NumLock ON</i> )	125	F14
66	B	98	NumPad 2 ( <i>NumLock ON</i> )	126	F15
67	C	99	NumPad 3 ( <i>NumLock ON</i> )	127	F16
68	D	100	NumPad 4 ( <i>NumLock ON</i> )	128	F17
69	E	101	NumPad 5 ( <i>NumLock ON</i> )	129	F18
70	F	102	NumPad 6 ( <i>NumLock ON</i> )	130	F19
71	G	103	NumPad 7 ( <i>NumLock ON</i> )	131	F20
72	H	104	NumPad 8 ( <i>NumLock ON</i> )	132	F21
73	I	105	NumPad 9 ( <i>NumLock ON</i> )	133	F22
74	J	106	NumPad *	134	F23
75	K	107	NumPad +	135	NumPad Enter (or F24?)
76	L	109	NumPad -	144	NumLock
77	M	110	NumPad .	145	ScrollLock
78	N	111	NumPad /	186	; : Key*
79	O	112	F1	187	= + Key*
80	P	113	F2	188	, < Key*
81	Q	114	F3	189	- _ Key*
82	R	115	F4	190	. > Key*
83	S	116	F5	191	/ ? Key*
84	T	117	F6	192	' @ Key*
85	U	118	F7	219	[ { Key*
86	V	119	F8	220	\   Key*
87	W	120	F9	221	] } Key*
88	X	121	F10	222	# ~ Key*
89	Y	122	F11	223	` ~   Key*
90	Z	123	F12		
96	NumPad 0 ( <i>NumLock ON</i> )	124	F13		

\* These keys will vary from keyboard to keyboard. The graphics indicated are those shown on my UK keyboard. It is possible that keys *in the same relative position* on the keyboard will respond similarly, so here is a positional description for those of you without UK keyboards. This list is in left-to-right, top down order, scanning the keyboard:

223	` ~	is top left, just left of the main keyboard 1 key
189	- _	is also in the top row, just to the right of the 0 key
187	= +	is to the right of 189
219	[ {	is in the 2nd row down, to the right of the alpha keys.
221	] }	is to the right of 219
186	; :	is in the 3rd row down, to the right of the alpha keys.
192	' @	is to the right of 186
222	# ~	is to the right of 192 (tucked in with the Enter key)
220	\	is in the 4th row down, to the left of all the alpha keys
188	, <	is also in the 4th row down, to the right of the alpha keys
190	. >	is to the right of 188
191	/ ?	is to the right of 190

The <shifts> value is a combination (add them) of the following values, as needed:

1	Shift
2	Control
4	Tab
8	Normal (add this in anyway)
16	Alt ( <i>take care with this one—it invokes the Menu</i> )
32	Windows key (left or right)
64	Menu key (the application key, to the right of the right Windows key)

[Note that the Tab and Alt keys are denoted by opposite bits here than when used for key programming. Apologies for this, which was a design oversight now too late to change]

If only “normal” is needed, the whole parameter and the preceding comma can be omitted. Usual values are:

9	for shift+ ...
10	for control+ ...
11	for shift+control+ ...

For FS controls the <control> is a number from 65536 upwards, denoting the specific FS control number. Lists of these can be found in my various FS controls documents. In the FSUIPC4 Buttons page the controls are shown by

name normally, but if you want to try a control which has no name but *might* do something useful for you, enter it here, in the INI file. In the Buttons page FSUIPC4 will show this by number instead of name.

The <parameter> for a control is optional – just omit this along with the preceding comma for most toggle/button type controls. A parameter value of 0 will be assumed anyway.

Either or both of the <control> and <parameter> values can be provided in hexadecimal, preceded by an ‘x’ character.

As well as the FS controls, a number of additional FSUIPC4 controls are available. These range from 1000 to 3000, and also values ‘xcc00zzzz’ (in hexadecimal) which encode the FSUIPC4 “Offset” controls. See the list below the discussion on ‘Keys’ for full details.

## SEQUENCES, COMBINATIONS, and MIXTURES

The Buttons page in the FSUIPC4 options is deliberately kept rather simple, hiding some of the programming possibilities. By editing the INI file you can do more:

- Hold one key down whilst pressing another
- Press and release a sequence of keys
- Mix key presses and FS controls in one button operation
- Make button actions conditional on the state of other buttons (see ‘Compound’ buttons, below)
- Make button actions conditional on values in FSUIPC4 offsets (see ‘Adding offset conditions’, below)

The first three are simply done by defining the actions in separate entries, each referring to the same joystick/button number. I’d recommend you first use the Buttons page to get the initial action programmed (this making sure you have the right button number), then close FS and edit the entries already made in the INI file. The only important thing is to number the entries in sequence – preferably, but not necessarily, consecutively.

Examples:

```
16=H1,2,K69,8
17=H1,2,K49,8
```

Presses and holds the ‘E’ key then presses and holds the ‘1’ key, so both are pressed together. They are both released (in the same order) when the button is released.

```
18=P1,3,K69,8
19=P1,3,K49,8
20=P1,3,K50,8
21=P1,3,K51,8
22=P1,3,K52,8
```

Presses and releases ‘E’, then ‘1’, ‘2’, ‘3’, and ‘4’ in rapid succession, selecting all Engines.

```
23=P2,3,K76,24
24=P2,3,K65,8
25=P2,3,K69,8
```

Presses and releases ALT+L then A then E, in *very* rapid succession! FSUIPC leaves no delays at all between actions when the ALT key has been used. Otherwise, as soon as it allows the processing of the keys to begin, the ALT key combination will bring up the menu item and (in this case) dialogue, and FSUIPC will not be running and will therefore not be able to provide the key releases. Horrible mix-ups may then ensue! <G>

This last example is a real one I am actually using. The ALT+L gets the Lago menu, the ‘A’ selects FSAssist, and the ‘E’ selects the Pushback with Engine Start. This puts you in the pushback dialogue, but then you are into using the mouse, I’m afraid. FSUIPC can help no more.

## COMPOUND BUTTON CONDITIONS

Facilities are included to allow you to specify actions for one button which are dependent on the state of another button (or more likely, switch). This by using what I call “Compound” button programming—though it could equally be “Conditional” or “Co-operative”. Anyhow, I use the letter C in the definitions, as follows:

```
n=CP(+j2,b2)j,b, ...
n=CU(+j2,b2)j,b, ...
```

n=CP(-j2,b2)j,b, ...  
n=CU(-j2,b2)j,b, ...

Here the 'C' denotes compound button checking, whilst P = pulse on pressing, U = pulse on releasing, as before. You can also use CR in place of CP for a repeating action—the repeats continue whilst all the conditions are true. There is no facility for the Hold action with the compound facilities.

Inside the parentheses are details of the *secondary* button, which must be in a certain condition for the current button to operate:

(+j2,b2) means that button b2 on joystick j2 must be pressed ("on") for the current button action (for j,b) to be obeyed.

(-j2,b2) means that button b2 on joystick j2 must be released ("off") for the current button action (for j,b) to be obeyed.

The j,b, ... part is the usual button parameter, for the action of the "current" button which is button b on joystick j.

You can have one condition, as shown above, or two, or more (up to 16 in fact), like this:

n=CP(+j2,b2)(+j3,b3)j,b, ....

where, now, *both* the parenthesised conditions must be met for the 'j,b' button action to result in the defined event.

The conditions can be made to apply *not* to the *current* state of a button, but to the state of a 'flag' that is set and cleared by a button (or even a keypress). For every possible "normal" button (16 joysticks x 32 buttons = 512 buttons) FSUIPC4 maintains a "Flag" (F). Each time any button is pressed (goes from off to on) FSUIPC4 toggles its flag. This makes the buttons flag a sort of "latching" switch. You can test it in any parenthesised condition by preceding the condition by F, thus:

N=CP(F+j2,b2) ...

This says the rest of this parameter is obeyed if the Flag associated with j2,b2 is set. A condition (F-j2,b2) tests for the Flag being clear. Note that the actual current state of the button j2,b2 is not relevant. All that matters is whether it last left its Flag set or clear.

Any of the conditions in a multiple-conditioned setting may be on Flags.

These Button Flags can also be set, cleared and toggled by three special FS controls, **Button Flag Set** (C1003), **Button Flag Clear** (C1004), and **Button Flag Toggle** (C1005). In all three cases the Joystick (0–15 *only*) and Button (0–31) referenced is given in the Parameter, by a value calculated as:

256 \* J + B                      (for example, Joystick 15, Button 31 would be 3871).

These three controls are listed in the FSUIPC4 options drop downs for assignment in both the Buttons and Keys pages, so you can program them there, or here in the INI file. With these themselves as controls resulting for conditional button actions, you can influence conditions for button actions in a whole multitude of ways.

One point to note: since you can use the keyboard or other compound button actions to set, clear or toggle the flags, the actual button for which the Flag is assigned *does not actually need to exist!*

Okay. Now what does this really mean? Some simpler examples will suffice here. I leave it to the more imaginative amongst you to come up with some really complex applications! <G>

First, it means that you can assign multiple uses to any number of buttons by making them conditional on a number of others. For example, a 12-position latching rotary switch could be wired to operate buttons 1 to 12 on joystick 1. Then for any other button I can program 12 different actions. For example, button 0,3 could have twelve different actions assigned, like this:

1=CP(+1,1)0,3, ...  
2=CP(+1,2)0,3, ...  
3=CP(+1,3)0,3, ...  
...  
12=CP(+1,12)0,3, ...

and so on. For example, you may have a set of assignments for ground operations, a set for take-off, a set for climb, a set for cruise, and so on.

Second, to economise sensibly on the use of buttons, where you really need a toggle you can make any button toggle between two actions by using a flag as a condition. For example, suppose your button is Joy 11, button 3, and a spare

flag (a button on joysticks 0-15 not otherwise used) is 15, 2. Program your button with three lines in FSUIPC (the numbers on the left need to be sequential with whatever's there already, but I'll assume you have no others so will start with 1):

1=P11,3,C1005,3842

This says execute Control 1005 whenever your button is pressed. Control 1005 is "Button Flag Toggle". The parameter '3842' identifies the Flag: 256 x joystick 15 + button 2. So, this flag will now alternate between being set and clear each time you press the button.

2=CP(F+15,2)11,3, ...

This tells FSUIPC what to do if the button is pressed AND the flag is set. Replace the ... part by the Control number and parameter for one of the actions you need.

3=CP(F-15,2)11,3, ...

Similarly, this tells FSUIPC what to do when the button is pressed and the flag is not set.

Third, you can now program those two-phase type rotary switches, the ones where turning the spindle one way gives pulses on two lines phase shifted one way, and turning the spindle the other way gives the opposite phase relationship.

Say the inputs from the rotary are on Joystick 1, Buttons 1 and 2. When B1 is ON and B2 goes from off to on, then the spindle has turned one way. When B1 is ON and B2 goes from on to off, the spindle has turned the other. That is the simplest example:

1=CP(+1,1)1,2, ...      turn direction 1 action  
2=CU(+1,1)1,2, ...      turn direction 2 action

You can also have double speed action, operating on every off to on and on to off change of B2. Just add two more conditions:

3=CP(-1,1)1,2, ...      turn direction 2 action (B2 goes off to on when B1 is off)  
4=CU(-1,1)1,2, ...      turn direction 1 action (B2 goes on to off when B1 is off).

Since the whole thing is completely symmetric (there is no reason why B1 should control B2, it could also be the other way around), you can actually program it to act on ALL edges of both buttons, by adding another 4 conditions:

5=CP(+1,2)1,1, ...      turn direction 2 action (B1 goes off to on when B2 is on)  
6=CU(+1,2)1,1, ...      turn direction 1 action (B1 goes on to off when B2 is on)  
7=CP(-1,2)1,1, ...      turn direction 1 action (B1 goes off to on when B2 is off)  
8=CU(-1,2)1,1, ...      turn direction 2 action (B1 goes on to off when B2 is off)

So, you can effectively choose how many pulses you will get for a given turning rate. As you can see, you can get rates of 1x, 2x or 4x—even 3x if you do one part for only half the changes! Note that for reliability at higher speeds you may need to reduce the **PollInterval**.

