

Entegra

Piper PA28 and PA32 EXP5000

Primary Flight Display Pilot's Guide



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1 Introduction

This Pilot's Guide provides information about the Entegra EXP5000 PFD for the following aircraft:

Aircraft Type	Model Name	Model Number
PA28	Warrior III	PA28-161
	Arrow	PA28R-201
	Archer	PA28-181
PA32	Saratoga II HP	PA32R-301
	Saratoga II TC	PA32R-301T
	6X	PA32-301FT
	6XT	PA32-301XTC

1.1 Notes and Warnings

Note: All images contained within this document, including screenshots and other displays, are for reference use only and are subject to change. The images contained herein may differ slightly from your actual equipment or display.

Notes and warnings provide guidance for the use of the EXP5000. Avidyne strongly suggests that you pay close attention to notes and warnings for your own safety.

For example:

Note: Notes provide useful information about how to use the EXP5000 Primary Flight Display.



Warnings are prefaced with exclamation points and denote information that can prevent serious injury or death on the part of the user.

The instructions and warnings in this manual are not intended to replace the instructions and warnings for other equipment on your aircraft. It is critical that you as the pilot in command have a complete

understanding of the warnings, operating instructions, and limitations for all equipment installed on your aircraft.



This manual assumes that the reader is an appropriately licensed pilot. Avidyne strongly recommends that you use the EXP5000 only under VFR conditions until you are very familiar with the EXP5000.

If you have questions, please contact Avidyne at **800-284-3963 (800-AVIDYNE)** before operating with the Entegra PFD under IFR conditions.



When using the EXP5000, be sure to cross-check the data displayed against other data sources for accuracy including other flight deck instruments and charts.

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2 EXP5000 System Overview

This section contains the following information:

- *Entegra EXP5000 Overview*, page 5
- *EXP5000 Upper Half Display*, page 7
- *EXP5000 Lower Half Display*, page 12
- *EXP5000 Buttons and Knobs*, page 15

2.1 Entegra EXP5000 Overview

This section provides an overview of the Entegra EXP5000 window.



Figure 1. The Entegra EXP5000 PFD

- 1) **Brightness Control (BRT/DIM)**—Allows you to adjust the display brightness. Press the top button to brighten the display; press the bottom button to dim it. The default brightness is 75%.

2) Upper Half Display—The upper half of your EXP5000 window displays information about your power plant, aircraft attitude, autopilot status (when equipped), navigation and more. This section includes the following:

- Engine instruments
- Autopilot annunciations
- Attitude Direction Indicator (ADI)
- Airspeed Indicator (ASI)
- Altimeter
- Vertical Speed Indicator (VSI)

For information about the data displayed on the upper section of the EXP5000 window, see Section 2.2, "EXP5000 Upper Half Display" on page 7.

3) Buttons—Buttons allow you to display new information or change the display. Button labels change to reflect the current environment.

4) Lower Half Display—Displays the Horizontal Situation Indicator (HSI) and other details about direction, windspeed, and flight plans. The HSI can display a moving map to help you determine your exact location. For more information, see Section 2.3, "EXP5000 Lower Half Display" on page 12.

5) Air Data Data Block— Contains Air Data information.

6) Left and Right Knobs—Knobs allow you to change the display as indicated for the particular settings. The knob labels change to indicate the active function.

- Left button and knob functions are described in *Left Buttons and Knob*, on page 15.
- Right button and knob functions are described in *Right Buttons and Knob*, on page 18.

2.2 EXP5000 Upper Half Display



Figure 2. EXP5000 Upper Half Display Symbols

Upper Half Display

The upper portion of the EXP5000 contains the following information:

- 1) **Oil Pressure**—As the engine comes online, displays the oil pressure in PSI. This data block supports engine start and is removed when the oil pressure is out of the warning (red) range.
- 2) **Manifold Pressure and RPM**—The MAP gauge indicates the current engine manifold absolute pressure. The RPM gauge displays current engine speed in revolutions per minute. If the MAP or RPM needle enters the warning (red) area, the numeric readout also displays value in red.
- 3) **FF (Fuel Flow)**—Displays the current engine fuel flow as a numeric display, to the nearest 0.1 gallon per hour (GPH).
- 4) **Autopilot Annunciation Area**—Displays the autopilot annunciations in your primary field of view. For more information, see the autopilot POH.

- 5) **Airspeed Tape**—Indicated airspeed with a display range from 20 kts to 300 kts. Each minor graduation represents 2 knots and each 10 knot major graduation is labeled. Color bands on the airspeed tape are as follows:

Band Color	Meaning
Red	V_{NE} up to top of the airspeed tape.
Yellow	V_{NO} up to V_{NE} .
Green	V_S up to V_{NO} .
White	V_{SO} up to V_{FE} .
Red	20 kts up to V_{SO} . This red band is removed during takeoff.

- 6) **Airspeed Window**—Displays current indicated airspeed in knots. Hash marks are displayed below 20 knots.
- 7) **Bank Angle Indicator**—The bank angle indicator is composed of an inverted white triangle and an upright white triangular Roll Pointer. The upright white triangle points to the current bank angle. Graduations are at 0, 10, 20, 30, 45, & 60 degrees. (Note: The 0 and 45 degree marks are inverted triangles).
- 8) **Skid/Slip Indicator**—The black trapezoid is centered under the roll pointer in coordinated flight. Full scale deflection is the width of the trapezoid.
- 9) **Pitch Ladder**—The pitch ladder is marked as follows:
- Every $2\frac{1}{2}^\circ$ within the range of $\pm 20^\circ$.
 - Every 5° from $+20^\circ$ to $+50^\circ$ and -20° to -30° .
 - 10° graduations of the pitch ladder have bar ends that point toward the horizon line.
 - $\pm 90^\circ$ is represented by small circles.
 - Large chevrons, described in *Using Trend Indicators*, on page 34, are only visible at excessive pitch angles and point toward the horizon (above $+50^\circ$ and below -30°).

10) Aircraft Reference Symbol (ARS)—The ARS is fixed on the display and provides a reference from which you can determine aircraft attitude. The EXP5000 can be configured as one of two different symbols:

- **Yellow Delta**—The Delta ARS displays in aircraft for which Flight Director is supported. The yellow outriggers are used with the ARS symbol to provide a reference for wings level flight.



- **Flying W**—The flying W displays in aircraft for which Flight Director is not supported.



11) Flight Director Steering Command Bars—Displays the accuracy of the pilot or autopilot tracking the autopilot commands. The pilot or autopilot is to steer the airplane toward the command bars until the ARS is tucked into the steering command bars. For more information about Flight Director, see *About Flight Director*, on page 31.

Note: The Flight Director steering command bars display only when Flight Director is enabled and available.

