

USERS MANUAL FOR THE TINMOUSE II SP-177 AUTOPILOT and AUTHROTTLE SYSTEM



Beginning with version 1.30 of the freeware TinMouse II panel, an optional simulation of the analog Sperry SP-177 Advanced Autopilot is included and integrated into the TinMouse II Boeing 737-200 ADV simulation. Thanks to Mark McCoy and Paul Scaratt for use of the bitmaps to make the gauge graphics.

The Sperry SP-177 analog controller was included as standard equipment on the Boeing 737-300 classic, and retrofitted to many -200 models over the years. The analog model is distinguished from its digital counterparts by mechanical digit displays, a much larger control head (spanning nearly half the panel), and was a generally less responsive and precise control system than its digital successors. The TinMouse II implementation of this system uses a modified digital control head face due to space considerations, but with mechanical digits and EPR/PDC modes replacing the N1 and VNAV modes present on the newer digital systems.

The SP-177 is integrated into the TinMouse panel—a flight director specific to the SP-177 is embedded in the ADI gauge and operates automatically when the SP-177 is present. SP-177-equipped systems also used a 4-row flight mode annunciator panel...at present the SP-177 is tied into the older APD (Approach Progress Display) on the panel, which provides most of the same functionality. Amber lights on the APD indicate “armed” status, green indicates “capture” or “engaged” status.

If using the optional freeware CIVA implementation of the Litton Inertial Nav Unit, or either of the ISG FMS boxes (a Honeywell GNS-XLS or the Smiths FMC) they are fully integrated into the panel when present. If using an ISG gauge, add “ISG” anywhere in the title line in your aircraft.cfg to activate the linkages. Do NOT put this setting into the title line if you do not have the ISG gauges installed into FS—it will crash FS when loading the panel. The panel automatically detects the CIVA, if present. You cannot, however use both ISG and CIVA gauges in the same panel. Selection of “LNAV” on the SP-177 mode control panel with a valid leg selected on the LNAV unit will couple the autopilot and illuminate the LNAV APD annunciator. The HSI is independently selectable to show either LNAV data or navaid info. You can, for example, set up for an ILS approach on the HSI in nav mode while the SP-177 is flying coupled to the LNAV,

or you can select LNAV to set up a routing change while the SP-177 is coupled to fly a VOR radial.

CONTROLS

Course Knob: Selects the HSI displayed course when in nav mode. Has no effect when LNAV is selected as the HSI nav data source (with the NAV/RAD button located near the lower-right corner of the HSI). As with the other knobs on the SP-177, the mousewheel may be used to dial the values up/down, as well as left-clicking the mouse on the clickspots on the left/right of the knob center. Right-clicking on the left side will rapidly decrease the setting by 10, right-clicking on the right side increases the course setting by 10. The HSI, although it has no knobs, still has heading and course change clickspots in the lower left/right corners of the HSI gauge, which operate the same way.

FD On/Off switch: Turns the flight director on and off. When on, with a valid nav source, the V-bar will descend into view from the top of the display.

A/T Arm Switch: Arms the autothrottle system for use. It does not engage the A/T by itself. If this switch is off, none of the A/T modes will engage, and if turned off while they are engaged, it will disconnect them. The A/T disconnect can be programmed into a joystick button by setting value 6 in offset byte 6D11—see manual for instructions. The offset will not toggle the setting, it is a disconnect only.

EPR Switchlight: Engages PDCS-controlled maximum power setting. A valid mode must be engaged in the PDCS for this mode to operate. For takeoffs, either full or reduced takeoff power page must be selected and engaged. Inflight, either climb, cruise, max continuous thrust, or go-around mode must be selected and engaged. Pressing on the switchlight while EPR thrust mode is engaged will stop further autothrottle inputs in this mode. If the #1 throttle axis is moved a short distance while EPR mode is engaged, the A/T arm and EPR modes will both be disengaged.

Speed mode switchlight: The autothrottle will attempt to hold the selected airspeed or mach number. When in speed mode, the A/T is not constrained by the PDCS computer, and can overboost the engines if managed carelessly, for example if speed mode is selected in conjunction with vertical speed hold and a vertical speed too high to maintain within engine power limits. This analog speed controller is not snappy...good pilot procedure involves making gradual changes early.

Level Change switchlight: This mode attempts to maintain the selected airspeed or mach with aircraft pitch. It is normally used for a maximum-effort climb or descent. If the A/T system is armed when this mode is selected, it will engage EPR thrust mode (if altitude selector is higher than current altitude) or will retard throttles to idle thrust (if altitude selector is set to a lower altitude than the acft). If the A/T system was engaged when LVL CHG was initiated and is still engaged at level off, the system will automatically switch to speed mode approximately 1000 feet from level off. If the #1

throttle is moved a short distance while in an autothrottle level-change climb/descent, the A/T arming switch and the selected throttle mode will be disengaged. This mode generally produces uncomfortably high rates of climb and descent and deck angles, and will cause a gentle porpoising of the nose as the aircraft uses pitch changes to control airspeed. Because of this it is rarely used, except possibly for the higher segments of heavyweight climbs where climbs at max power produce deck angles that are less uncomfortable.