By the way, it is with some of these rotary switches where the double condition facility can come in very useful. If you have a single rotary of this type with also a push button action available, you can program it to adjust both the units and fractions of, say, a radio receiver. Just use the Flag associated with the button action to choose between one pair of actions or another, thus, supposing 1,3 to be the button:

1=CP(F+1,3)(+1,1)1,2, ...    increment fraction  
2=CU(F+1,3)(+1,1)1,2, ...    decrement fraction  
3=CP(F-1,3)(+1,1)1,2, ...    increment integer  
4=CU(F-1,3)(+1,1)1,2, ...    decrement integer

One last thing. Using several rotaries of this type (that is, with the two signals in different phase relationships to indicate direction of turning), if they are of the type that have both signals 'off' in the detent you can save button connections by making one of them (on each one) common. If you do this you can only turn one of them at a time, but this is probably a worthwhile restriction if you are getting short of button connections.

## ADDING OFFSET CONDITIONS

As well as all the above (and below, for Keys) any or all entries in all Buttons and Keys sections of FSUIPC4.INI can each contain a single condition based on the value of bits, bytes, words or double words in the FSUIPC4 IPC

interface. These values are addressed by an “offset” value in hexadecimal and include just about anything you can think of about what is happening in FS.

Just taking some examples, you can make conditions based on:

- Whether the aircraft is airborne or on the ground
- Whether the engines are running
- Whether one or more of specific lights are switched on or off
- Whether the gear is up or down
- Even whether there are valid radio signals for NAV1, NAV2, GS, ILS LOC

... and so on. The possibilities are endless!

To make good use of this you will need the Programmer’s Guide, which lists all of the offsets. This document is in the FSUIPC4 SDK. You’ll find a lot of data in there that you cannot make use of—the conditions here deal with bits or values in 8-bit bytes, 126-bit words and 32-bit “double words”. You cannot make use of string values, tables of floating point values.

You add an offset condition to any Key or Button parameter line in FSUIPC4.INI as follows:

```
<sequence number>=<offset condition> <usual parameter>
```

The space between the new condition and the normal parameter is essential.

A simple example will help. Take this button push parameter, designed to toggle the landing gear when the button is pushed:

```
1=P1,0,C65570,0
```

By adding an offset condition we can stop this doing anything when the aircraft is on the ground:

```
1=W0366=0 P1,0,C65570,0
```

The inserted part, “W0366=0” specify that the Word (16-bit or 2-byte value) at offset 0366 must be zero for this line to be obeyed. Offset 0366 contains 0 when the aircraft is airborne, 1 when it is on the ground.

The format of the condition is:

```
<size><offset><mask><condition>
```

where

<size> is B for Byte, W for Word or D for Double Word,

<offset> is the FSUIPC offset, an hexadecimal value between 0000 and FFFF,

<mask> is optional, and if given selects one of more bits: specify as &x where ‘x’ is the 8, 16 or 32-bit mask in hexadecimal. The value in the offset is “ANDed” with this mask before being used,

<condition> is one of:

=value for equality

!value for inequality

<value for less than

>value for greater than

and the “value” here is *decimal* unless preceded by an x (or X) in which case it is *hexadecimal* like the offset and mask. FSUIPC will output hexadecimal where a mask is used, otherwise decimal. All values are treated as unsigned.

The optional mask facility is useful for testing specific bits, as in the case of the light switches in offset 0D0C or the radio reception details in offset 3300. For example, the offset condition:

```
W3300&0040!0
```

is TRUE when the currently tuned NAV1 is for an ILS.

The <condition> part is optional too, defaulting to !0 when omitted, so this last example could be abbreviated to:

W3300&0040

For Project Magenta users who sometimes use the default FS autopilot instead one very useful condition is simply:

W0500

Offset 0500 is non-zero when PM's MCP is running, zero otherwise, so you can program buttons and keys to operate PM when it is running, but FS otherwise.

Finally, for clever switching you may want to consider using one button to adjust an FSUIPC4 offset value which then, via offset conditions, selects between a number of alternative button and/or key assignments. To assist in this, offsets 66C0 to 66FF are reserved purely for you to do with as you like. The offset cyclic increment/decrement controls allow, say, a byte value in offset 66C0 to cycle through a number of values, then each value selects particular actions for defined keys or buttons. The entries in Buttons or Keys might look like this:

```
31=P174,10,Cx510066C0,x00030001
32=B66C0=0 P117,6,C1030,0
33=B66C0=1 P117,6,C1034,0
34=B66C0=2 P117,6,C1038,0
35=B66C0=3 P117,6,C1042,0
```

Here the value in the Byte at offset 66C0 is cycled from 0-3, and back to 0, by button 174,10, and this value, in turn, selects what happens with button 117,6.

These are real examples related to programming of a Go-Flight GF45 unit for different frequency adjustments. Many fuller examples of all this will appear in the documentation for my GFdisplay program, due shortly. GFdisplay brings my support for GF devices to a completion with display handling to complement the button programming in FSUIPC4.

#### **FOR FURTHER STUDY AND BETTER EXAMPLES**

Additional interesting and useful examples of button programming are provided in an Appendix to this current document. That Appendix was graciously contributed by an enthusiastic FSUIPC user, to whom I am most grateful.

## ERRORS IN BUTTON PARAMETERS

When the [Buttons] sections are read (or re-read via the “Reload” button in the FSUIPC4 Buttons page), the lines are thoroughly checked. Any that are syntactically wrong are ignored. However, where a line is ignored, an error message is appended in the form:

... << ERROR n ...

The error numbers possible here are listed below. You can then correct the line and press “Reload” again to re-check it. You don’t have to erase the << ERROR ... additions. If the line is now okay, that message will be erased for you. If it is still in error a new error number may appear.

The errors are:

- 1 Offset condition: no hexadecimal offset following the size (B, W or D)
- 2 Offset condition: the offset is too big (more than 4 hex digits)
- 3 Offset condition: the ‘&mask’ part has no hexadecimal mask
- 4 Offset condition: the mask is too big (more than 8 hex digits)
- 5 Offset condition: condition not recognised (not =, !, <, > or space representing !0)
- 6 Offset condition: comparison value X for hex, not followed by hex value
- 7 Offset condition: comparison value X for hex, too big (more than 8 hex digits)
- 8 Offset condition: no decimal or Xhex value after =, !, < or >.
- 9 Button operation not specified as H, P, R, U or C
- 10 Conditional button operation, no P, R or U after the C
- 11 Too many (...) button conditions
- 12 Condition joystick number too big
- 13 Button number omitted in condition (the ,b in (j,b))
- 14 No matching ) found for ( condition
- 15 Button number cannot be > 31 in condition
- 16 Main button joystick number is too big
- 17 Main button number is greater than 39
- 18 Comma (,) missing after main button number
- 19 The C.r Kor M needed for Control, Key or Macro is missing
- 20 Unknown formatting, syntax unintelligible

## Keyboard Programming

FSUIPC4's options dialogue provides a page for programming keypresses to assign specific single FS controls. Here we look at how this programming is encoded in the FSUIPC4.INI file, and how the programming can be extended to provide multiple controls for a single keystroke combination.

### FORMAT OF KEY DEFINITIONS

The key programming is saved in sections in the INI file. For globally operative keys this is called [Keys]. For aircraft-specific buttons it is [Keys.<aircraft name>]. Up to 1024 separate entries defining key actions can be included in each section, normally numbered sequentially from 0, provided that the total of the definitions in the Global section and the largest aircraft-specific section is not greater than 1024.

As with the Button parameters, Key press entries are reloaded each time you change aircraft in Flight Sim, so you can make changes in the INI file and test them without reloading FS.

If the [General] parameter **ShortAircraftNameOk** is set to **Yes** or **Substring**, the <aircraft name> part of the section heading can be abbreviated (manually, by editing the INI file) so that it applies to more than one aircraft. With the 'Yes' option, FSUIPC4 will automatically select the section with the *longest* match. The ordering of sections in the INI file is not relevant. However, with the 'Substring' option it will select the first section with a substring match – there's no concept of "longest match" in this case.

The format of each entry in the Keys section is as follows:

n=key,shifts,control,parameter

for a key press action only, or

n=key,shifts,control1,parameter1,control2,parameter2

for a key with press (1) and release (2) actions.

Here n can run from 0 to 1023 (i.e. maximum 1024 different keystroke actions can be added),

key virtual keycode, as in the FS CFG file (see list above, in the section about Buttons).

**Note:** If the key press automatic repeats are to be ignored, this code is preceded by the letter 'N'.

shifts 8 normal

+1 shift

+2 control

+4 alt (not really very useful)

+16 tab (an added "shift" to give more combinations)

+32 Windows key (left or right)

+64 Menu key (the application key, to the right of the right Windows key)

*[Note that the Tab and Alt keys are denoted by opposite bits here than when used for button programming. Apologies for this, which was a design oversight now too late to change]*

control This is normally an FS control number (as in my lists), or a special FSUIPC4 number for additional controls. It can be in decimal, or, preceded by 'x' in hexadecimal. The additional FSUIPC4 controls range from 1000 to 3000, and also values xcc00zzzz in hexadecimal which encode the FSUIPC "Offset" controls. See list below for full details.

Alternatively, it can be a Macro reference, in which case it takes the form:

M<file#>:<ref#>

For example M3:4 would refer to macro file 3, macro number 4 in that file. Please see the section on macros for more details.

It can also be a Lua plug-in reference:

L<file#>:<action>

Where the File number refers to the [LuaFiles] list in the INI, and the action is one of these letters:

R=Run, K=Kill, S=Set, C=Clear, T=Toggle, D=Debug

parameter value to go with control, for "SET" types and some special FSUIPC controls. This also is normally in decimal, but can be in hexadecimal preceded by 'x'.

You can do all of this programming directly in the FSUIPC4 "Keys" page whilst in FS. In fact it is better to do it there, so you can test it out directly. Note that some of the listed FS controls either do not work, or do not do as you might suppose! And some seem to be mixed up—for instance the "Zoom Out" and "Zoom In" controls appear to be switched, even though the Fine variants of these are okay.

There are two reasons you may want to edit the details in the INI file. The first is to make a single button press operate more than one control. You can specify such actions here, merely by adding the appropriate parameter lines. The controls will be sent in the order of the parameter entries (i.e. the 'n' in "n= ..."). You can view all these, and delete them, in the Keys page on-line, but you cannot edit any other than the first such assignment for that key press.

The second reason is to add FSUIPC4 offset conditions. The facilities for making Button presses conditional upon assorted FS internals all apply to Key programming too, and the format and other details are the same as for Buttons. Please refer to the section above entitled "adding Offset Conditions".

## ERRORS IN KEY PARAMETERS

When the [Keys] sections are read (or re-read via the "Reload" button in the FSUIPC4 Keys page), the lines are thoroughly checked. Any that are syntactically wrong are ignored. However, where a line is ignored, an error message is appended in the form:

... << ERROR n ...

The error numbers possible here are listed below. You can then correct the line and press "Reload" again to re-check it. You don't have to erase the << ERROR ... additions. If the line is now okay, that message will be erased for you. If it is still in error a new error number may appear.