12) Horizontal Deviation Indicator (HDI)—Displays when:

- The NAV source is VLOC.
- The localizer signal has been received.

The source of the HDI data is displayed immediately to the right of the HDI (e.g. LOC or ILS). If the signal is lost, the HDI is replaced with a red **X** and the source letters turn red.

To remove the HDI, change either the NAV source or the VOR/LOC frequency.

13) Altitude Tape—Displays baro-corrected altitude with a display range from -1,000 feet to 35,000 feet. Each minor graduation represents 20 feet and each 100 foot graduation is labeled.

14) Altitude Window—Displays the current baro-corrected altitude.

15) Vertical Deviation Indicator (VDI)—Displays only when the NAV source is VLOC and an ILS glideslope signal has been received.

- When the GS signal is received, the letters *ILS* display in green below the VDI.
- If the GS signal is lost, the VDI is replaced with a red **X** and the letters *ILS* turn red.

To remove the VDI display, change either the NAV Source or the localizer frequency.

16) Vertical Speed Indicator (VSI)—Displays the vertical speed in Feet per Minute (fpm). The VSI shows $\pm 2,000$ fpm VSI scale. Scale graduations display every 100 fpm between $\pm 1,000$ fpm.

When vertical speed is above scale limits, a digital readout of the current vertical speed is displayed on the appropriate end of the VSI scale. The maximum displayed value of the digital readout is $\pm 4,000$ fpm.

EXP5000 Display Options

The following display options are set during installation:

Horizon Heading Reference Marks

Horizon Heading Reference Marks provide heading information on the ADI. If Horizon Heading Reference Marks are installed on your EXP5000, the marks and labels appear at each quadrant (N, E, S, W) and mid-quadrant (NE, SE, SW, NW). The reference pointer for the Heading Marks is the apex of the ARS.



Labeled VSPEEDS

Depending on your aircraft, under high power conditions, the V_Y label or V_X and V_Y labels are shown at the correct airspeeds for the Best Angle of Climb speed (V_X) and Best Rate of Climb speed (V_Y). V_X and V_Y are adjusted based on density altitude, as described in the Airspeeds for Normal Operations section of your aircraft *Pilot Operating Handbook*.

Under low power conditions, the V_G label displays at the Best Glide airspeed as listed in the Airspeeds for Emergency Operations section of your aircraft *Pilot Operating Handbook*

Note: If your aircraft POH lists Best Glide airspeeds for multiple gross weights, V_G is displayed as a range between the highest and lowest Best Glide airspeed. Make sure you consult the POH for the correct Best Glide airspeed for a particular gross weight.

2.3 EXP5000 Lower Half Display

The lower half of your EXP5000 provides the Horizontal Situation Indicator (HSI) function and other information. You can choose to display the HSI as either a full 360° circle or as a 120° arc. The arc view is shown in Figure 4 on page 14.



All features can display in both the 360° and 120° views.

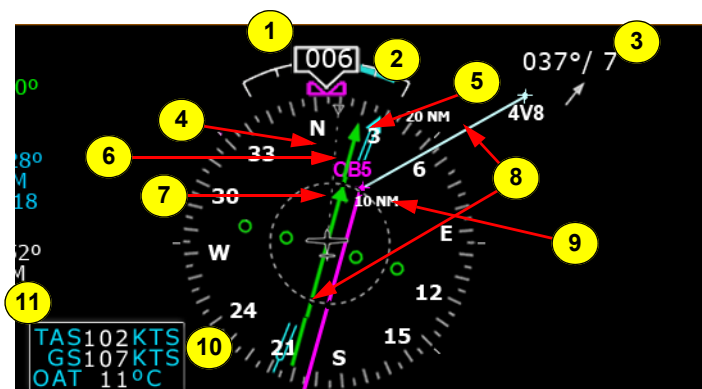


Figure 3. EHSI 360° View


- 1) **Magnetic Heading**—A numeric indication of current aircraft magnetic heading.
- 2) **Rate of Turn Indicator**—The tip of the blue rate of turn indicator displays the current rate of turn. The indicator is marked for 1/2 and full standard rate of turn. An arrowhead indicates a value beyond 1 1/2 standard rate. For more information, see *Using Trend Indicators*, on page 34.
- 3) **Wind Vector**—Displays the current wind speed and wind direction. The arrow indicates the direction of the wind relative to the current aircraft heading.



After you turn, there will be a lag of several seconds in updating current wind speed and direction.

The wind vector on the HSI is very useful in any phase of flight where you need to take winds aloft into account. You can use a combination of the wind vector and projected track line in navigation tasks.

Note: Under very light wind conditions or when wind speed cannot be calculated, wind data will be replaced by dashes.

- 4) **Projected Track Line**—The dashed gray projected track line originates from the aircraft present position symbol and terminates at the triangle along the outer edge of the compass rose. It displays a projection of the current ground track of the aircraft.
 To take the guesswork out of determining proper crab angles for wind corrections, align the projected track line with the desired course
- 5) **Bearing Pointer**—The blue dual-line bearing pointer is associated with the Bearing source and displays the current bearing to the Bearing waypoint (GPS 1 or GPS 2) or to the station (VLOC 1 or VLOC 2). A bearing pointer does not display if you tune the VLOC source to an ILS or LOC station.
- 6) **Course Deviation Indicator (CDI)**—The green single-line CDI displays deviation from the set or desired course.
- 7) **To-From Flag**—The small green arrow indicates whether you are heading *to* or *from* the current VOR or GPS waypoint. If you are heading *to* the VOR, the arrow points the direction you are flying. If *from*, the arrow points towards your most recent VOR or waypoint.
- 8) **HSI Moving Map**—Displays up to a maximum of 15 waypoints and labels from the active flight plan. The active leg of the flight plan is depicted in magenta, and all other legs of the flight plan are depicted in white. The moving map will also display waypoints and labels of an approach and hold.
- 9) **HSI Map Range**—When the moving map is selected for display on the HSI via the View knob, the outer and inner rings of the compass rose are labeled with range in nautical miles. Outer ring ranges are 2, 5, 10, 20, 50, 100, and 200 NM.

10) Compass Rose—In both the 360° view and 120° arc view, the minor graduation marks represent 5 degrees, major graduation marks represent 10 degrees, with every 30 degrees labeled. The outer edge of the compass rose is marked with reference marks.

11) Air Data Data Block—Displays:

- True Airspeed (TAS) in knots
- Ground Speed (GS) in knots
- Outside Air Temperature (OAT) in degrees Celsius



Figure 4. EHSI Arc (120°) View

2.4 EXP5000 Buttons and Knobs

Left Buttons and Knob

The left-hand buttons and knob on the Entegra EXP5000 allow you to set the navigation configuration and course.

