Pilot Guide Addendum
S-TEC 55X Flight Director / Preselect / VS Command Integration For PFD Evolution Software Version 2.9 and Subsequent

This addendum is applicable to the following Primary Flight Display Pilot Guides:

- EFD1000 PFD Pilot’s Guide
- EFD 1000 PRO PFD Pilot’s Guide
- EFD1000/500 MFD Pilot’s Guide

Evolution Software Version 2.9 incorporates new features to enhance the functionality and operation of your Evolution Flight Display System with an ACU2 when integrated with an S-TEC System 55X autopilot. When unlocked, these new features allow the pilot to preselect altitude, control Vertical Speed (VS) on the PFD, and optionally, present Flight Director on the PFD. This Pilot Guide Addendum describes these new features and enhancements.

NOTE: The S-TEC 55X Flight Director/Preselect / VS Command integration with the EFD1000 and ACU2 requires a software unlock tool and installation of additional wiring. The Flight Director is optional. Refer to the Airplane Flight Manual Supplement (AFMS) for the Aspen Avionics Evolution Flight Display System, Document # 900-00008-001 REV AC or later for the Installed Equipment List for your airplane. If the unlock tool is not used and the ACU2 is not installed, software version 2.9 has no effect on the existing S-TEC 55X autopilot integration.

NOTE: Refer to the airplane AFM, S-TEC System 55X AFMS and the S-TEC System 55X Pilot’s Operating Handbook for information on the autopilot operation and limitations.

NOTE: All references to the EFD1000 PFD and PFD in this document refer to the EFD1000 PFD as installed in the aircraft.

NOTE: For a complete list of all S-TEC System 55X annunciations that appear on the EFD1000 PFD refer to the FAA Approved AFMS for the Aspen Avionics Evolution Flight Display System, Aspen Avionics Document # 900-00008-001 REV AC or later.

1. Theory of Operation

The Altitude Preselect and Vertical Speed Control in the EFD1000 PFD allows the pilot to preselect altitudes and rates of climb/descent used by the autopilot. When the preselected altitude matches the aircraft altitude the EFD1000 PFD signals the autopilot to engage the altitude hold mode of the autopilot.

The Vertical Speed Control provides an output to the autopilot pitch flight guidance computer (the S-TEC 55X Programmer/Computer). The signal is used by the autopilot when the autopilot VS mode is engaged. The autopilot compares the existing vertical speed with the selected vertical speed and maneuvers the airplane to match the signal. The EFD1000 PFD vertical speed control can be disabled by selecting the STEC 55X A/P Menu page on the EFD1000 PFD and changing the VERT SPD CNTL from PFD to STEC55X. This action will cause the autopilot to use the vertical speed command from the S-TEC 55X Programmer/Computer.

The Vertical Speed Control function on the EFD1000 PFD can operate anytime the Vertical Speed (VS) Hotkey label and Vertical Speed bug are displayed. Pressing the VS Hotkey on the EFD1000 PFD will permit editing of the Vertical Speed bug by turning the lower right knob of the EFD1000 PFD. The VS mode of the autopilot is selected by pressing VS on the S-TEC 55X.
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Programmer/Computer. The EFD1000 PFD Altitude Preselect will function when both ALT and VS
modes on the S-TEC 55X Programmer/Computer are selected. A lateral autopilot mode must be
engaged prior to engaging ALT VS.

2. Vertical Speed Control

There are two Vertical Speed Control options on the EFD1000 PFD’s STEC55X A/P menu page; PFD
and STEC55X. The options are accessed by pressing the MENU button on the PFD and selecting the
STEC55X A/P Menu page. For Vertical Speed control and Altitude Preselect on the PFD, choose the
PFD option. For Vertical Speed control on the S-TEC 55X Programmer/Computer and Altitude
Preselect on the PFD, choose the STEC55X option. After initialization or a power cycle of the PFD,
the Vertical Speed control will revert to the EFD1000 PFD option.

When the PFD option is selected, the VS Hotkey label is green and the Vertical Speed bug is
displayed on the PFD. See Figure 2 and Figure 3. When the STEC55X option is selected, the VS
hotkey label and the Vertical Speed bug are not displayed. See Figure 5 and Figure 6.