The errors are:

- 1 Offset condition: no hexadecimal offset following the size (B, W or D)
- 2 Offset condition: the offset is too big (more than 4 hex digits)
- 3 Offset condition: the '&mask' part has no hexadecimal mask
- 4 Offset condition: the mask is too big (more than 8 hex digits)
- 5 Offset condition: condition not recognised (not =, !, <, > or space representing !0)
- 6 Offset condition: comparison value X for hex, not followed by hex value
- 7 Offset condition: comparison value X for hex, too big (more than 8 hex digits)
- 8 Offset condition: no decimal or Xhex value after =, !, < or >.
- 20 Unknown formatting, syntax unintelligible
- 21 Virtual key number not in range 1–255
- 22 No comma (,) after key number
- 23 No comma (,) after shift code value
- 24 Bad control value

## Additional "FS" Controls added by FSUIPC4

All the true FS controls are represented by numbers above 65536. They are listed in my FS-version specific documents called "FSxxxx Controls ...". FSUIPC has augmented these with its own set, programmable for both Button and Keys, and these utilise lower numbers, currently in the 1000–3000 range. These are:

- |      |   |
|------|---|
| 1001 | PTT on (for Squawkbox 3, Roger Wilco or AVC Advanced Voice Client)    |
| 1002 | PTT off (for Squawkbox 3, Roger Wilco or AVC Advanced Voice Client)   |
| 1003 | Set button flag (param = 256*joy + btn or JjBb)                       |
| 1004 | Clear button flag (param = 256*joy + btn or JjBb)                     |
| 1005 | Toggle button flag (param = 256*joy + btn or JjBb)                    |
| 1006 | KeySend to WideClients (param = KeySend number, 1–255)                |
| 1007 | Autobrake Set (param=0 for RTO, 1=off, 2-5 for 1,2,3,Max)             |
| 1008 | Traffic Density Set (param = 0–100 %)                                 |
| 1009 | Traffic Density Toggle (param = 0–100 %)                              |
| 1010 | Spoiler inc (by 512 or amount set in SpoilerIncrement= INI parameter) |
| 1011 | Spoiler dec (by 512 or amount set in SpoilerIncrement= INI parameter) |
| 1012 | ---   |
| 1013 | ---   |
| 1014 | ---   |
| 1015 | ---   |

1016	Ap Alt Var Dec Fast (-1000)
1017	Ap Alt Var Inc Fast (+1000)
1018	Ap Mach Var Dec Fast (-.10)
1019	Ap Mach Var Inc Fast (+.10)
1020	Ap Spd Var Dec Fast (-10)
1021	Ap Spd Var Inc Fast (+10)
1022	Ap Vs Var Dec Fast (-1000)
1023	Ap Vs Var Inc Fast (+1000)
1024	Heading Bug Dec Fast (-10)
1025	Heading Bug Inc Fast (+10)
1026	Vor1 Obi Dec Fast (-10)
1027	Vor1 Obi Inc Fast (+10)
1028	Vor2 Obi Dec Fast (-10)
1029	Vor2 Obi Inc Fast (+10)
1030	Com1 use whole inc
1031	Com1 use whole dec
1032	Com1 use frac inc
1033	Com1 use frac dec
1034	Com2 use whole inc
1035	Com2 use whole dec
1036	Com2 use frac inc
1037	Com2 use frac dec
1038	Nav1 use whole inc
1039	Nav1 use whole dec
1040	Nav1 use frac inc
1041	Nav1 use frac dec
1042	Nav2 use whole inc
1043	Nav2 use whole dec
1044	Nav2 use frac inc
1045	Nav2 use frac dec
1046	Adf1 use whole inc
1047	Adf1 use whole dec
1048	Adf1 use frac inc
1049	Adf1 use frac dec
1050	Adf2 use whole inc
1051	Adf2 use whole dec
1052	Adf2 use frac inc
1053	Adf2 use frac dec
1054	Xpndr low NN dec
1055	Xpndr low NN inc
1056	Xpndr high NN dec
1057	Xpndr high NN inc
1058	Freeze pos on
1059	Freeze pos off
1060	Freeze pos toggle
1061	Engine 1 Autostart
1062	Engine 2 Autostart
1063	Engine 3 Autostart
1064	Engine 4 Autostart
1065	Throttles off
1066	Throttles on
1067	Throttles toggle
1068	PVT voice transmit on (for Squawkbox 3.0.4 or later)
1069	PVT voice transmit off (for Squawkbox 3.0.4 or later)
1070	Key Press and Release (param is Keycode + 256*Shift code, or JsBk)
1071	Key Press/Hold (param is Keycode + 256*Shift code, or JsBk)
1072	Key Release (param is Keycode + 256*Shift code, or JsBk)
1073	FSUIPC4 display window toggle
1074	Airline traffic density set
1075	GA traffic density set
1076	Shipping traffic density set
1077	Cloud cover density set
1078	Simple/complex clouds set
1079	Traffic zapper
1080	Wheel trim toggle (for mousewheel trim adjusting)
1081	Wheel trim faster
1082	Wheel trim slower

1083 Wheel trim speed toggle  
1084 Lua Kill All  
1085 Traffic Zapall  
1086 FollowMe please (i.e. request) (needs FollowMe 2)  
1087 FollowMe cancel (needs FollowMe 2)  
1088 FollowMe continue (needs FollowMe 2)  
1089 AutoDeleteAI toggle  
1090 AutoDeleteAI on  
1091 AutoDeleteAI off  
1092 Re-SimConnect (re-initialises SimConnect interface)  
1093 Efis ND scale inc (default B738 and A321)  
1094 Efis ND scale dec (default B738 and A321)  
1095 Efis ND mode inc (default B738 and A321)  
1096 Efis ND mode dec (default B738 and A321)  
1097 Efis ND map item inc (default B738 and A321)  
1098 Efis ND map item dec (default B738 and A321)  
1099 Efis VORADF1 inc (default B738 and A321)  
1100 Efis VORADF1 dec (default B738 and A321)  
1101 Efis VORADF2 inc (default B738 and A321)  
1102 Efis VORADF2 dec (default B738 and A321)  
1103 Efis 738 ND centre (default B738)  
1104 Efis 738 ND arc (default B738)  
1105 Efis A321 InHg/hPA toggle (default A321)  
1106 Efis A321 ILS mode toggle (default A321)  
1107 AP alt change rate toggle (default A321)  
1108 Efis ND scale set (parameter 0–7 for 738, 0–5 for A321) (default B738 and A321)  
1109 Efis ND mode set (parameter 0–2 for 738, 0–3 for A321) (default B738 and A321)  
1110 Efis ND map item set (parameter 0–3) (default B738 and A321)  
1111 Efis VORADF1 set (parameter 0–2) (default B738 and A321)  
1112 Efis VORADF2 set (parameter 0–2) (default B738 and A321)  
1113 Efis A321 InHg/hPA set (parameter 0–1) (A321)  
1114 List local panel variables (“L.vars”) in log when change aircraft  
1115 IYP Listen On  
1116 IYP Listen Off  
1117 IYP ComeFly Active  
1118 IYP ComeFly Inactive  
1930 FSUIPC bank hold off  
1931 FSUIPC bank hold on  
1932 FSUIPC bank hold set  
1933 FSUIPC bank hold toggle  
1934 FSUIPC mach hold off  
1935 FSUIPC mach hold on  
1936 FSUIPC mach hold set  
1937 FSUIPC mach hold toggle  
1938 FSUIPC pitch hold off  
1939 FSUIPC pitch hold on  
1940 FSUIPC pitch hold set  
1941 FSUIPC pitch hold toggle  
1942 FSUIPC speed hold off  
1943 FSUIPC speed hold on  
1944 FSUIPC speed hold set  
1945 FSUIPC speed hold toggle  
2010 PM MCP SPD push on B747  
2011 PM MCP HDG sel on B747  
2012 PM MCP ALT push on B747  
2013 –  
2014 –  
2015 –  
2016 –  
2017 PM MCP FD2 off  
2018 PM MCP FD2 on  
2019 PM MCP A/T on  
2020 PM MCP A/T off  
2021 PM MCP THR mode button

2022	PM MCP SPD mode button
2023	PM MCP Mach/IAS sel
2024	PM MCP FLCH mode button
2025	PM MCP HDG mode button
2026	PM MCP VNAV mode button
2027	PM MCP LNAV mode button
2028	PM MCP LOC mode button
2029	PM MCP APP mode button
2030	PM MCP ALT mode button
2031	PM MCP VS mode button
2032	PM MCP AP1 (L) button
2033	PM MCP AP2 (C) button
2034	–
2035	–
2036	PM MCP AP3 (R) button
2037	PM MCP FD1 off
2038	PM MCP FD1 on
2039	–
2040	PM MCP AP Disc (not 747)
2041	PM MCP AP Eng (not 747)
2042	PM MCP AP Disc (747 only)
2043	–
2044	–
2045	–
2046	–
2047	–
2048	–
2049	PM AB LS button
2050	PM AB STD QNH rel (push)
2051	PM AB STD QNH set (pull)
2052	PM AB SPD button push
2053	PM AB SPD button pull
2054	PM AB HDG button push
2055	PM AB HDG button pull
2056	PM AB ALT button push
2057	PM AB ALT button pull
2058	PM AB VS button push
2059	PM AB VS button pull
2060	PM AB EXPED button
2061	PM AB TRKFPA button
2062	–
2063	–
2064	PM PFD Decision Ht Dec
2065	PM PFD Decision Ht Inc
2066	PM MCP Hdg Dec 1
2067	PM MCP Hdg Inc 1
2068	PM MCP Hdg Dec 10
2069	PM MCP Hdg Inc 10
2070	PM MCP Alt Dec 100
2071	PM MCP Alt Inc 100
2072	PM MCP Alt Dec 1000
2073	PM MCP Alt Inc 1000
2074	PM MCP Spd Dec 1/.01
2075	PM MCP Spd Inc 1/.01
2076	PM MCP Spd Dec 10/.10
2077	PM MCP Spd Inc 10/.10
2078	PM MCP V/S Dec 100
2079	PM MCP V/S Inc 100
2080	PM MCP Crs Dec 1
2081	PM MCP Crs Inc 1
2082	PM QNH Dec 0.01/1
2083	PM QNH Inc 0.01/1
2084	PM ND Range Dec
2085	PM ND Range Inc
2086	PM ND Mode Dec
2087	PM ND Mode Inc
2088	PM ND2 Range Dec

2089	PM ND2 Range Inc
2090	PM ND2 Mode Dec
2091	PM ND2 Mode Inc
2092	–
2093	–
2094	–
2095	–
2096	PM AB ND ILS Mode
2097	PM ND Map Arc Mode
2098	PM ND Map Ctr Mode
2099	PM ND Rose Mode
2100	PM ND Map Plan Mode
2101	PM ND Range 10
2102	PM ND Range 20
2103	PM ND Range 40
2104	PM ND Range 80
2105	PM ND Range 160
2106	PM ND Range 320
2107	PM ND Range 640
2108	PM ND VOR display
2109	PM ND NDB display
2110	PM ND WPT display
2111	PM ND ARPT display
2112	PM ND DATA display
2113	PM ND POS display
2114	PM AB ND VOR1 on
2115	PM AB ND ADF1 on
2116	PM AB ND VORADF1 off
2117	PM AB ND VOR2 on
2118	PM AB ND ADF2 on
2119	PM AB ND VORADF2 off
2120	PM AB ND Metric
2121	PM AB ND HDGVS/TRKFPA
2122	PM AB THR TOGA
2123	PM AB THR FLX/MCT
2124	PM AB THR CLB
2125	PM AB THR IDLE
2126	PM AB THR REV IDLE
2127	PM AB THR MAX REV
2128	PM AB ND2 ILS Mode
2129	PM ND2 Map Arc Mode
2130	PM ND2 Map Ctr Mode
2131	PM ND2 Rose Mode
2132	PM ND2 Map Plan Mode
2133	PM ND2 Range 10
2134	PM ND2 Range 20
2135	PM ND2 Range 40
2136	PM ND2 Range 80
2137	PM ND2 Range 160
2138	PM ND2 Range 320
2139	PM ND2 Range 640
2140	PM ND2 VOR display
2141	PM ND2 NDB display
2142	PM ND2 WPT display
2143	PM ND2 ARPT display
2144	PM ND2 DATA display
2145	PM ND2 POS display
2146	PM AB ND2 VOR1 on
2147	PM AB ND2 ADF1 on
2148	PM AB ND2 VORADF1 off
2149	PM AB ND2 VOR2 on
2150	PM AB ND2 ADF2 on
2151	PM AB ND2 VORADF2 off
2152	PM AB ND2 Metric
2153	PM AB ND2 HDGVS/TRKFPA
2154	–
2155	–

2156	–
2157	–
2158	–
2159	–
2160	PM EICAS Show Controls
2161	PM EICAS Standby Gauge
2162	PM EICAS Page Dec
2163	PM EICAS Page Inc
2164	PM EICAS Synoptic Dec
2165	PM EICAS Synoptic Inc
2166	PM AB ND ILS Mode
2167	PM ND Plan Wpt Dec
2168	PM ND Plan Wpt Inc
2950	PM Elec All Toggle
2951	PM Elec PFD Toggle
2952	PM Elec ND Toggle
2953	PM Elec EICAS Toggle
2955	PM Elec PFD2 Toggle
2956	PM Elec ND2 Toggle
2958	PM Elec Stdbby Toggle
2966	PM Elec All ON
2967	PM Elec PFD ON
2968	PM Elec ND ON
2969	PM Elec EICAS ON
2971	PM Elec PFD2 ON
2972	PM Elec ND2 ON
2974	PM Elec Stdbby ON
2982	PM Elec All OFF
2983	PM Elec PFD OFF
2984	PM Elec ND OFF
2985	PM Elec EICAS OFF
2987	PM Elec PFD2 OFF
2988	PM Elec ND2 OFF
2990	PM Elec Stdbby OFF"
2994	PM Whazzup keys (by Param), see PM offsets list, 542E
2995	PM Quickmap keys (by Param), see PM offsets list, 542C
2996	PM GC keys (by Param), see PM offsets list, 542A
2997	PM CDU keys (by Param), see PM offsets list, 5428

Note: all the "Keys" inputs to PM modules provide efficient ways of directing specific keypresses to them, wherever they may be on the Network. The parameter in these is the keystroke code (see the list earlier in this document) , plus specific PM-defined values for shifts, thus:

256 for Shift, 512 for Ctrl, 1024 for Alt.