The Nav (Primary Navigation) button is enabled by default (the enabled button has a green rim). To enable a different left-hand button, press it. Once enabled, you can continue to press the button to change the setting.

Note: The Nav button is re-enabled ten seconds after you last push or rotate the Bearing, Aux, and Range/View button. Avidyne suggests that you enable the desired button just before you change the knob.

The state of each navigation button is displayed in the adjacent data block, as shown in Figure 5. For information about the data blocks, see *Nav, Bearing, and Aux Data Blocks*, on page 17.






Figure 5. Left Knob & Buttons

- 1) **Nav (Primary Navigation)**—Controls the source for the Course Deviation Indicator (CDI) and adjacent data block. In a dual GPS/VHF navigator system, the available sources are: GPS 1, VLOC 1, GPS 2, and VLOC 2.

- 2) **Bearing (Secondary Navigation)**—Controls the source for the Bearing Pointer and adjacent data block. In a dual GPS/VHF navigator system, the available sources are: GPS 1, VLOC 1, GPS 2, VLOC 2, ADF (if available), OFF.
- 3) **Aux (Auxiliary Navigation)**—Controls the source of the adjacent data block only. In a dual GPS/VHF navigator system, the available sources are: GPS 1, VLOC 1, GPS 2, VLOC 2, ADF (if available), OFF.
- 4) **HSI Moving Map Range and View Button (Range/View)**—When selected, *Range/View* allows the left knob to control the HSI's moving map range and view:
 - **Pushing the knob**—Cycles the HSI through the HSI views (360° with map; 360° without map, 120° with map; 120° without map).
 - **Rotating the knob**—Changes the HSI moving map range when the map is available.



For more information about the HSI Map, see *Setting Up the HSI*, on page 26.
- 5) **Left Knob**—The function of the left knob changes depending on the enabled button.
 - When Nav is enabled, the Crs Set label displays when you can set a course, as shown in Table 2.1. For information about setting a course, see Section 3.5, "Using GPS/VHF Systems with the EXP5000" on page 27.

Table 2.1 Crs Set Labels

NAV Source	GPS Nav Condition	Left Knob Label
GPS 1 or GPS 2	GPS in Auto-Leg mode	None
GPS 1 or GPS 2	GPS in OBS mode	Crs Set  Cntr
VLOC 1 or VLOC 2	Tuned NavAid is a VOR	Crs Set  Cntr
VLOC 1 or VLOC 2	Tuned NavAid is an ILS or LOC	Crs Set 

- When Range/View is enabled, the left knob controls the HSI view, and if applicable, the moving map range, as follows:

Table 2.2 HSI Moving Map Range Labels

View Selection	Left Knob Label
With moving map	Range  View
Without moving map	 View

Nav, Bearing, and Aux Data Blocks

The Nav data block content varies depends on the source, as follows:

Table 2.3 Primary Navigation Source

NAV Source	Data Block Format
GPS 1 or GPS 2	<ul style="list-style-type: none"> ■ Waypoint Identifier ■ Desired Track to Waypoint ■ Distance to Waypoint ■ Time-to-Go to Waypoint
VLOC 1 or VLOC 2 (VOR Tuned)	<ul style="list-style-type: none"> ■ “VOR” ■ VOR Frequency ■ Course
VLOC 1 or VLOC 2 (ILS or LOC Tuned)	<ul style="list-style-type: none"> ■ “ILS” or “LOC” ■ Localizer Frequency ■ Course

The Bearing and Aux data block content depends on the source, as follows:

Table 2.4 Bearing or Aux Source

Bearing or Aux Source	Data Block Format
GPS 1 or GPS 2	<ul style="list-style-type: none"> ■ Waypoint Identifier ■ Bearing to Waypoint ■ Distance to Waypoint ■ Time-to-Go to Waypoint
VLOC 1 or VLOC 2 (VOR Tuned)	<ul style="list-style-type: none"> ■ “VOR” ■ VOR Frequency ■ Bearing to station
VLOC 1 or VLOC 2 (ILS or LOC Tuned)	<ul style="list-style-type: none"> ■ “ILS” or “LOC” ■ Localizer Frequency
ADF (if available)	<ul style="list-style-type: none"> ■ ADF Frequency (if available) ■ ADF Bearing
OFF	■ Blank

Right Buttons and Knob

After you press a button to enable it, use the right knob to change the target settings for that Bug (or setting). The knob label displays the current functionality, as shown in Table 2.5 on page 20.

Note: The *Hdg Bug* button is re-enabled ten seconds after you last push or rotate the knob to set the *Alt Bug*, *VSI Bug*, or *Baro Set* buttons. Avidyne recommends that you always select the desired button just before you use the knob.

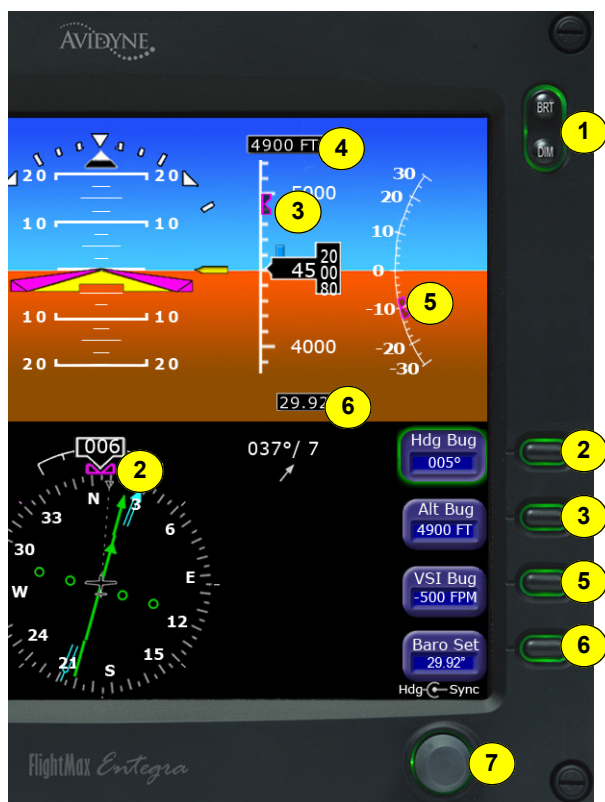
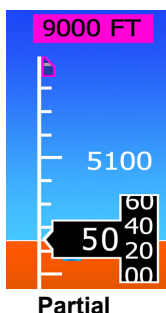


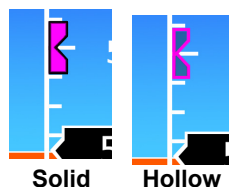
Figure 6. Right Buttons and Knob

- 1) **Brightness Control (BRT/DIM)**—Allows you to adjust the display brightness. Press the top button to brighten the display; press the bottom button to dim it.