Figure 1 - Vertical Speed Control Option: PFD

To set the Vertical Speed bug when the PFD option is selected, press the VS hotkey (Hotkey 4 on
page 1 of the Hotkey Rows, (see Figure 2). Then, to change the Vertical Speed bug into the edit state,
rotate the right knob in the desired direction (clockwise to increase and counterclockwise to
decrease). While in the edit state the Vertical Speed bug is magenta and the numerical VS command
value is displayed (Figure 3). After the editing is complete press the Vertical Speed bug to change
the Vertical Speed bug to the cyan, non-editing state. If the VS hotkey is not pressed, the Vertical
Speed bug will automatically change to the non-edit cyan color in ten seconds. When ALT/VS is
engaged, the cyan Vertical Speed command will be shown by the Vertical Speed bug and the
numerical value. When only VS is engaged, the Vertical Speed command will be shown by the cyan
Vertical Speed bug without the numerical value.

The Vertical Speed bug shape is filled when the VS Mode on the autopilot is engaged (FD or FD/AP).
Figure 1 shows a filled Vertical Speed bug. The Vertical Speed bug shape is hollow when VS Mode
is not engaged. Figure 2 shows a hollow Vertical Speed bug.
Press the VS button on the S-TEC 55X Programmer/Computer to engage the autopilot VS mode. To engage the Altitude Preselect function, simultaneously press the VS and ALT buttons on the 55X Programmer/Computer. A lateral mode (such as HDG) must also be engaged.

The maximum allowable commanded vertical speeds are +1600 FPM and -1600 FPM. When setting the Vertical Speed Command, further rotation of the knob past the allowable maximum settings is not possible. When the knob rotation is stopped, the Vertical Speed Command will remain at the setting limit.

When the VS hotkey is enabled and the right knob is pushed and held, the Vertical Speed bug will synchronize to the closest 100-foot increment of the current aircraft vertical speed, but not to exceed the maximum allowable commanded vertical speed limits.

A negative vertical speed cannot be commanded when a positive relative altitude is selected. If attempted, (and VS and ALT modes are engaged) the Vertical Speed Command bug will not permit selection of a negative vertical speed. When the knob rotation is stopped, the Vertical Speed bug
will automatically position to 500 FPM in the proper direction. If the preselected altitude is the opposite polarity from the selected Vertical Speed Command bug when VS and ALT are pressed, the Vertical Speed bug will change to 500 FPM in the proper direction. For example, if a climb to 7000 feet is desired and the Vertical Speed bug is set to -600 FPM, the Vertical Speed bug will automatically position to +500 FPM when the ALT and VS modes are engaged. It is not possible to alter the Vertical Speed bug in the opposite direction during altitude capture.

During autopilot-operated vertical speed and altitude capture (the ALT and VS modes are engaged) the PFD automatically reduces the commanded vertical speed as the aircraft approaches the selected altitude to facilitate a smooth level-off. For all but maximum rate climbs and descents\(^1\), the vertical speed is reduced in 100-foot increments beginning at 700 FPM when 500 feet prior to the preselected altitude. The minimum commanded vertical speed is 300 FPM. See the Automatic Commanded Vertical Speed Reduction Table (Table 1).

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<thead>
<tr>
<th>Automatic Commanded Vertical Speed Reduction Table</th>
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<tr>
<td>Feet Prior</td>
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<td>500</td>
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<td>300</td>
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<td>200</td>
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**NOTE:** Due to the automatic reduction in commanded vertical speed the EFD1000 PFD will not accept high vertical speeds for relatively small changes in altitude. If climbing or descending at a rate less than 700 FPM, the commanded vertical speed reduction will not commence until within the altitude window for the next lower commanded vertical speed.

\(^1\) The first automatic reduction in commanded vertical speed commences at approximately 900 feet prior to desired altitude when climbing or descending at the maximum rate. This initial reduction is to 1100 FPM after which it continues the reduction.
During the Commanded Vertical Speed Reduction, the Vertical Speed bug will display the changing Commanded Vertical Speed (Figure 4). In this condition, the Vertical Speed bug cannot be increased by the pilot. When the altitude is captured the Vertical Speed bug will reset to 0 FPM.

Figure 4 - Vertical Speed bug during the Automatic Commanded Vertical Speed Reduction

When the Vertical Speed Control is set to STEC55X on the EFD1000 PFD’s Menu STEC55X A/P page (Figure 5) the vertical speed is controlled by the S-TEC 55X Computer/Programmer.

Figure 5 - Vertical Speed Control option: S-TEC 55X

When the Vertical Speed Control is set to STEC55X, the VS Hotkey label and Vertical Speed bug are removed from the PFD (Figure 6).
When the Vertical Speed Control is set to STEC55X in the EFD1000 PFD Menu, the Automatic Commanded Vertical Speed Reduction is disabled. This means that when the Vertical Speed Control is set to STEC55X, the autopilot can still capture the preselected altitude set on the EFD1000 PFD, but there is no automatic reduction in vertical speed.