You don't need to worry about changing other bits when two codes are the same—FSUIPC takes care of that automatically.

## PM MCP Kcodes (by Param), see Pm offsets list, 04F2

This way of controlling the PM MCP may offer some features not found elsewhere. The parameter is the number used in the Elan Informatique “Knnn” codes normally sent to the MCP via a serial connection. Here is a list of those known at present, but please refer to the PM offsets document for up-to-date information:

10 SPDP (SPD pushbutton 747 MCP, Speed Intervention on B737 MCP)	52 OFF1
11 HDGP (heading SEL pushbutton 747 MCP, use 25 for HDG HOLD, use 25 for HDG SEL on the 737)	53 VOR2
12 ALTP (ALT pushbutton 747 MCP, Altitude Intervention on 737 MCP)	54 ADF2
17 FDN (switch on First Officer's FD)	55 OFF2
18 FDF (switch off First Officer's FD)	62 IN
19 ATON (switch on)	63 HPA
20 ATFF (switch off)	64 setDH
21 THR	65 setMDA
22 SPD	66 APP ND
23 MACH	67 VOR ND
24 FLCH	68 MAP ND
25 HDG K025	69 PLN ND
26 VNAV K026	70 VOR
27 LNAV K027	72 OFF1
28 LOC K028	73 VOR2
29 APP K029	74 ADF2
30 ALT K030	75 OFF2
31 VS K031	80 STA
32 AP1 K032	81 WXR
33 AP2 K033	99 DISC (747 disconnect)
34 CWSA K034	144 FPV Copilot
35 CWSB K035	145 MTRS Copilot
36 AP3 K036	147 TFC (Copilot TCAS)
37 FDN K037 (switch on Captain's FD)	148 RST Copilot RST
38 FDF K038 (switch off Captain's FD)	149 STD Copilot STD
40 APDI (AP Disengage - not used in 747-400 MCP)	170 VOR1 F/O
41 APEN (AP Engage - not used in 747-400 MCP)	171 ADF1 F/O
44 FPV	172 OFF1 F/O
45 MTRS	173 VOR2 F/O
46 CTR ND	174 ADF2 F/O
47 TFC (TCAS)	175 OFF2 F/O
48 RST	
49 STD	
50 VOR1	
51 ADF1	

Project Magenta GC Controls. Param specifies action, as shown below (list from Project Magenta "Offsets" publication, with permission). [Add 100 for First Officer GC, else Captain side assumed.]

Airbus	76 VORADFR OFF
1 MAP (Captain Side, 101 F/O side)	77 ADFR ON
2 NAV (Captain Side, 102 F/O side)	78 VORR ON
3 VOR (Captain Side, 103 F/O side)	80 Terrain Display On
4 PLAN (Captain Side, 104 F/O side)	81 Terrain Display Off
5 ILS Mode	82 Toggle Terrain Display
	83 Terrain Type Change
Boeing 'Classic Modes'	84 Terrain Colour/Mode Change
1 MAP ARC	85 Terrain Size Change
2 MAP CTR	86 Terrain 3D
3 VOR	90 STA
4 MAP PLAN	91 VOR
	92 NDB
New ND Modes (!)	93 WPT
1 MAP	94 ARPT
3 VOR	95 DATA
4 PLN	96 POS
5 APP	
6 CTR Pushbutton	321 Decr Synoptic/System Display Page
7 Force display to 8 Modes (APP/VOR/MAP/PLN)	322 Incr Synoptic/System Display Page
	(Boeing)
8 Show Controls in EICAS/ECAM	Secondary EICAS pages and functions 747 (777)
9 Hide Controls in EICAS/ECAM	301 ENG
10 PFD/ND->PFD->ND (like F4,F1,F2 in GC)	302 STAT
11 PFD/EICAS	303 ELEC
12 EICAS with Standby	304 FUEL (777: HYD)
13 EICAS without Standby	305 ECS (777: FUEL)
14 FPV (Boeing)	306 HYD (777: AIR)
15 EICAS/ND	307 DRS (777: DOORS)
19 Toggle Controls in EICAS/ECAM	308 GEAR
20 Incr Engine Page	309 --- (777: FCTL)
21 Decr Engine Page	310 CANC
22 Toggle No Smoking	311 RCL
23 Toggle Seatbelts	
24 Toggle Overview Page	(Boeing)
25 Toggle RMI/HSI display in Boeing-Type ND MAP ARC	401 Caution On (see 0x4FE)
26 Metric Toggle	402 Caution Reset
28/29 ND Mode INC/DEC for Airbus	
30 Engine Page (Primary) 0	411 Show FuelUsed Toggle
31 Engine Page 1	412 ShowFuelUsed On
32 Engine Page 2	413 ShowFuelUsed Of
..	414 Reset FuelUsed = 0
39 Engine Page 9 (if defined)	(Both)
40 Range 5 NM	421 Toggle No Smoking
41 Range 10 NM	422 No Smoking On
42 Range 20 NM	423 No Smoking Off
43 Range 40 NM	424 Toggle Seatbelts
44 Range 80 NM	425 Seatbelts On
45 Range 160 NM	426 Seatbelts OFF
46 Range 320 NM	
47 Range 640 NM	(Airbus)
48 Range DEC	Secondary EICAS pages and functions AB
49 Range INC	301 ENG
50 TCAS Off	302 BLEED
51 TCAS Alt	303 PRESS
52 TCAS Callsign	304 ELEC
53 TCAS All	305 HYD
54 Toggle TCAS Off/Alt	306 FUEL
55 Show MCP Values in EICAS (Boeing)	307 APU
56 Hide MCP Values in EICAS (Boeing)	308 COND
57 PLAN mode next waypoint	310 DOOR
58 PLAN mode previous waypoint	311 WHEEL
60 Show Overview Page in ND	312 F/CTL
61 Hide Overview Page in ND	313 ALL
62 Set/Reset Timer (AB Glass Cockpit)	314 CLR
70 Show WXR	315 STS
71 Hide WXR	316 RCL
72 Toggle WXR	317 CLR
73 VORADFL OFF	318 EL/DC (A330/340)
74 ADFL ON	319 C/B (A330/340)
75 VORL ON	

x0100zzzz	Offset Byte Set (offset = zzzz), hexadecimal
x0200zzzz	Offset Word Set (offset = zzzz), hexadecimal
x0300zzzz	Offset Dword Set (offset = zzzz), hexadecimal
x0500zzzz	Offset Byte Setbits (offset = zzzz), hexadecimal
x0600zzzz	Offset Word Setbits (offset = zzzz), hexadecimal
x0700zzzz	Offset Dword Setbits (offset = zzzz), hexadecimal
x0900zzzz	Offset Byte Clrbits (offset = zzzz), hexadecimal
x0A00zzzz	Offset Word Clrbits (offset = zzzz), hexadecimal
x0B00zzzz	Offset Dword Clrbits (offset = zzzz), hexadecimal
x0D00zzzz	Offset Byte Togglebits (offset = zzzz), hexadecimal
x0E00zzzz	Offset Word Togglebits (offset = zzzz), hexadecimal
x0F00zzzz	Offset Dword Togglebits (offset = zzzz), hexadecimal
x1100zzzz	Offset UByte Increment (offset = zzzz), hexadecimal *
x1200zzzz	Offset UWord Increment (offset = zzzz), hexadecimal *
x2100zzzz	Offset UByte Decrement (offset = zzzz), hexadecimal *
x2200zzzz	Offset UWord Decrement (offset = zzzz), hexadecimal *
x3100zzzz	Offset SByte Increment (offset = zzzz), hexadecimal *
x3200zzzz	Offset SWord Increment (offset = zzzz), hexadecimal *
x4100zzzz	Offset SByte Decrement (offset = zzzz), hexadecimal *
x4200zzzz	Offset SWord Decrement (offset = zzzz), hexadecimal *
x5100zzzz	Offset Byte Cyclic Increment (offset = zzzz), hexadecimal *
x5200zzzz	Offset Word Cyclic Increment (offset = zzzz), hexadecimal *
x6100zzzz	Offset Byte Cyclic Decrement (offset = zzzz), hexadecimal *
x6200zzzz	Offset Word Cyclic Decrement (offset = zzzz), hexadecimal *
x7000zzzz	Offset Float32 Set/1000 (offset = zzzz): the parameter is divided by 1000
x7400zzzz	Offset Float64 Set/1000 (offset = zzzz): the parameter is divided by 1000
x7800zzzz	Offset Float32 Inc/1000 (offset = zzzz): the parameter is divided by 1000
x7C00zzzz	Offset Float64 Inc/1000 (offset = zzzz): the parameter is divided by 1000 (For “decrements” use a negative parameter in the increment controls)

\* The fixed point increment/decrement values operate on Unsigned (U) or Signed (S) values, and have a parameter with the unsigned or signed limit in the upper 16 bits and the increment/decrement amount (always unsigned) in the lower 16 bits.

## Macro Controls

FSUIPC4 will read any file in the Modules folder which has file type “micro”. Such files contain definitions of additional controls to be listed and assignable in FSUIPC4’s Keys, Buttons and Axis Assignments dialogues. All macro files are also re-read and re-installed whenever the Reload button in any of those three dialogues are used.

It is important that the file name (xxxx.micro) be unique in the first 16 characters, as this will be used as part of the name of the added controls in the drop-downs. Best to keep the names short and to the point—probably the name of the program or program function for which the controls are being added.

Inside a macro file there should be just one section called [Macros]. This must contain definitions of numbered controls, with names also up to 16 characters. These names only have to be unique in that file.

Here is an example, here for a possible Project Magenta glass cockpit ND Mode switch:

```
[Macros]
1=MAP Capt=C2999,1
2=NAV Capt=C2999,2
3=VOR Capt=C2999,3
4=PLN Capt=C2999,4
5=APP Capt=C2999,5
6=CTR Capt=C2999,6
101=MAP F/O=C2999,101
102=NAV F/O=C2999,102
103=VOR F/O=C2999,103
104=PLN F/O=C2999,104
105=APP F/O=C2999,105
106=CTR F/O=C2999,106
```

Note that the numbers on the left do not have to be contiguous, but must be in the range 1–999 inclusive. These will be used internally, and in the FSUIPC4 INI file, to identify the control within the file.

Supposing the example above occurred in a file called 'PM GC.micro'. The names which would then appear, in proper alpha sequence in the FSUIPC4 drop-downs, would be:

```
PM GC: APP Capt
PM GC: APP F/O
PM GC: CTR Capt
PM GC: CTR F/O
PM GC: MAP Capt
PM GC: MAP F/O
PM GC: PLN Capt
PM GC: PLN F/O
PM GC: VOR Capt
PM GC: VOR F/O
```

The value assigned to each control is either another control (*any* FS or FSUIPC-added control, including offset controls and even macro controls—see later), or a Keypress. i.e:

Either: Cn,p (control number, parameter, optionally in hex with a preceding x)

Or: Kk,s (keycode and shifts).

Both of these are exactly as already defined for Button controls—see the earlier section on Button programming.

## Macro Control References

Macro controls are represented internally in the same sort of way as FSUIPC offsets controls, by using high-value bits in the control number. However, the representation in Macro files and in the INI file is as follows:

```
Mm:n
```

where m is the Macro File number (see below) and n is the control number from the file, as described above.

Macro file numbers are assigned by FSUIPC when it loads the file. These are remembered in the INI file in a new section [MacroFiles]. For example, in the above case you might get:

```
[MacroFiles]
1=PM GC
```

making "PM GC.micro" file number 1 for all reference purposes.

It is important to note that different users will have a different selection of macro files in different orders. If they wish to exchange Button assignments they will need to re-assign all macro controls after making their [MacroFiles] sections the same, or at least the same for those files they have in common.