- 2) **Heading Bug (Hdg Bug)**— Controlled by the right knob when *Hdg Bug* is selected, the notched part of the magenta bug symbol indicates the current Heading Bug value. The Heading Bug is positioned on the selected side of the compass rose and remains in partial view when the HSI is in 120° view and the Heading Bug value is outside the current compass rose field of view. The range is 001 to 360 degrees.

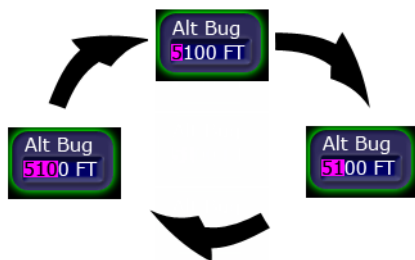


- 3) **Altitude Bug (Alt Bug)**— Controlled by the right knob when you select *Alt Bug*. The notched part of the magenta bug symbol indicates the current altitude preselect value. When the selected value is outside the current altimeter field of view, the Bug is positioned at the appropriate end of the tape and remains in partial view (left). The Alt Bug displays on the altitude tape and the range of



values is the same as the altitude tape (–1,000 feet to 35,000 feet).

Press the *Alt Bug* button to switch between the Alt Bug modes (1,000 ft., 100 ft., and 10 ft.). The default adjustment position is 1,000 ft. Push the button to select the mode, then rotate the knob to adjust the altitude for that mode.







- 4) **Altitude Preselect**—Displays the numeric value of the Altitude Bug setting and, when enabled, the altitude that the autopilot is commanded to capture and hold. When *Alt Bug* is selected, the numbers appear as black on magenta.
- 5) **Vertical Speed Indicator Bug (VSI Bug)**—Controlled by the right knob when you select *VSI Bug*. The notched part of the magenta bug symbol indicates the current VSI Bug set value. The VSI Bug displays on the VSI Indicator. The VSI Bug range is $\pm 1,600$ fpm, which is the maximum vertical speed allowed by the S-TEC 55X autopilot.

- 6) Barometric Correction Setting (Baro Set)**—Controlled by the right knob when you select *Baro Set*, the value indicates the current barometric correction setting. The baro correction may display as inches of mercury (Hg), millibars (Mb), or hectopascals (Hp). Barometric units are set during EXP5000 installation. The range of allowable values is 27.50" to 31.50" (931 mb/HPa - 1067 mb/HPa). The value appears in the button label and in the Barometric Correction Setting window.
- 7) Right Knob**—Once you enable one of the setting buttons, you can either rotate or push the knob:
- **Rotate**—Allows you to change the desired setting one number at a time.
 - **Push:**
 - ◆ **Hdg Bug, Alt Bug, and VSI Bug**—Syncs the setting to the current heading or vertical speed. After pushing the knob, you can then rotate it to easily make small adjustments to your heading and speed.
 - ◆ **Baro Set**—Sets the barometric correction to the international standard setting of 29.92" (1012 hPA/mb).

Table 2.5 summarizes the right knob settings:

Table 2.5 Right Knob Settings

Active Button	Knob Label	Rotary Action	Push Action
Hdg Bug	Hdg  Sync	Sets Heading Bug	Syncs Heading Bug to current magnetic heading.
Alt Bug	Alt  Sync	Sets Altitude Bug	Syncs Altitude Bug to nearest 100'.
VSI Bug	VSI  Sync	Sets VSI Heading Bug	Syncs VSI Bug to nearest 50 fpm.
Baro Set	Baro  Std	Sets Baro	Sets Baro to 29.92.

3 Flying with the EXP5000

3.1 Introduction

This chapter contains all the basic information you need to use the EXP5000. Information includes:

- *Starting the EXP5000*, page 22
- *EXP5000 Alignment Messages*, page 23
- *Setting Up the HSI*, page 26
- *Using GPS/VHF Systems with the EXP5000*, page 27
- *Controlling the Autopilot*, page 28
- *Precision Flying with EXP5000*, page 33
- *Using the EXP5000 for Approaches*, page 36

3.2 Starting the EXP5000

The EXP5000 includes a solid state Air Data and Attitude Heading Reference System (ADAHRS) which requires an alignment time before you are ready for flight.

The EXP5000 is designed to operate during engine start and shut down procedures. EXP5000 start-up is automatic once power is applied via the battery switch.

➡ A common startup procedure is to turn on BAT and conduct the aircraft preflight during the ADAHRS alignment process. The PFD and the ADAHRS alignment process may restart when you start the engine.

Approximately 10 seconds after turning on the EXP5000, the AHRS Alignment message box displays. In addition to AHRS Alignment messages, the box also displays the aircraft model, product name, and software part number. The informational messages automatically transition as described in Table 3.6 on page 23. When warm-up is complete, the message box is removed.



Figure 7. Entegra EXP5000 AHRS Alignment Message

Typical alignment time is 3 minutes but may take longer if the aircraft is subjected to motion. Air data (airspeed, altitude, vertical speed) will become valid prior to attitude data. Engine instruments are available after EXP5000 start-up. The start-up message block displays a series of messages as shown in Figure 3.6 on page 23, and is automatically removed when warm-up is complete.

EXP5000 Alignment Messages

Note: For faster alignments (3 minutes or less), Avidyne recommends that you do not move the aircraft until alignment is complete. The OK TO TAXI message provides increased flexibility during ground operations, but it may extend overall alignment time.

Table 3.6 Initialization Phases

Alignment Phase & Dialog Displayed	Approximate Duration	Pilot Action
INITIAL AHRS ALIGNMENT REMAIN STATIONARY OK TO TAXI IN xx SECONDS	30 Seconds	Remain Stationary
AHRS WARMING UP OK TO TAXI	90 seconds, if stationary. Up to several minutes if moving.	You can taxi, but Avidyne recommends remaining stationary for faster overall alignments
READY FOR FINAL AHRS ALIGNMENT BRING AIRCRAFT TO A STOP AS SOON AS PRACTICAL	5 seconds, if stationary. Up to several minutes if moving.	If moving, bring aircraft to a stop as soon as practical.
FINAL AHRS ALIGNMENT REMAIN STATIONARY READY TO GO IN X SECONDS	40 - 45 seconds	Remain stationary

AHRS Alignment Errors

While alignment and startup should proceed smoothly, in the case of error, you may see one of the following messages in the AHRS Init box:

Table 3.7 AHRS Alignment Errors

Message	Recommended Pilot Action
UNABLE TO COMPLETE ALIGNMENT MOTION SENSED - STOP AIRCRAFT Alignment Should Resume Within 2 Mins.	Stop aircraft as soon as practical and wait for alignment to resume.
UNABLE TO COMPLETE ALIGNMENT MAGNETIC ANOMALY IN THE AREA Recommend Moving Aircraft	Move Aircraft to different location and begin startup operations.
UNABLE TO COMPLETE ALIGNMENT SOFTWARE FAULT EXPERIENCED Recommend Power Cycle	Power Cycle the PFD. If message displays again, contact Avidyne Technical Support.
UNABLE TO COMPLETE ALIGNMENT ATTITUDE SENSOR FAILURE Recommend One-Time Power Cycle	Power Cycle the PFD. If message displays again, contact Avidyne Technical Support.
UNABLE TO COMPLETE ALIGNMENT NO COMM. WITH MAGNETOMETER	Contact an Avidyne Entegra Certified Service Center.