**NOTE:** There is a greater likelihood of overshooting the desired altitude without the automatic reduction in commanded vertical speed.

**NOTE:** When any lateral mode is engaged with VS, verify the Vertical Speed bug setting prior to changing the Vertical Speed Control setting in the Menu or switching the autopilot Source Select from the PFD to the reversionary PFD. An unexpected vertical speed may result.

### 3. Flight Director

The optional Flight Director is a single cue (two-axis) design with movement corresponding to the autopilot pitch and roll commands (Figure 7). If Flight Director is provided, a three-position Autopilot Master switch marked FD/AP, FD and OFF permits selection of Flight Director with Autopilot, Flight Director only or Off (see Figure 9).

The PFD shows the same autopilot mode annunciations as the S-TEC 55X Computer/Programmer. The Flight Director-only selection is shown as FD on the PFD Autopilot Annunciator bar. When FD/AP is selected, the PFD annunciation bar shows AP in place of FD.
4. Control Wheel Steering

When in Control Wheel Steering (CWS) mode (CWS is pressed and released) the PFD Autopilot annunciation bar shows CWS VS (Figure 9). The Vertical Speed bug will disappear and the VS Hotkey label on the EFD1000 PFD will be gray. The gray hotkey label is the indication that the S-TEC 55X Programmer/Computer is controlling the Vertical Speed Command.

5. Inflight Operation When the PFD Vertical Speed Control Option is Selected

1) Follow all appropriate S-TEC 55X guidance.
2) Select the desired preselect altitude on the Aspen PFD.
3) Select the desired vertical speed on the Aspen PFD.
4) Engagement: Simultaneously depress the VS and ALT Switches on the S-TEC 55X Programmer/Computer (an autopilot lateral mode must be engaged). This will engage Vertical Speed Mode and arm the Altitude Hold mode for activation by the Altitude Preselect.

5) Disconnect: Autopilot disconnect is normal and unchanged with the EFD1000 PFD integration. When the DISC button is pressed, the Annunciation bar on the PFD will show flashing RDY for about five seconds like the 55X Programmer/Computer, alternating with AP or FD, depending.
NOTE: Vertical speed can be controlled either by using the Vertical Speed Control on the Aspen PFD or by using the manual VS modifier knob on the S-TEC 55X Programmer/Computer. When using Vertical Speed Control, the Vertical Speed bug will be shown on the PFD and the VS Hotkey label will be green to remind the pilot that the VS control is available on the Aspen PFD. Automatic VS reduction for a smooth capture will occur as the target altitude is approached.

Previous STEC-55X integration with Aspen Avionics EFDs had a GPSS hotkey on the EFD. This hotkey is now labeled VS and is used to enable VS bug editing. To engage GPSS with SW 2.9 and above you must press NAV twice on the STEC-55X Programmer/Computer.

If autopilot operation using the S-TEC 55X Programmer/Computer, press MENU on the Aspen PFD, turn the right knob to select the STEC55X A/P page and change the VERT SPD CNTL to STEC55X (Figure 5). With this option, Vertical Speed control is available through the S-TEC 55X Programmer/Computer. The VS Hotkey label and the Vertical Speed bug on the Aspen PFD will extinguish. Automatic Vertical speed reduction will not occur as the target altitude is approached.

IMPORTANT:
When using the Altitude Preselect, the selected vertical speed direction (polarity) must match the direction required to achieve the selected altitude. The system includes safeguards that, under normal conditions, will advise the pilot of an altitude/vertical speed compatibility problem. It will also automatically change the direction of the vertical speed as required. Always check that the preselected altitude is correct.

Rate of climb performance typically diminishes with increases in altitude.

NOTE: Always be sure the selected vertical speed is within the capability of the airplane for the existing conditions. Reduce the commanded vertical speed when the indicated airspeed falls below the best rate of climb speed for the altitude you are passing through.

6. Emergency Procedures

The Altitude Preselect provides only switching information to the autopilot and cannot contribute to an autopilot malfunction. If for any reason, the Aspen PFD Altitude Preselect does not function properly, select MENU on the PFD, select the STEC55X A/P page and change the VERT SPD CNTL to STEC55X. This action will cause the autopilot to revert to normal autopilot operation. This will completely remove the EFD1000 PFD Vertical Speed Control function from the autopilot system. Do not attempt further use until the fault has been corrected. The autopilot altitude hold mode (ALT) will override the Altitude Preselect when the ALT mode is manually selected by depressing the ALT switch on the autopilot Programmer/Computer.

We thank you for your continued support of Aspen Avionics and confidence in the Evolution Flight Display System.