## Multiple actions in one macro control

A macro control is not limited to having only one resulting action. If more than one action is required several lines are used in the definition, as follows:

```
n=<name>
n.1=action1
n.2=action2
etc.
```

For an example consider a 'Menu.micro' file containing these definitions:

```
[Macros]
1=Display
1.1=K79,16 ;O
1.2=K69,8 ;E
1.3=K68,8 ;D
2=FSUIPC
2.1=K68,16 ;Alt D
2.2=K70,8 ;F
```

This adds two controls, ‘Menu: Display’ and ‘Menu: FSUIPC’. The first uses ALT+O E D keystrokes to call up the FS display settings dialogue, the second uses ALT+D F to call up the FSUIPC4 options.

Note that there’s a limit of 2000 numbered parameters in total in the macro file—so, for instance, 999 macro numbers (1–999, the maximum) with an average of two actions each would be just two shy of the limit. Large files aren’t good in any case as the drop-down list will be full of the added controls all beginning with the same filename. Best to split into functional groups with meaningful filenames, to make the controls easier to locate.

## Parameter passing

Normally, and certainly in all the above examples, any parameter set for a Macro Control, when assigned in the Buttons or Keys dialogues, would be discarded as not relevant. However, there is a facility to allow it to be used.

If the parameter part of *any* of the controls defined in the macro is omitted, the parameter value from the *calling* macro is substituted.

As a rather silly example, if you wanted a general PM GC control but not the one named already in FSUIPC, you could define it as

```
7=by param=C2999
```

This would appear in the drop-downs as ‘PM GC:by param’, and the parameter assigned by the user would be used in the C2999 operation. Note that in multiple-line definitions, the same parameter value substitutes for every omitted parameter value.

One interesting consequence of this is the possibility of defining axis controls. To make another silly example, if I define a macro like this:

```
8=Flaps=C66534 ;FS control 66534 is Axis Flaps Set
```

and then assign it to an axis in the Axis assignments dropdown, the axis I’ve assigned will operate exactly as the Axis Flaps Set axis.

This may not seem so futile when you realise that you can have multiple line mixtures of controls and keypresses also produced by the same Macro. I’m sure there would be wealth of ideas for using this ‘feature’ (which actually fell out of the implementation by accident rather than by design!).

## Mouse macros

Another feature of Macro files is their ability to add controls to your armoury which operate switches, dials and other features of FS panels and gauges (mostly add-on ones) which can otherwise only be operated by using the mouse. Furthermore, this facility can actually be used even without recourse to manually preparing the macro files directly—that part is semi-automated via Mouse Macro buttons in both the Buttons and Keys option tabs in FSUIPC. Details of the automatic facilities are provided in the main User Guide. Here we just concentrate on the file itself, the format of the mouse macro lines.

Note that a single Macro file can contain any mixture of mouse and other macros. In fact Mouse, Control and Keypress actions can all be mixed and combined in a single Macro. Of course, this doesn’t happen for the automatically generated macros.

This mouse facility adds the rather obscure format:

```
R<module>:<rect#>,<mouseflag>
```

to those already described for Keys (K), Controls (C) and onward Macro references (M). The ‘R’ here is for mouse **R**ectangle, because it is via specific rectangular areas on screen that FS recognises mouse requests. An ‘M’ for Mouse would have been better, but that’s already used for Macro.

Now I’ll explain what the values in this specification actually mean, but in general no user will actually be concerned with them, as they either have to be supplied by the gauge maker (the add-on panel supplier), or, more usually, be generated automatically for you by FSUIPC, through use of the Mouse itself in mouse macro creation mode.

So, in the mouse action specification:

**<module>**: is optional. It is a reference to the Gauge or DLL filename, the part of the panel which will be asked to process the Mouse action. It is a numerical reference to another line which must also be present somewhere in the [Macros] section of the .MCRO file, one like this:

```
ModuleN="name of gauge or DLL"
```

where 'N' can run from 1 to 99, or be omitted (so giving "Module="...").

If the <module>: part of the mouse action is omitted, the Module being referenced is the one with no number. Otherwise it is simply N:, referring directly to the module.

The **<rect#>** part is the only mandatory part. It is either a reference to the "MouseRect" number in the tables in the Module—as "Rn" referring to the nth rectangle, counting from 0—or a direct reference to the Mouse Function inside the module, as "RXxxxx\*xxxx", where the 'xxxx' parts refer to a hexadecimal offset and check-word, respectively. The offset is from the Module's load address in memory, and the check word are the 16 bits around the mouse function's entry point: 8 bits before and 8 bits after. The check-word is a safety measure, in case the macro is used on a different version of the same Gauge or DLL.

Finally, the **<mouseflag>** part provides the actual mouse action required to operate the facility. This is encoded as a number and will sometimes be one of the following:

31	MOUSE_RIGHTSINGLE	19	MOUSE_RIGHTRELEASE *
30	MOUSE_MIDDLESINGLE	18	MOUSE_MIDDLERELEASE *
29	MOUSE_LEFTSINGLE	17	MOUSE_LEFTRELEASE *
28	MOUSE_RIGHTDOUBLE	14	MOUSE_WHEEL_UP
27	MOUSE_MIDDLEDDOUBLE	13	MOUSE_WHEEL_DOWN
26	MOUSE_LEFTDOUBLE	11	MOUSE_LEAVE *
21	MOUSE_DOWN_REPEAT		

Of these, 29 is by far the most common and is assumed when the parameter is omitted. Note that the values actually equate to the mouse flags by those names in the FS Gauge C/C++ SDK.

Those marked \* cannot be generated automatically by FSUIPC as they refer to the mouse buttons being released. However, they may be needed for some switch implementations, and you would need to add them yourself—experimentation is key here. There are examples in the main User Guide.

Just to put all this stuff into context, here are some actual examples. The first is from the FS9 PMDG737NG overhead:

```
Module="PMDG_737NG_Overhead.gau"  
1=Batt=RX3170*X8b90  
Module1="PMDG_737NG_OHD_APU.GAU"  
40=APU=R1:1
```

If these lines are in a loaded MCRO file called "737 OHD" then the Buttons and Keys controls drop-downs would list "737 OHD:Batt", which would operate the Battery switch, and "737 OHD: APU" which would operate the APU switch. These would only do anything if the overhead gauge is loaded—i.e. the aircraft is in use. Note that the Overhead gauge itself doesn't have to be visible.

Here is an extract from the Macro file for the add-on gauge/DLL "APchart":

```
Window="Airport Chart"  
Module="APchart.dll"  
1=Show/Hide=C66506,10000  
...  
7=Knob1 Down=R20,14  
8=Knob1 Up=R20,13
```

This has a non-Mouse control included to show and hide the AP chart window. That uses the "PANEL ID SET" control with the panel ID number 10000 as parameter (gleaned from the Panel.cfg file). It also has a couple of entries shown which are operated by the mouse wheel.

But note that new parameter:

```
Window="window title"
```

This needs to be present when it only makes sense to use the controls with the window both open and visible. This applies to APchart where zooming and moving the chart would be daft without seeing it. You will find Window names for panel parts in the Panel.CFG file. The automatic mouse macro generating facilities in FSUIPC never add a Window parameter, so this may be the one good reason you ever edit a MCRO file.

## Gauge local variable access (L:vars), by macro

Local named panel variables (“L:<name>”), which I’ll refer to as “**Lvars**”, can now be listed in the Log, written to via Macros, and manipulated with both reads and writes through extensions to the ipc Lua Library

The log listing is obtained for the currently loaded aircraft panels by a new assignable control in the drop-down lists called “**List local panel variables**”.

This requests FSUIPC4 to list all **Lvars** found in the FSUIPC4 log file, by L:name and current value. For example, here’s the Log listing for the default Cessna 172 with the G1000:

```
Aircraft="Cessna Skyhawk 172SP G1000"
Panel includes these local variables:
L:CDI Source Selected = 1.000000
L:time hdg bug changed = 0.000000
L:time crs changed = 0.000000
L:SelectedNav2 = 0.000000
L:SelectedCom2 = 0.000000
L:pfid HDGKnob pressed = 0.000000
L:COM1 Mic pressed = 0.000000
L:COM2 Mic pressed = 0.000000
L:NAV1 pressed = 0.000000
L:NAV2 pressed = 0.000000
L:MKR pressed = 0.000000
L:DME pressed = 0.000000
L:COM1 pressed = 0.000000
L:COM2 pressed = 0.000000
L:Reversionary pressed = 0.000000
L:map_ZoomStep = 0.000000
L:map_ZoomFactor = 0.000000
L:MapInit = 0.000000
L:LayerAirports = 0.000000
L:LayerAirspaces = 0.000000
L:LayerTerrain = 0.000000
L:LayerVORs = 0.000000
L:LayerILSs = 0.000000
L:LayerNDBs = 0.000000
L:LayerLowAirways = 0.000000
L:LayerTags = 0.000000
L:LayerCompass = 0.000000
L:LayerIntersections = 0.000000
L:LayerRangeRings = 0.000000
L:VehicleObjectDetail = 0.000000
L:Filter = 0.000000
L>LastLandingLightPosition = 0.000000
L:EmergencyThrottleInUse = 0.000000
L:Engine1ThrottlePosition = 24.404907
```

Note that all FSUIPC can do is list what it finds. Whether the values are of any use or not is questionable—they are internal to the gauge and how they are used, manipulated, and so on, will vary enormously. By all means try things if you wish, but don’t assume the solution is there waiting for you.

Some of the really useful **Lvars**, specifically those for the default B738 and A321 EFIS panels, have been given specific FSUIPC4 controls and also offsets so that they can be manipulated directly by application programs. But for the others you will need to use Macro files or Lua plug-ins, as described next..

## Macros to change Lvars

The macro facility to operate **Lvars** can only be used by editing macro files and building them manually. The format is:

```
N=L:name=ACTION
```

Where ACTION must be one of: **Set**, **Inc**, **Dec**, **Cyclic** or **Toggle** (but only the first 3 letters are needed):

- Set** copies the parameter in the Macro invocation to the identified Lvar. Alternatively, a value can be given explicitly here, by “**Set,n**”. Values are limited to the normal parameter range, –32768 to 32767.
- Inc** increments the value, and here the parameter (explicit or supplied) gives the upper limit, which can be equalled but not exceeded.
- Dec** decrements the value, with the parameter setting the lower limit.
- Cyclic** is the same as **Inc**, but after the limit is reached the next value is 0.
- Toggle** changes the value to zero if it is non-zero, or 1 if it is zero.

The multi-line macro format can still be used with the Lvar macros, as follows:

```
N=L:name
N.1=action1
N.2=action2
... etc.
```

## Lua access to Lvars

The Lua facilities are **ipc.readLvar**, **ipc.writeLvar**, **ipc.getLvarName**, and **ipc.getLvarId**. These are all described in the updated Lua library documentation, and a sample Lua plug-in is provided demonstrating their use.

## Automatic running of Macros and Lua plugins

By some editing in the INI file, you can arrange for one or more Macros or Lua plugins to be executed, in order, automatically whenever the current aircraft is changed (or, indeed, first loaded), or a specific named aircraft (or Profile) is loaded.

This allows switches, offsets, and other things to be set specifically for an aircraft (or aircraft type, for Profiles) when it is first loaded.

This is done by adding new sections to the INI file with the title{

**[Auto]**

or

**[Auto.xxxx...]**

where the **xxxx** part is the aircraft name, or part-name (as in Aircraft Specific sections), or a profile name when profiles are being used.

These Auto sections thus parallel the Keys and Buttons sections -- the naming and selection follows the same system. The generic **[Auto]** section is carried out for *all* aircraft changes whilst the specific ones are only applied to matching aircraft or profile..

Each Auto section contains a series of numbered lines (1=..., 2=... etc) each of which is either a Lua command, or a Macro call. For example:

**[Auto.737]**

**1=Lua SetMyOffsets**

**2=737 OHD:Air Allbleeds**

When Lua calls run a plug-in which doesn't self-terminate, the plug-in thread still running is killed automatically on an aircraft/profile change.

## Axis Assignments

Axis assignments are saved in the [Axes] section, or [Axes.<aircraft name>] for aircraft specific assignments. Generic aircraft assignments can be made using the same parameter and name shortening as for the Buttons and Keyboard sections.