Note: If any error message continues to display, contact an Avidyne Entegra Certified Service Center.

3.3 Startup Settings



Figure 8. Default Startup Settings

When powered up, the Entegra EXP5000 starts with the following default values:

- **Hdg Bug, Alt Bug, Baro Set**—The value from just before previous shutdown
- **Map Range, Map View**—The setting from just before previous shutdown
- **Alt Bug Mode**—Thousands mode
- **VSI Bug**—Set to 0
- **Nav**—GPS 1
- **Bearing**—OFF
- **Aux**—OFF
- **Right Side Active Button**—Hdg Bug
- **Left Side Active Button**—Nav
- **Right Knob**—Sets Hdg Bug
- **Left Knob**—Inactive

3.4 Setting Up the HSI

The Entegra EXP5000 can integrate with single or dual GNS 400/500-series GPS or GPS/VHF navigator systems. When your EXP5000 PFD is installed, it is configured for the number and type of navigator systems on board.

Use the *Nav* button (Primary Nav) to select the navigator source for the green single-line CDI and the moving map data. The active flight plan from the selected navigator unit drives the moving map on the HSI and will display up to 15 waypoints, including the curved approach path and holding pattern segments.

GPS 1 is also the primary source for ground-speed readout and a required element for the wind vector calculation and display. If GPS 1 is unavailable, ground speed and wind vector data are derived from GPS 2. If the Nav source is selected to a VOR or localizer source, the HSI will display the appropriate course deviation indicator. The moving map from the associated GPS will still display.

For more information about the Wind Vector and the HSI moving map display, see Figure 4 EHSD Arc (120°) View on page 14.

Use the *Bearing* button to select the Nav source for the blue double-line bearing pointer. If the selected bearing source is a Localizer, the bearing pointer does not display.

To take full advantage of the EXP5000, GPS 2 can be loaded with Direct-To waypoints, alternative flight plans, or Navaid frequencies to provide additional guidance beyond what is loaded into GPS 1. This information can be selected for display on the EXP5000 as the *Bearing* or *Aux*.

While using the crossfill capability of dual-configured GPS systems is fully supported and a common technique, it can prevent you from taking full advantage of the multiple Nav source display capability of the EXP5000.

For information about loading data into your GPS/VHF unit see the *Pilot's Guide* for your GPS/VHF system.

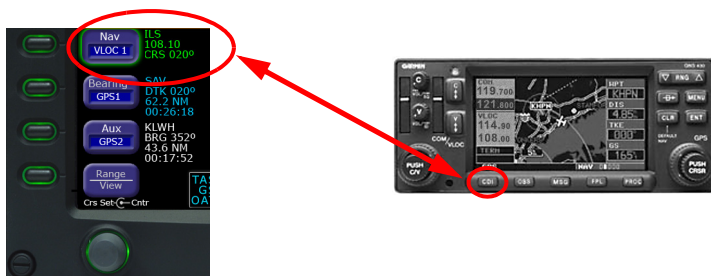
Note: The CDI on the EXP5000's HSI comes from the selected *Nav* source which may be different from the CDI displayed on the GPS 1 or GPS 2 displays.

3.5 Using GPS/VHF Systems with the EXP5000

You can use the EXP5000 to set a primary navigation course setting on the HSI when one of three conditions is met:

- **PFD Nav Source = GPS 1 or GPS 2** and the selected GPS/VHF system is in OBS mode.
- **PFD Nav Source = VLOC 1 or VLOC 2** and the current frequency is a VOR station.
- **PFD Nav Source = VLOC 1 or VLOC 2** and the current frequency is an ILS or localizer. In this case, you can set a course for reference. The CDI is driven by the received localizer signal, regardless of the course set.

The CDI scale on the EXP5000's HSI is automatically set by the GPS/VHF system as a function of the Nav source you select with the PFD Nav button.



The source you select for Nav is coupled with the *CDI* button on the GPS/VHF unit, as follows:

- When you toggle the *Nav* button on the EXP5000 from GPS 1 to VLOC 1 and back, the CDI source on GPS 1 changes from GPS to VLOC and back to match the current *Nav* setting.
- Similarly, when you toggle the *CDI* button on the GPS/VHF unit from GPS to VLOC and back, the *Nav* source on the EXP5000 changes to match.

➔ Avidyne recommends that you use the CDI button on GPS 1 to toggle the Nav source back and forth, especially for dual-GPS installations where the PFD *Nav* button cycles through all four Nav sources (GPS 1, VLOC 1, GPS 2, VLOC 2), and the CDI button on GPS 1 makes it easy to switch the EXP5000 between GPS 1 and VLOC 1 and back.

3.6 Controlling the Autopilot

Your Entegra EXP5000 is integrated with the S-TEC Fifty Five X (55X) Autopilot. When you select an active autopilot mode, full guidance is provided from the EXP5000 to the autopilot, including heading captures and smooth transitions to altitude.

The status of the reference Bugs, autopilot annunciations, and Flight Director steering command bars indicate when the EXP5000 is coupled with the autopilot. A solid magenta Heading, Altitude, or VSI Bug indicates that the function is currently coupled to an active mode of the autopilot. A hollow magenta Bug indicates that the function is not currently coupled to the autopilot in an active mode. In other words, a hollow Bug indicates manual or “hand-flying” status. For more information about the EXP5000 bugs, see *Right Buttons and Knob*, on page 18.

In Flight Director-equipped aircraft, when using a vertical mode of the autopilot, a set of Flight Director command bars will indicate the required steering of the aircraft to achieve the commanded tracking from the autopilot. In full autopilot mode, “AP” will be in the autopilot annunciation field, the command bars will be visible and magenta and the aircraft should track those bars very precisely.

In Flight Director only mode, “FD” will be displayed in the autopilot annunciation field, the command bars will be visible and green, and you are expected to use the flight controls as required to track those bars.