C/O button: Switches between knots indicates airspeed and mach number on the MCP speed control mode.

PDC switchlight: Currently not implemented. This would couple the selected IAS/mach, and indirectly the A/T system, to the selected mode in the PDCS.

Heading knob: Operates the heading select knob in the same way as the course knob. Note that the heading bug is no-longer controlled by the LNAV units, even when they are coupled to the autopilot. You can select a heading to fly while in LNAV, then press the “HDG SEL” switchlight to turn to the heading displayed in the heading window. Currently the bank angle (outer knob) control is not implemented.

HDG SEL switchlight: Couples lateral mode of the AP-177 to fly the heading displayed in the MCP heading window. Note that you do NOT selected heading mode in this panel to couple to the CIVA/ISG units, it is done automatically when the LNAV switchlight is pressed, and the acft will fly the selected course without moving the heading bug.

LNAV switchlight: Couples the lateral mode of the SP-177 to an LNAV source, In the TinMouse, that can be a CIVA Litton INS, the ISG implementation of either the GNS-XLS or Smiths FMS (no VNAV), or the default MSFS GPS. There must be a valid leg selected for the MCP to couple-up. When a valid mode is selected, the LNAV annunciator on the APD will illuminate.

VOR LOC switchlight: Couples the lateral mode of the SP-177 to fly a selected radio nav course—either a VOR radial, or a localizer course. This mode does not enable the glideslope. The VOR/LOC APD annunciators for the flight director (left side) and autopilot (right side) will illuminate as appropriate.

APP switchlight: Used to fly an ILS approach. Once the localizer is captured in VOR LOC mode, the APP switchlight is pressed to arm glideslope capture. The VOR LOC light will also remain on until G/S capture. The flt director and A/P glideslope APD lights will display armed/capture status as appropriate.

Altitude knob: Changes the selected altitude for vertical mode of the autopilot. Works the same as the heading/course knobs—left clicks or mouse wheel clicks are in increments of 100 feet, right-clicking the left/right side of knob produces rapid changes in increments of 1000 feet. The aircraft will not automatically climb/descent when this setting is changed—use VSpeed or LVL CHG vertical modes to initiate a climb/descent.

If, during a climb/descent, the target altitude is changed before the ALT HLD switchlight indicates altitude capture, the aircraft will continue in the selected mode to the new altitude. If altitude capture has already occurred, a climb/descent must be re-initiated with the VSpeed or LVL CHG switchlights.

ALT HLD switchlight: When pressed, will command the aircraft to level off and hold the altitude at time of activation. The light will also illuminate whenever the aircraft switches to altitude hold mode when a VSpeed or LVL CHG climb reaches and captures the altitude displayed in the Altitude window. Pressing the switchlight when Alt Hold is engaged will disengage the vertical mode of the A/P.

V/S Switchlight: Engages the vertical mode to fly the vertical speed selected in the VERT SPEED window. Pressing the switchlight when V/S is engaged will disengage the vertical mode of the A/P.

Vertical Speed Thumbwheel: Sets the target vertical speed for climb/descent in the VERT SPEED window. Note that changing this value without the V/S switchlight selected and illuminated will not cause the acft to climb or descend. Good pilot practice is to select target altitude with the altitude knob first, then set an initial moderate climb or descent rate with the thumbwheel, then engage V/S mode, and adjust VSpeed with the thumbwheel gradually to provide for smoothness and comfort in altitude changes. Note that the VERT SPEED digits are masked when altitude capture occurs—movement of the thumbwheel will unmask the display and allow a setting to be made. Mousewheel sense is the same as the thumbwheel—rotating forward on the mousewheel commands nose-down inputs, rotating back is nose-up.

A/P Engage switchlight: Engages the autopilot in the modes selected on the MCP. Note that this is not a toggle—pressing it will not disengage the A/P.

CWS Switchlight: Currently not implemented. Will engage the control-wheel steering (SP-77) control mode.

A/P Disengage Bar: Disengages (does not toggle) the autopilot. The red A/P disengage warning above the altimeter will flash until the warning light is pressed, or the disengage bar is pressed a second time. The standard FS control (default “Z”) also works, but will toggle the A/P on/off. The A/P disconnect feature can also be programmed into a joystick button by setting value 5 in offset 6D11—see the user manual for a step-by-step description of the setup.

Additionally, Go-Around mode can be toggled on/off with the GA button near the bottom of the window control stack, or by setting value 7 into FSUIPC offset 6D11.