The polling interval can be changed by a parameter

PollInterval=10

inserted into the main [Axes] section. The units are milliseconds, 10 being the default.

The format of the axis parameters in these sections is as follows:

For the main axis entry (explanation of values below):

n=ja,(R)delta(/delay)

where the parentheses merely show optional parts, and

j = joystick # (0 to 18, 16 to 18 being PFC)

a = axis (XYZRUVSTPQMN)

R is only present when "Raw" mode is selected

delta is the delta value (eg 512, or 1 for Raw mode and POVs)

/delay is an optional delay\*, in milliseconds

When axis controls are assigned (the left part of the options), this is extended by the definition of the controls:

n=ja,(R)delta(/delay),ForD,ctl1,ctl2,ctl3,ctl4

where

ForD is an F for "FS control" or D for "Direct to FSUIPC calibration"

ctl1 to ctl4 are the control numbers, or zero where unassigned. For Direct mode, these are the calibration indices, 1–4 on Page 1 of calibrations, 5–8 on page 2, etc. Numbers 45–48 are the “dual” controls, equating to others depending on whether FS is in flight mode or Slew mode.

\* FSUIPC4 can apply delays to any axis assigned through its Axis Assignment facilities. The delay is limited to a minimum of 2 x the axis polling interval (which defaults to 10 mSecs) and a maximum of 200 x this interval (i.e. 2 seconds with the default polling interval).

Delays for axes have to be edited in the INI file. There is no facility to change them or even see them in the option screens. Delays of 200 mSecs or more should be reasonably accurately maintained most of the time, but short ones could vary quite a bit, the smaller you set them, because of the granularity of the polling interval and the sharing of the processor with other things going on in FS.

Here's an example of an axis assigned to the FSUIPC4 Spoiler, with a 1 second delay:

```
0=0Y,256/1000,D,22,0,0,0
```

If the axis is programmed to send controls based on the axis passing through zones (the right side of the options), there will also be entries for each such assignment, thus:

```
n=ja,UDorB(R),low,high,ctl,param
```

where

UDorB is U for Up, D for Down or B for Both  
R optionally specifies Repeat  
low and high give the axis values for the zone  
ctl and param are the Control numbers, and Parameter where used.

Here's an example for a Gear lever:

```
1=0Z,256/500  
2=0Z,U,6400,16383,66079,0  
3=0Z,D,-16384,-13783,66080,0
```

Note that the delay option (here half a second) still goes on the main axis entry, the one defining the delta (and "Raw" mode if applicable).

You can edit the INI file whilst FS is running, then simply going to the Axis Assignment options page and clicking the reload button at the bottom of the window.

### Additional parameters to scale input axis values

Axis values assigned in FSUIPC4 can be arithmetically adjusted before being passed onto FSUIPC4 calibration (or to FS via FS controls). To do this you assign the axis as normal, then edit the FSUIPC4.INI file. Find the axis assignment there, in the relevant [Axes] section, and add one or both of these parameters to the end:

**,\*<number>** to multiply the axis value by <number>. This can be a fraction, such as 0.5 (to divide by 2), and it can be negative, to reverse the axis direction.

**,+<number>** or **-<number>**  
to add or subtract a number (an integer, no fractions) to or from the value.

If both parameters are given, the multiplication must come first, and is performed first. The resulting value is constrained to be in the range -16384 to +16383.

As an example, if the normal input range of an axis is -16384 to + 16383 and you only want the positive half, but need to still use the whole of the lever movement:

```
,*0.5,+8192
```

would be added to the assignment. The \*0.5 changes the range to -8192 to +8191, and then adding 8192 gives 0 to +16383.

After editing, just tell FSUIPC to reload the axis assignments (a button on the Axes page). You won't see the results there, but you will in the calibrations.

## Programs: facilities to load and run additional programs

FSUIPC4 can, as an extra, cause other programs to be run each time you load and run Flight simulator. Details of what programs to be run are provided in an additional section in the FSUIPC4.INI file. This section cannot be edited in the on-line FSUIPC4 options dialogues. You need to edit the details directly in the INI file.

The additional section is

[Programs]

and can contain up to 16 requests to run other programs—up to 8 “Run” parameters Run1 to Run8, and up to 8 “RunIf” parameters, RunIf1 to RunIf8. Both sets are otherwise identical in format. The only difference is that the RunIf programs are not run if they appear to be already running. The ordinary “Run” programs will be loaded without such checking.

The format is simply:

RunN=(Options,)<full pathname of program to be run>  
or RunIfN=(Options,)<full pathname of program to be run>

where N runs from 1 to 8. Details of options are given below, but if none are required the parameter simplifies into just the full pathname.

For example: Run1=D:\RadarContact\RCV4.exe

might be used to run Radar Contact version 4.

If the program needs command-line parameters these can be included by enclosing the whole value in quotes, so that the space(s) needed don't cause problems. You may also need to include the quotes if the pathname includes spaces.

For example:

Run2="c:\epic\loadpic fs98jet"

The programs are loaded in order of the run number, 1–8. If a mixture of Run and RunIf parameters are given, the order is Run1, RunIf1, Run2, RunIf2, and so on.

The Options you can use are as follows:

HIDE	tries to get the program to hide itself when it runs. This is only possible if the program defines its window to use default settings, so it isn't very useful for many programs, unfortunately.
HIGH	runs the program at higher priority than FS. <i>Use with care!</i> Messing about with priorities doesn't work well in all circumstances, and FSX may not like it much.
CLOSE	closes the program tidily (if possible) when FS is terminated.
KILL	forcibly terminates the program, if possible, when FS is terminated.
LOW	runs the program at IDLE priority. Depending on what the program does, this may actually effectively stop it until you direct user focus to it, as FS tends to soak up all Idle time.
READY	delays loading and running the program until FS is up and ready to fly, and FSUIPC4 can supply valid data through its IPC interface. (This parameter may, of course, result in the programs being run in a different order to that specified by the Run number).

Of these really only CLOSE, KILL and READY are of general use. If you want to apply more than one option, list them separated by commas, but *no spaces*. For example:

RunIf1=READY,KILL,D:\FS2002\WeatherSet.exe

## Assignment of additional axis controls

(Reverser, Aileron and Rudder Trims, and Cowl Flaps)

There are no axis controls provided in FS for jet thrust reversing nor for aileron or rudder trim or even for setting the cowl flaps. To get around this, and for other axis assignments not possible in FS's menus, please check the Axis

Assignment facilities in the FSUIPC4 options. You'll find a lot more axis type controls you can assign there, and by directing the Aileron Trim, Rudder Trim and Cowl Flaps to FSUIPC4's own calibrations, they can be operational within minutes. FSUIPC4's Joystick section (on page 7 or 8) deals with these.

The Reverser control is special to FSUIPC4 and can be assigned and calibrated in the same way. Additionally there's another controlling parameter:

```
MaxThrottleForReverser=0
```

This controls the interlock—the reverser will not engage until all throttles are reduced to this setting (normally 0, or idle). You can try a non-zero value here if you cannot calibrate your throttles to produce a stable idle zero.

## Multiple Joysticks for Multiple Pilots

### Method 1:

Using the Joystick sections of the FSUIPC4 options to calibrate the main flight controls, FSUIPC4 can also accept up to four different control inputs for each main flight control, treating them equally. You can have up to 4 aileron, elevator, rudder, throttle, left and right brake controls. FSUIPC4 takes the value from the input giving *maximum* deflection from 'neutral' or 'idle'. There's no averaging, or other types of conflict resolution, taking place.

You have to somehow *connect* up your multiple joystick axes, whether by using an EPIC card, multiple Game Ports, or multiple USB devices. FSUIPC4 cannot help there. Having done that, you need to find 'spare' FS controls which you will not otherwise be using from joystick inputs (see the List of FSX controls PDF)—it doesn't matter if you will be using those controls from the keyboard. FSUIPC4 only pinches the joystick inputs. You have to assign the additional joystick axes, wherever they may be, to these "spare" controls.

Now add to the FSUIPC4.INI file's JoystickCalibration section (add the section if necessary) a list of declarations which define the additional controls you have assigned. You define these by *number*. The main flight controls are defined by parameters like this:

```
AileronB=<control number>  
ElevatorB=<control number>  
RudderB=<control number>
```

Other parameters here can define LeftBrakeB, RightBrakeB, ThrottleB, and also C and D versions of all 6 controls, so providing up to 4 copies of each one.

Note that you will need to calibrate all controls so that the ones controlling the same values are as close as possible in range and response. Do this first in Windows Control Panel, then, after making the above adjustments and assignments, in FSUIPC4. Calibrate dead zones at the ends (and in the centre for aileron, elevator and rudder) to "cover up" any discrepancies—in other words, calibrate for the worst of each.

### Method 2:

An easier method is now available, provided you use the FSUIPC Axis Assignments facility to assign your controls, deleting them from FS assignments.

FSUIPC's axis assignments allows any of your joystick axes to be assigned to any of FS's or FSUIPC's axis controls, and there's no restrictions on how many you can assign to any of them. So that's the first problem solved – you can assign two sets of yokes, rudders, whatever, to the same controls.

Both FSUIPC and FS take notice of the last movement in an axis. They don't "poll" them to get regular inputs, but only see changes coming from them. So both will see the last change from multiple axes. However, that might be from an unwanted jitter or small accidental movement. So, *provided you assign your axes for Direct FSUIPC Calibration* (as opposed to an FS control), FSUIPC now arbitrates, selecting the axis with the highest deflection (defined here as a difference from zero).

Note, however, that it still only sees axes when they change, so even if one axis is held at an large deflection, once another axis for the same control moves to a similar or higher position, that takes control then even if it moves lower than the held on—the latter is effectively "out of it" until it is moved.

The hints about calibration in Method 1 still apply.

## HELICOPTER PITCH and BANK TRIM facilities

A facility to operate pitch and bank trims on helicopters is provided. This uses the normal FS elevator and aileron trim controls (and axes) to modify the end value on the “Y” (elevator) and “X” (aileron) axis of the cyclic. To use this you need to ensure that the axes are calibrated through FSUIPC4 (as the elevator and aileron axes respectively), and add

### **ApplyHeloTrim=Both**

to the relevant [JoystickCalibration ...] section(s) in FSUIPC4.INI. Note that, as a precaution, the trim value will never be added to the relevant axis if the normal trim value is non-zero.

This new “helo trim” values are maintained in IPC offsets as follows:

0BBE 2 bytes 16-bit Helo Pitch Trim value, range -16383 to +16383

0C06 2 bytes 16-bit Helo Bank Trim value, range -16383 to +16383

Both of these can be written to for external program control.

Note that if you only require a pitch trim you can set

### **ApplyHeloTrim=Yes**

Instead of ‘both’. The aileron/bank axis and trim values will then be left alone.

---

## Message Filters

Messages sent to FSUIPC for display on the FS screen can be filtered and forcibly routed according to their first few characters. This is done by adding a new section to the FSUIPC.INI file, as follows:

**[MessageFilters]**

**Suppress=...**

**SingleLine=...**

**MultiLine= ...**

The “...” part is replaced by a list of up to 8 strings (in "quotes"), each of less than 16 characters. Messages sent to FSUIPC are compared with these. If they start with the same characters (case ignored) then the action taken is as follows:

**Suppress:** the message is discarded

**SingleLine:** the message is treated as a single line message even if it isn't

**Multiline:** the message is treated as a multiline message even if it isn't.

For example:

SingleLine="FDC", "PM MCP"

will route messages beginning "FDC" or "PM MCP" to the single line window, unless such messages are suppressed by FSUIPC option.

## Multiple INI files

In general, because of the flexible aircraft-specific keypress, axis and button assignment and calibration facilities built into FSUIPC4, it is not really often necessary to consider having different INI files for different needs. But it is possible. Here's how:

For each additional set of INI parameters, you have to make a copy of the FSX.EXE file, in the main FSX folder, with another name. There are two variations on how the changed name is used.

If you give a name beginning with “FSX”, such as **FSX\_for\_Choppers.EXE** then FSUIPC4 uses the appended part for its files, thus:

**FSUIPC4\_for\_Choppers.INI** (also for **.LOG**, and even **.KEY**—so remember to duplicate your KEY file and rename it accordingly or you will find yourself unregistered).