Note: A small amount of jitter of the command bars when in FD mode is considered normal.

The following is a description of the six autopilot modes supported by the EXP5000. The autopilot can only be coupled to the GPS/VHF selected as the PFD Nav source. The autopilot cannot be coupled to the GPS/VHF unit selected as the PFD Bearing source.

Horizontal Modes

Heading Capture/Hold Mode (HDG Mode)

Press the *Hdg Bug* button on the EXP5000 and rotate the right knob to set a desired heading. Press the *HDG* button on the autopilot control head to engage heading mode. At this point, the Heading Bug will become solid magenta and the autopilot will track the input heading. The autopilot control head and the EXP5000 will indicate

“HDG”. The Heading Bug will remain solid magenta until heading mode is cancelled. Select a new heading at any time while the autopilot is in heading mode and the autopilot will track the new Heading Bug value.

Nav Mode

Press the *NAV* button on the autopilot control head to engage Nav mode. The autopilot will intercept and track the desired course. In this mode, the autopilot tracks the active plan of the selected navigator (Nav=GPS 1 or GPS 2) or an active VOR or localizer (Nav=VLOC 1 or VLOC 2). The autopilot control head and the EXP5000 will indicate “NAV”. If a localizer is selected, the autopilot will automatically select APR mode. In this mode, the Heading Bug will be hollow and remains at its last set value, which is not necessarily aligned with the Nav course. Both the autopilot control head and the EXP5000 will annunciate “NAV APR”. Glideslope capture is supported while in “NAV APR ALT” mode.

GPS Roll Steering Mode (GPSS Mode)

In GPS Roll Steering mode, the autopilot tracks the active flight plan of the selected GPS (Nav=GPS 1 or GPS 2). Press the NAV button on the autopilot control head twice to engage GPSS mode. The autopilot will then begin tracking the GPS steering commands from the selected GPS. The autopilot control head and the EXP5000 autopilot annunciation bar will indicate GPSS. Avidyne recommends that you use GPSS mode as the Nav Mode during autopilot operations to provide a higher level of accuracy. In this mode, the Heading Bug will be hollow and remains at its last set value, which is not necessarily aligned with the Nav course.



Do not use GPSS mode on the final approach segment of a VLOC approach (ILS, LOC or non-GPS-overlay VOR). You must select NAV mode (and clear GPSS mode) prior to the turn onto the final approach course.



If a VLOC is selected in NAV on the PFD and GPSS mode is engaged on the autopilot, the autopilot will track the active flight plan in GPS 1 if VLOC 1 is selected or GPS 2 if VLOC 2 is selected. It will not track VLOC 1 or VLOC 2 as the selected source in NAV on the PFD. Therefore the course deviation on the PFD CDI and the course deviation flown by the autopilot can be different. This situation may be confusing and should be avoided.

During this condition, the normally green “GPSS” annunciation on the PFD changes to amber to alert you to this condition.

Vertical Modes

Note: One of the Horizontal Modes (HDG or NAV) must be engaged on the autopilot control head before you can select a vertical mode.

Altitude Hold Mode

Push *ALT* on the autopilot control panel to enable altitude hold. The target altitude is the current altitude when you pressed the *ALT* button and the autopilot will hold that altitude. The Alt Bug will be set to the nearest 100 feet of the current altitude and will become solid magenta. If Flight Director is available, the Flight Director steering command bars will display.

Note: You can use the knob on the right side of the autopilot control head as an altitude “bump,” such that each rotational click of the knob will change target altitude by 20 feet. The Altitude Bug setting will not change.

Vertical Speed Mode (VS mode)

Push the *VSI Bug* button and rotate the right knob on the EXP5000 to set the desired vertical speed. The VSI Bug is hollow at this point. Engage VS mode by pressing the *VS* button on the autopilot control head. At this point, the VSI Bug will become solid magenta. If Flight Director is available, the Flight Director steering command bars will display. When VS mode is cancelled, the VSI Bug will become hollow but remains at its last value.

Note: The VSI Bug may be set to a range of +/- 1,600 fpm. This range coincides with the VS limits of the autopilot.

Altitude Capture Mode

Push the *Alt Bug* button on the EXP5000 and rotate the right knob on the EXP5000 to set a desired target altitude. Engage Altitude Capture mode by simultaneously pressing the *ALT* and *VS* buttons on the autopilot control head. The *Alt Bug* and *VSI Bug* will become solid magenta, while the Flight Director steering command bars, if configured on the aircraft, are shifted to correspond with the autopilot commands.

- In autopilot mode, the autopilot control head and the EXP5000 autopilot annunciation bar will indicate “AP”, and the autopilot will follow the *VSI Bug* to the selected target altitude.
- In Flight Director mode, the autopilot control head and the EXP5000 autopilot annunciation bar will indicate “FD”, and the Flight Director command bars will move to the appropriate location, but it is your responsibility to match the command bars.

As the target altitude is approached, the *VSI Bug* will automatically move toward zero and will become hollow when the target altitude is captured. At the target altitude, the delta-shaped aircraft reference symbol is tucked into the Flight Director command bars.



When engaging the Altitude Capture Mode, confirm that both *ALT* and *VS* are engaged on the autopilot. If *VS* is not engaged the autopilot will level the aircraft at the current altitude when *ALT* is engaged on the autopilot.

Autopilot Operation During PFD Failures

In the unlikely event of a total PFD failure, the autopilot can still be controlled via its control head. GPS roll steering (GPSS Mode) is the only autopilot horizontal mode available. *Alt Hold Mode* and *VS mode* are still available and may be controlled using the *ALT* and *VS* buttons and the rotary knob on the autopilot control head. See the autopilot POH for usage instructions.

Note: Only Navigator1 is capable of being the navigation source to the autopilot in the event of a PFD failure.

About Flight Director

The Flight Director is a display of the flight profile commanded from the autopilot. Typically, a remote switch on the instrument panel allows you to toggle control of the autopilot modes between autopilot (*AP*), and Flight Director (*FD*).

The color of the Flight Director steering command bars reflect the status of the autopilot, as follows:

- When the autopilot is in AP mode, the Flight Director steering command bars are magenta. In AP mode, the autopilot steers the airplane toward the command bars until the Aircraft Reference Symbol (ARS) is tucked into the steering command bars.
- When the autopilot is in FD mode, the Flight Director steering command bars are green. In FD mode, the command bars show you where to steer, but you need to guide the aircraft so that the ARS is tucked into the steering command bars.

3.7 Precision Flying with EXP5000

This section describes several techniques which take advantage of the EXP5000's features to produce precision flight performance.

Obtaining Level Flight

You can obtain level flight by placing the apex of the yellow delta-shaped reference symbol on the horizon line in cruise conditions appropriate to your aircraft. The pitch angle for level flight will vary with flight conditions, depending on speed, altitude and weight. There is no manual adjust capability (i.e. parallax adjust).

Flying a Constant Rate Turn

The proper technique for flying a constant rate turn involves using a combination of the turn indicator and the bank angle indicator. Figure 9 shows a constant rate turn to the left.



Figure 9. Flying a Constant Rate Turn

Initiate the standard rate turn by banking to an initial bank angle of 20 degrees with reference to the bank angle indicator, then adjust the bank angle to standard rate by reference to the standard rate turn indicator. Deviations from an intended bank angle are extremely easy to notice with the EXP5000 ADI horizon line.

Using Trend Indicators

Use the trend indicators to capture and maintain a desired airspeed and altitude by adjusting the pitch and/or power to the airspeed or altitude you want. This results in a smooth capture of the desired airspeed and altitude.



Figure 10. Trend Indicators

- 1) **Airspeed Trend Indicator**—The tip of the blue airspeed trend indicator displays the predicted airspeed six seconds into the future at the current rate of change. The Airspeed Trend Indicator displays changes greater than 0.8 knots/sec. An arrowhead indicates a value beyond the current tape field of view.
- 2) **Excessive Pitch Chevrons**—Large white chevrons display at pitch values greater than +50 degrees and less than -30 degrees. In all cases, the chevrons point towards the horizon line.
- 3) **Rate of Turn Indicator**—The tip of the blue rate of turn indicator displays the current rate of turn. The indicator is marked for 1/2 and full standard rate of turn. An arrowhead indicates a value beyond 1 1/2 standard rate.

- 4) **Altitude Trend Indicator**—The tip of the blue airspeed trend indicator displays the predicted altitude six seconds into the future at the current rate of change. An arrowhead indicates a value beyond the current tape field of view.

3.8 Using the EXP5000 for Approaches

Precision Approaches



Figure 11. Flying an ILS Approach

Flying an ILS Approach

The EXP5000 is designed to take full advantage of the auto transition capability of the Navigator systems for flying a GPS flight plan ending in an ILS approach. In this case, the horizontal deviation indicator (HDI) and vertical deviation indicator (VDI) windows are displayed on the ADI.

The CDI course is automatically set to the inbound localizer course resulting in a hands-free transition.

As long as you select a localizer or ILS via the EXP5000 Nav button, the HDI and VDI will automatically display when applicable localizer and glideslope signals are received. No pilot action is required for the HDI and VDI to display.

Avidyne recommends that you set the inbound course using the EXP5000 Course Set knob to serve as reference during the localizer intercept and tracking. This is automatic if the Navigator system has been set to Autoslew. The CDI deflection will be driven by the localizer signal itself, regardless of the course setting.

Flying an Autopilot-Coupled Approach

To perform an autopilot-coupled approach, ensure the approach has been activated in the Navigator selected as the Nav source. Then:

- Press *NAV* on the autopilot control head to activate Nav mode.
- Press the *APR* button on the Autopilot control head to activate the Glideslope capture capability.

The autopilot will then track the Glidescope and localizer. Refer to the autopilot user's guide for Glideslope capture scenarios.

Avidyne recommends that you set the Altitude Bug to the published approach decision height to serve as a visual reference during the approach.

Note: For maximum situational awareness during all types of precision and non-precision instrument approaches, always select and activate the approach in the Navigator. This will enable the EXP5000 to display the approach waypoints on its moving map.

Note: Upon reaching the Final Approach Fix (FAF), ensure that the correct baro is entered in both the EXP5000 and standby altimeter. Also verify that the EXP5000 and standby altimeter indicate the same altitude.

Non-Precision Approaches

The EXP5000 is also designed to aid in the flying of non-precision approaches. Once the published approach has been activated in the Navigator system, the inbound course on the EXP5000 will be automatically set to match the inbound course of the published approach.

Flying an Autopilot-Coupled Non-Precision Approach

A recommended technique when performing an autopilot-coupled non-precision approach is:

- 1) Select the *HDG*, *NAV* and *ALT* buttons on the autopilot while still outside the Final Approach Fix (FAF).
- 2) Prior to reaching the FAF, if present, set the desired VS descent rate:
 - Use the EXP5000 HDG Bug to set the desired heading for climbout/missed approach.

- Use the EXP5000 Alt Bug to set the desired intermediate level off altitude or the minimum descent altitude (MDA) as a visual reminder.
- 3) After crossing the FAF, select VS mode on the autopilot.
 - 4) Just prior to reaching MDA, select *ALT* on the autopilot to command altitude hold.

Flying a Back Course Localizer Approach

The EXP5000 is designed to fully support flying back course localizer approaches. To perform a back course localizer approach, ensure the front course value is set via the EXP5000 Course Set knob. As soon as the EXP5000 determines that it is established on the back course localizer, the HDI source label indicates “LOC BCRS” and both the HDI and CDI display correct sensing. There is no further pilot action required.

Note: For coupled approaches, the Autopilot may have to be set to reverse mode. Please consult the Autopilot POH for proper operation.

Missed Approach

Prior to missed approach, disconnect the autopilot, ensure the aircraft is trimmed for the power setting, establish a climb attitude and use the EXP5000 Alt Bug to set the desired missed approach altitude. On the climbout, select *HDG* or *NAV* (depending on missed approach instructions) on the autopilot, press *ALT* and *VS* simultaneously on the autopilot, and press *OBS* on the Navigator to continue the coupled missed approach.

4 Invalid Sensors and Error Conditions

When the data coming into the EXP5000 is unavailable or otherwise invalid, the EXP5000 provides appropriate warnings and messages.