If you don't keep “FSX” as the first characters, then the whole of the new name is appended after a ‘.’—for example **PetesFSX.EXE** would give:

**FSUIPC4.PetesFSX.INI** (and again the same for **.LOG** and **.KEY**).

**IMPORTANT:** Each renamed FSX has its renamed CFG file too—if you don't copy your FSX.CFG file and rename it to match your renamed FSX.EXE file, when FSX reloads it will generate a new default one with its new name.

# APPENDIX 1: Do more with your joystick!

*This section is from a contribution graciously made by an intrepid FSUIPC user. I hope you will find it useful. Apart from formatting to fit this current document I've left it exactly as originally submitted.*

During the past flightsim years, the PC flight simulators have become more and more professional and more complex. Very sophisticated airplanes can be downloaded for free or purchased for a reasonable price. Many of them includes all bells and whistles in a way that "flightsim" is no "game" any more, and for many among us it becomes more and more a "real flight simulator" as used in the real flying world. Some have built very real looking cockpits with instrument panels with every switch and control in its right place; others like myself are still using their joystick and keyboard.

As I have a small computer desk, it is not so handy to use the keyboard and my joystick together especially for flightsim. A cockpit is overloaded with devices to be set, numerous switches have to be used, many settings must be executed via keyboard entries and with a joystick with a scrubby eight buttons for all the remaining commands, it seems to be impossible to do this in any user-friendly way

In FSX and previous simulators, Microsoft has assigned some, but not all, commands to the joystick buttons by default and these can be modified by the menu tree "Options—Controls—Assignments". By selecting a command from a list and defining a button of your joystick, the activation of this button will execute the selected command. There is also an option that repeats the command as long as the button is pushed.

I have an 8-button joystick but the simple default joystick programming of the eight buttons was not sufficient anymore. I need more commands, more sophistication on my joystick. So I searched for a solution: because my joystick was absolutely necessary the only option is then to eliminate keyboard entries as much as possible.

Lucky there are still some smart guys on this world, guys like Pete Dowson. Pete is well known for his excellent FSUIPC.DLL add-on module for MS flight simulators. This module makes it possible to correct some flaws in FS and to enhance FS, and must be considered as 'a must have' for the whole FS community. But FSUIPC includes also many features that the modal user can use to his advantage. One of these features for licensed FSUIPC users is "joystick and keyboard button programming".

Originally, Pete has provided this feature for owners of Goflight and Epic devices but this can also be used for your joystick too! I have written this guideline on the request of Pete because we realize that only a few FS users use this powerful tool as intended. I will try to explain the marvellous things you can do with this superb programming tool. A few weeks ago I didn't realize it myself, but now, oh boy!

I will explain some programming tricks I'm using in the button programming of my own Sidewinder Force Feedback Joystick 2 from Microsoft.

The following documentation is needed before you can start the programming:

First: A fully user-licensed FSUIPC4, version 4 installed in your copy of FSX.

Second: the "FSUIPC4 for Advanced Users" manual [*the one now before you*]. Please, read very carefully the chapters concerning keyboard and joystick button programming, especially the section about compound buttons.

Third: the "List of FSX Controls" document which will have also been installed for you in your FSX modules folder.

*To be sure that all commands will be executed the way you have programmed them, almost all the default programming of the buttons in Flight Simulator must be removed.* I have removed them all, except the Hat button programming.

I use the two buttons on the left of the joystick pedestal to set conditions for the selection of commands assigned to the six other buttons. I also include the tricks you can use if you would use three buttons to set conditions.

Let us start with the first case. The two buttons used to define a condition, are labeled "7" and "8" on the joystick. The lowest button label on the joystick is being "1". For programming however the button numbering starts with button "0" for the button with label 1, "1" for button 2 etc. And so, again in our case, the conditions are programmed by button "6" and "7". Four possibilities are created by the button status, pushed or released, of a combination of two buttons:

1. button 6 and 7 are both up,
2. button 6 is down and button 7 is up,
3. button 7 is down and button 6 is up
4. button 6 and button 7 are both down.

The status of these two buttons together with an action of one of the other six buttons can be used to program a flight simulator command. In fact we can now assign up to 4 commands per button or 24 commands to the six remaining buttons (even 48, because we can program a function if one of the “action” buttons is going down and another when the same button goes up again)

The following can be done with a combination of three buttons:

1. button 5, 6 and 7 are all three up
2. button 5 is down, 6 and 7 up
3. button 6 is down, 5 and 7 are up
4. button 7 is down, 5 and 6 are up
5. button 5 and 6 are down, button 7 is up
6. button 5 and 7 are down, 6 is up
7. button 6 and 7 are down, button 5 is up
8. button 5, 6 and 7 are all three down

There are now 8 possibilities in the combination and 5 remaining buttons which gives 40 and up to 80 commands that could be assigned to these 5 buttons.

As specified in the section on Button programming, earlier, two kinds of commands can be generated: use the button combination to simulate a hit of a key combination on the keyboard, or use the joystick button combination to generate an “internal” FS command. A list of all the possibilities for these commands can be found in the “List of FSX Controls” document.

Let us take a few rules out of a button programming as examples:

```
3=CP(-0,6)(-0,7)0,3,C65615,0
...
...
9=CP(+0,6)(-0,7)0,3,C65769,0
```

In these both cases the active button (the button that is generating the command) is button 3 (with label 4 on the joystick). In the first case the command “65615” is generated when button 6 and 7 are up and button 3 is going down. C65615 will generate an “Elevator Trim Up”, the same command as the default joystick button programming. The “CP” syntax defines that the command will be only executed once, even if the button 3 is holding down.

However, by holding down the “6” button (“7” on the MS joystick) and activating button 3, FSUIPC will generate a “65769, Propeller Pitch Increment”, command. This command is not a default joystick button command, but a command that, if it was not programmed that way, had to be entered by a button combination on the keyboard.

By defining the button combination with a “CR”, the command will be repeated until the action button is released again, which is in our application more advantageous. And in fact, the repeat function is used on both commands:

```
2=CR(-0,6)(-0,7)0,2,C65607,0
3=CR(-0,6)(-0,7)0,3,C65615,0
...
...
8=CR(+0,6)(-0,7)0,2,C65771,0
9=CR(+0,6)(-0,7)0,3,C65769,0
```

The buttons “2” and “3” are used here to trim up/down (rule 2 and 3) with button 6 and 7 up. The same buttons, but now with button 6 activated while button 7 is up, controls the propeller pitch.

I assigned another two commands to the same “2” and “3” buttons; also I programmed the combination with the 7 button for “Mixture Incr” and “Mixture Decr” in rule 19 and 20:

```
19=CR(-0,6)(+0,7)0,2,C65775,0
20=CR(-0,6)(+0,7)0,3,C65777,0
```

I must emphasise here that FSUIPC uses the *status* (up or down) of the buttons in the compound combinations (+/-j,b)(+/-j,b) for a condition, but the *changes* of the button status, in fact “the pushing” or “the releasing” of a joystick button for the activation of the command, which is valid for one whole scan, meaning the check of all following button programming rules. This is important to remember.

On the MS joysticks, button 2 and 3 are very well placed for using them as increment and decrement functions and a lot of commands could be attached to them. However, we have used already 3 of the four condition statuses. So if we

only use the combination of two buttons and like to attach much more commands to these buttons we have to find another way.

First of all, with all preceding versions up to and including 3.14, FSUIPC allowed compound combinations of the status of up to two buttons, and not more than two buttons, to create a condition. In the newer versions the status of 16 buttons can be used to create a condition—but the explained tricks will still be valid.

In fact, the button programming does not work directly with the buttons because FSUIPC stores the status of a button in a “flag”, an internal storage space, during a process cycle or scan of all programmed button rules. The programmed conditions use these flags to define the result status of the programmed condition.

FSUIPC saves now the status for up to 32 buttons of up to 16 joysticks, which means 512 flags for 512 buttons!

From these 512 flags, only 8 are used for the 8 buttons of my joystick and the rest of these flags likes to be wasted space. Not entirely! Because Peter has provided some commands to set, toggle or reset the flags, even if they are not “connected” to a button. So an instruction can be used to set or reset a flag and to use the flag afterwards in a condition. And because there is no connection to an existing button, the status of the flag is entirely dependent of the programmed instructions that are given for that particular flag.

What we are going to do now is to make ONE flag reflecting the condition of the TWO buttons, so that this flag can be used together with the status of another button, to create another condition. To do this, I use the following tricks:

```
; Flag 10 follows keys (-6 AND -7)
;
0=CU(-0,7)0,6,C1003,10
1=CU(-0,6)0,7,C1003,10
```

When FS is started and the module FSUIPC.DLL is activated, all flags are reset. To be sure about the setting of flag 10 we have to “play a bit” with buttons 6 and 7. Playing a bit with these buttons at the beginning of our flight does not generate commands, because both buttons are “dead” buttons and they will not send commands to FS (this is the same as the shift keys on your computer keyboard which are doing nothing on their own but only functioning together with other keys). The above rules are assuring that flag 10 will be set when both buttons are up or are going up:

**Rule 0:** when button 7 is up, and button 6 goes up, set flag 10

**Rule 1:** when button 6 is up, and button 7 goes up, set flag 10

The following rules are setting flags when one of the both buttons is going down. In these cases however we have to reset flag 10:

```
; Flag 11 follows keys (+6 AND -7)
;
2=CP(-0,7)0,6,C1004,10
3=CP(-0,7)0,6,C1003,11
4=CU(F+0,11)0,6,C1004,11
;
; Flag 12 follows key (-6 AND +7)
;
5=CP(-0,6)0,7,C1004,10
6=CP(-0,6)0,7,C1003,12
7=CU(F+0,12)0,7,C1004,12
```

The explanation of these programming rules is:

**Rule 2:** if button 6 goes down and button 7 is still up, reset flag 10.

**Rule 3:** if button 6 goes down and button 7 is still up, set flag 11 (remember that the action of the active button can be seen by all the following rules in the same scan).

**Rule 4:** when flag 11 is set and button 6 goes up, reset flag 11.

Flag 11 follows now the status of button 6 (up or down) while button 7 is up.

**Rule 5:** if button 7 goes down and button 6 is still up, reset flag 10.

**Rule 6:** if button 7 goes down and button 6 is still up, set flag 12.

**Rule 7:** when flag 12 is set and button 7 goes up, reset flag 12.

In this case flag 12 follows the status of button 7 (up or down) while button 6 is up.

Now follows a more tricky part because we want to make a “follower” for button 6 and 7 down, (if we wouldn’t use a combination with both buttons down, then, in any case, we have to include rule 8 and 11 to be sure of a resetting of flags 11 and 12 when the conditions in the above rules aren’t valid any more):

```
; Flag 13 follows key (+6 AND +7)
;
8=CP(+0,6)(F+0,11)0,7,C1004,11
9=CP(+0,6)0,7,C1003,13
10=CU(F+0,13)0,7,C1004,13
;
11=CP(+0,7)(F+0,12)0,6,C1004,12
12=CP(+0,7)0,6,C1003,13
13=CU(F+0,13)0,6,C1004,13
```

Even if we do our very best, it’s nearly impossible to push two buttons at the same time, so we have to disable the resulting flag setting of these rules in rule 8 and 11 because the program loop will detect that the conditions as specified in rule 3 or 6 will be satisfied before the second button is activated:

**Rule 8:** If button 6 is down and flag 11 is set (because we were faster with button 6 as with button 7) and button 7 goes down, reset flag 11.

**Rule 9:** If button 6 is down and button 7 is down, set flag 13.

**Rule 10:** If flag 13 is set and button 7 is released, reset flag 13. This programming rule acts if button 7 is released before button 6. In that case you would think that rule 3 is back in the game, but that’s not true: FSUIPC doesn’t react on the status of the “active” key but on the change of his status: “button down” is actually meaning “button goes down”, “button up” is actually “button goes up”. And because there is no change in the status of button 6, rule 3 is not activated.

**Rule 11:** If button 7 is down and flag 12 is set (because we were faster with button 7 as with button 6) and button 6 goes down, reset flag 12.

**Rule 12:** If button 7 is down and button 6 goes down, set flag 13.

**Rule 13:** If flag 13 is set and button 6 is released, reset flag 13. This programming rule acts if button 6 is released before button 7. Here also the same remark as for rule 10, but now regarding rule 6.

Now these flags can be used to assign real Microsoft Flight Simulator functions to the remaining buttons:

```
; IF -6 AND -7 (Flag 10)
;
14=CR(F+0,10)0,0,C65588,0      ;repeat break
15=CP(F+0,10)0,1,C65570,0      ;toggle gear
16=CR(F+0,10)0,2,C65607,0      ;repeat trim pitch up
17=CR(F+0,10)0,3,C65615,0      ;repeat trim pitch down
18=CP(F+0,10)0,4,C65758,0      ;increment flaps
19=CP(F+0,10)0,5,C65759,0      ;decrement flaps
;
; IF +6 AND -7 (Flag 11)
;
20=CP(F+0,11)0,0,K192,1        ;voice key for CS727
21=CP(F+0,11)0,1,C65751,0      ;toggle landing lights
22=CR(F+0,11)0,2,C65771,0      ;repeat decr. mixture
23=CR(F+0,11)0,3,C65769,0      ;repeat incr. mixture
24=CP(F+0,11)(F+0,20)0,4,C66390,0 ;AND +F20 toggle wing fold (Drag chute on CS F104)
25=CP(F+0,11)(F-0,20)0,4,C66391,0 ;toggle tail hook (Drag chute on CS Mig21)
26=CP(F+0,11)0,5,C65589,0      ;toggle air break
```

A little more about rule 24 and 25: I am a fan of Captain Sim airplanes, but the CS team uses a different command for the drag chute on the Mig21 as for the drag chute on the Starfighter. I decided to use a flag (which I program later on) to generate a different command for the same button, depending on the status of that flag. Here is another trick that I am also using for the Yak 3 of Captain Sim airplanes: the default animation of the rear-view mirror uses two

different commands for the activation and deactivation of the mirror. This is a rather weird because this is a toggle command. The next trick allows me to toggle the mirror with one button:

```

36=CP(F+0,13)(F-0,30)0,0,C66294,0      ;Incr Concorde Visor (activate rear-view mirror)
37=CP(F+0,13)(F+0,30)0,0,C66295,0      ;Decr Concorde Visor (deactivate rear-view mirror)
38=CU(F+0,13)0,0,C1005,30              ;Toggle flag 30

```

The combination of these three rows is used to switch the button command from incr to decr and visa versa, each time the 0 button is activated while button 6 and 7 are both down.

The next button programming rules in the INI file are:

```

; IF (-6 AND +7) = F12
;
27=CP(F+0,12)0,1,C65858,0              ;toggle pitot-heat
28=CR(F+0,12)0,2,C65777,0              ;repeat mixture decrement
29=CR(F+0,12)0,3,C65775,0              ;repeat mixture increment
30=CP(F+0,12)0,4,K83,8                  ;keyboard "S" (next view)
31=CP(F+0,12)0,5,K83,1                  ;keyboard "SHIFT-S" (previous view)
;
; IF(+7 AND +8) = F13
;
32=CP(F+0,13)0,0,C66224,0              ;autostart engines
33=CP(F+0,13)0,1,C66293,0              ;toggle avionics on/off
34=CR(F+0,13)0,2,C65880,0              ;increment heading bug
35=CR(F+0,13)0,3,C65879,0              ;decrement heading bug

```

By using the combination of three buttons is the following can be accomplished:

```

; Flag 10 follows keys (-5 AND -6 AND -7)
;
0=CU(-0,6)(-0,7)0,5,C1003,10
1=CU(-0,5)(-0,7)0,6,C1003,10
2=CU(-0,5)(-0,6)0,7,C1003,10
;
; Flag 11 follows keys (+5 AND -6 AND -7)
;
3=CP(-0,6)(-0,7)0,5,C1004,10
4=CP(-0,6)(-0,7)0,5,C1003,11
5=CU(F+0,11)0,5,C1004,11
;
; Flag 12 follows key (-5 AND +6 AND -7)
;
6=CP(-0,5)(-0,7)0,6,C1004,10
7=CP(-0,5)(-0,7)0,6,C1003,12
8=CU(F+0,12)0,6,C1004,12
;
; Flag 14 follows key (-5 AND -6 AND +7)
;
9=CP(-0,5)(-0,6)0,7,C1004,10
10=CP(-0,5)(-0,6)0,7,C1003,14
11=CU(F+0,14)0,7,C1004,14
;
; Flag 14 follows key (+5 AND +6 AND -7)
;
12=CP(+0,6)(F+0,12)0,5,C1004,12
13=CP(+0,6)(-0,7)0,5,C1003,13
14=CU(F+0,13)0,5,C1004,13
;
15=CP(+0,5)(F+0,11)0,6,C1004,11
16=CP(+0,5)(-0,7)0,6,C1003,13

```

17=CU(F+0,13)0,6,C1004,14  
;  
; Flag 15 follows key (+5 AND -6 AND +7)  
;  
18=CP(+0,7)(F+0,13)0,5,C1004,13  
19=CP(+0,7)(-0,6)0,5,C1003,15  
20=CU(F+0,15)0,5,C1004,15  
;  
21=CP(+0,5)(F+0,13)0,7,C1004,11  
22=CP(+0,5)(-0,6)0,7,C1003,15  
23=CU(F+0,15)0,7,C1004,15  
;  
; Flag 16 follows key (-5 AND +6 AND +7)  
;  
18=CP(+0,6)(F+0,12)0,7,C1004,12  
19=CP(+0,6)(-0,5)0,7,C1003,16  
20=CU(F+0,16)0,7,C1004,16  
;  
21=CP(+0,7)(F+0,13)0,6,C1004,13  
22=CP(+0,7)(-0,5)0,6,C1003,16  
23=CU(F+0,16)0,6,C1004,16

## Appendix 2: About the *Aircraft Specific* option and “*ShortAircraftNameOK*”

**Note: this is a contribution from a user, to whom thanks is expressed.**

There are these three choices in FSUIPC settings:

**ShortAircraftNameOK=No**

**ShortAircraftNameOK=Yes**

**ShortAircraftNameOK=Substring**

Result: To get exactly the same settings for AXES, BUTTONS, KEYS and CALIBRATION for each plane repaint or variant.

The Short Aircraft Name in FSUIPC refers to the name in the Aircraft.cfg file under “title”

For example: Aerosoft DHC Beaver. There might be 7 variants or repaints

```
aircraft.cfg \(\flightsim.X)\title= Aerosoft Beaver DHC-2A 55-0682
aircraft.cfg \(\flightsim.X)\title=DHC-2A C-GSKY Beaver
aircraft.cfg \(\flightsim.X)\title= Aerosoft DHC-2A C-GSKY modern
aircraft.cfg \(\flightsim.X)\title=Beaver DHC-2A DQ-GEE
aircraft.cfg \(\flightsim.X)\title=DHC-2A DQ-GEE modern
aircraft.cfg \(\flightsim.X)\title= Aerosoft DHC-2A N299EE
aircraft.cfg \(\flightsim.X)\title=Beaver Aerosoft DHC-2A N299EE modern
```

Edit the FSUIPC.ini file:

### Scenario 1: If “ShortAircraftNameOK=No”

Presuming that you have already assigned the axes, keys and buttons and calibrated the joystick for one of the above variants or repaints: in order to get the same settings for the rest of the above variants/repaints of the Aerosoft Beaver you would need to edit the FSUIPC.ini file and add 4 separate entries for each title name (exactly as above) under [Axes], [Buttons], [Keys], [Joystick Calibration] to ensure that all of the settings were exactly the same, ie 28 entries in all. Pretty tedious in fact— I had over 40 variants/repaints of this plane so I would have need 160 entries in the FSUIPC.ini file.

[Axes. Aerosoft Beaver DHC-2A 55-068]
[Buttons. Aerosoft Beaver DHC-2A 55-068]
[Keys. Aerosoft Beaver DHC-2A 55-068]
[JoystickCalibration.Aerosoft Beaver DHC-2A 55-068]
[Axes. DHC-2A C-GSKY Beaver]
[Buttons. DHC-2A C-GSKY Beaver]
[Keys. DHC-2A C-GSKY Beaver]
[JoystickCalibration.DHC-2A C-GSKY Beaver]
[Axes. Aerosoft DHC-2A C-GSKY modern]
[Buttons. Aerosoft DHC-2A C-GSKY modern]
[Keys. Aerosoft DHC-2A C-GSKY modern]
[JoystickCalibration.Aerosoft DHC-2A C-GSKY modern]
[Axes. Beaver DHC-2A DQ-GEE]
[Buttons. Beaver DHC-2A DQ-GEE]
[Keys. Beaver DHC-2A DQ-GEE]
[JoystickCalibration.Beaver DHC-2A DQ-GEE]
[Axes. DHC-2A DQ-GEE modern]

[Buttons. DHC-2A DQ-GEE modern] [Keys. DHC-2A DQ-GEE modern] [JoystickCalibration.DHC-2A DQ-GEE modern]
[Axes. Aerosoft DHC-2A N299EE] [Buttons. Aerosoft DHC-2A N299EE] [Keys. Aerosoft DHC-2A N299EE] [JoystickCalibration. Aerosoft DHC-2A N299EE]
[Axes. Beaver Aerosoft DHC-2A N299EE modern] [Buttons. Beaver AerosoftDHC-2A N299EE modern] [Keys. Beaver Aerosoft DHC-2A N299EE modern] [JoystickCalibration.Beaver Aerosoft DHC-2A N299EE modern]

**Scenario 2: If “ShortAircraftNameOK=YES”**

12 entries would be required to make sure all settings were the same

[Axes. Aerosoft [Buttons. Aerosoft [Keys. Aerosoft [JoystickCalibration.Aerosoft]	[Axes. DHC] [Buttons. DHC] [Keys.DHC] [JoystickCalibration.DHC]	[Axes. Beaver] [Buttons. Beaver] [Keys.Beaver] [JoystickCalibration.Beaver]
--	--	--

Explanation:

1. “Aerosoft” would pick all those entries in the title STARTING with “AEROSOFT”, but NOT Aerosoft in any other part of the title.
2. “DHC” would pick all those entries in the title STARTING with “DHC” but not those with “DHC” in any other part of the title
3. “Beaver” would pick all those entries in the title STARTING with “Beaver” but not those with “Beaver” in any other part of the title

**Scenario 3: If “ShortAircraftNameOK=Substring”**

4 entries only, i.e. “DHC” in the FSUIPC.ini file would result in all variants having exactly the same settings – “DHC” is common to all titles.

[Axes. DHC] [Buttons. DHC] [Keys. DHC] [JoystickCalibration.DHC]
---

To summarise:

<b>ShortAircraftNameOK=No</b>	<b>One entry for each different title in the aircraft.cfg file</b>
<b>ShortAircraftNameOK=Yes</b>	<b>Picks up the starting part of the title in the aircraft.cfg file</b>
<b>ShortAircraftNameOK=Substring</b>	<b>Picks up any part of the title in the aircraft.cfg file</b>

Title in aircraft.cfg file	ShortAircraftNameOK=		
	No	Yes	Substring
title=Airbus A321 title=Airbus A321 Paint2 title=Airbus A321 Paint4 title=Airbus A321 Paint5 title=Boeing 737-400 title=Boeing 737-400 Paint1 title=Boeing 737-400 Paint2 title=Boeing 737-400 Paint3 title=Boeing 737-400 Paint4 title=Boeing 747-400 title=Boeing 747-400 Paint1 title=Boeing 747-400 Paint2 title=Boeing 747-400 Paint3 title=Boeing 777-300 title=Boeing 777-300 Paint1 title=Boeing 777-300 Paint2 title=Boeing 777-300 Paint 3	<b>Separate entry for each title</b>	<b>“Airbus”:</b> Would apply to all entries starting with Airbus.  <b>“Boeing”</b> would apply to all entries starting with Boeing.	<b>“A321”:</b> Any variant with A321 in the title.  <b>“Paint”</b> Any variant with PAINT in the title.  <b>“737”:</b> Any variant with 737 in the title.

Explanation: **ShortAircraftNameOK=Substring** Any text that is in any position in the “title” located in the aircraft.cfg file that is inserted in the ini file as above will result in the same settings for those aircraft. For instance choosing “737” ie [**Axes.737**] etc would result in all planes with 737 in the title having the same settings. Likewise choosing “Boeing” would cover all variants/repaints with Boeing in the title

To summarise if you had 20 variants/models/repaints with all different titles you would need 20 entries per section (80 in all) in the ini file. Using **ShortAircraftNameOK=Substring** you could cut this back to just 1 entry per section (4 in total).