This section discusses the following topics:

- *Invalid Air Data*, page 40
- *Invalid Heading*, page 41
- *Crosscheck Monitor*, page 42
- *Warmstart Conditions*, page 43
- *Recoverable Attitude*, page 44
- *Invalid Attitude & Heading*, page 45
- *Invalid Engine Data*, page 46
- *Nav Source Crosscheck*, page 47

4.1 Invalid Air Data

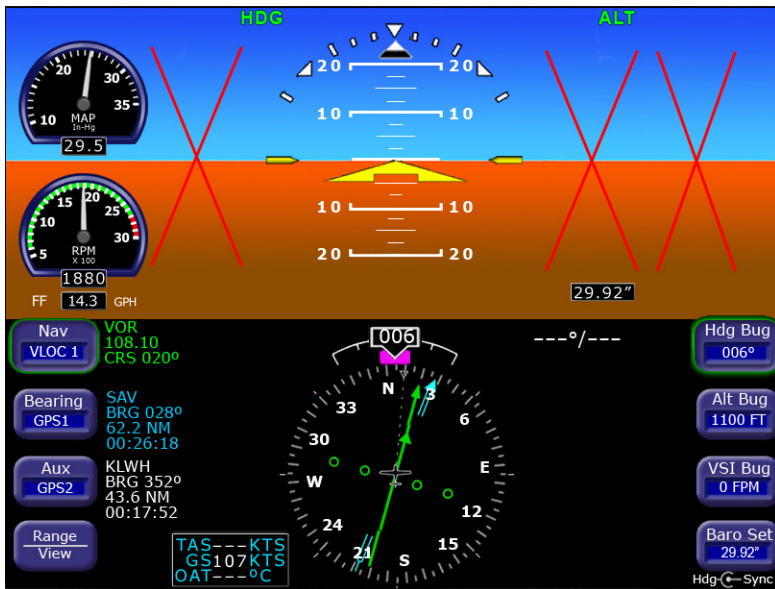


Figure 12. Invalid Air Data

If air data becomes unavailable:

- 1) Airspeed, altitude, and vertical speed data are removed and replaced by red **X**'s.
 - 2) Wind Vector data is removed and replaced by dashes.
 - 3) Outside Air Temperature and True airspeed data are removed and replaced by dashes.
- If invalid air data occurs use the mechanical backup airspeed indicator and altimeter. Avidyne recommends that you cross reference the EXP5000 attitude to the backup ADI when flying with invalid air data.

Note: When the EXP5000 determines that the air data is valid, it will resume air data display.

4.2 Invalid Heading

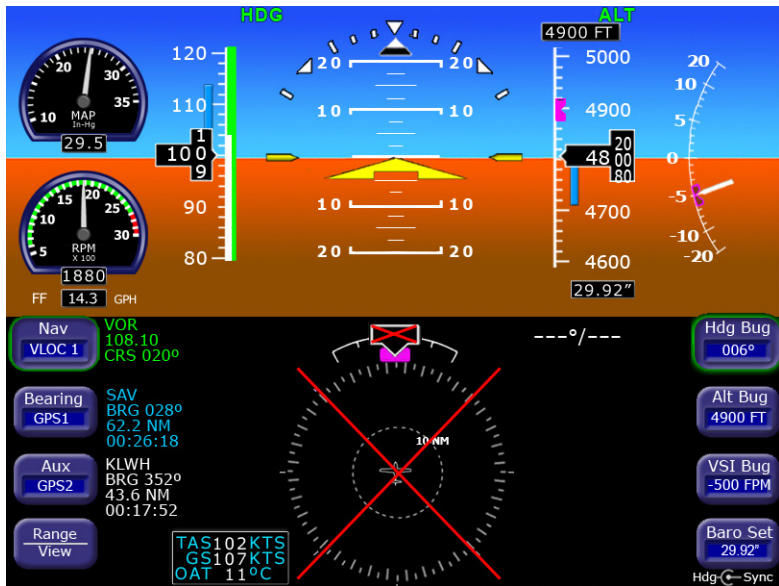


Figure 13. Invalid Heading

If valid heading data becomes unavailable, heading data and HSI navigation data are removed from the display and replaced with a red **X**.

Note: Refer to the aircraft compass for heading. Refer to the EX5000 MFD or GPS Navigator for ground track and flight plan.

When heading data is determined to be valid, the display of heading and HSI navigation data will be restored.

4.3 Crosscheck Monitor



Figure 14. Crosscheck Monitor

The Entegra EXP5000 comes equipped with a self-check monitor. When this monitor detects a condition that does not warrant removal of data, a CROSSCHECK ATTITUDE warning message displays.

When this message is displayed, scan all backup instruments and auxiliary instruments (backup attitude indicator, backup airspeed indicator, and back up altimeter) to crosscheck the aircraft attitude. The warning message is automatically removed when the self-check monitor confirms the EXP5000 attitude is valid.



If a CROSSCHECK ATTITUDE alert displays on the PFD, Avidyne strongly recommends using Autopilot (not HDG mode).

The message will not display when air data is invalid (as shown on page 40). Cross referencing the EXP5000 attitude to the backup ADI is recommended during flight with invalid air data.

Note: Highly dynamic maneuvering such as multiple linked lazy-8 leaves may result in small pitch and/or bank errors. If the errors build up to an excessive amount, the crosscheck attitude message may display.

4.4 Warmstart Conditions

The EXP5000 is capable of performing a warmstart from a fully aligned condition when subjected to a power loss of less than 30 seconds. In this event, the “PLEASE STANDBY” message in the warmup box is displayed for approximately 2 seconds followed by the “ATTEMPTING QUICK RESTART” message and its countdown. There is no requirement to limit dynamic maneuvering during this warmstart attempt.

Note: Two warmstart attempts in a row without a successful alignment between attempts will result in a full alignment attempt.

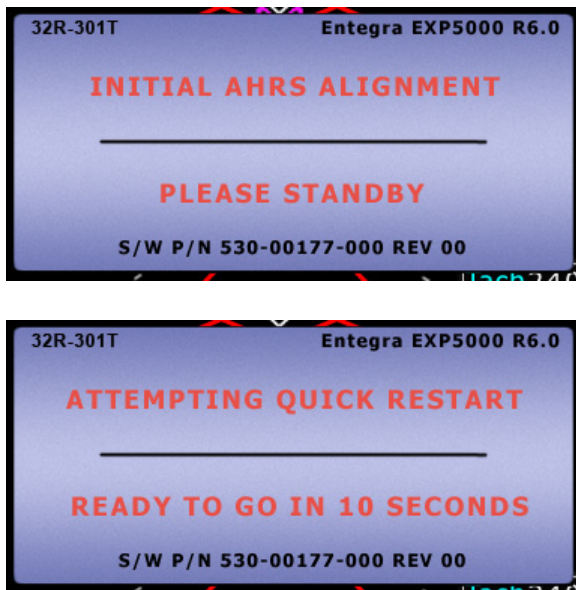


Figure 15. Quick Restart Messages

4.5 Recoverable Attitude



Figure 16. Recoverable Attitude Situation

If a recoverable attitude data failure occurs:

- 1) All normal button labels are removed.
- 2) Attitude data is removed from the display and replaced with a red **X**.
- 3) A *Fast Erect* button label and message displays.

When you press *Fast Erect*, the message will change to "Maintain straight and level flight" until the 10 second count-down timer expires. At that point, all attitude data is restored.



It is imperative that you obtain straight and level flight before pressing *Fast Erect*. Use the backup instruments and/or outside visual references to obtain straight and level conditions.

4.6 Invalid Attitude & Heading



Figure 17. Invalid Attitude and Heading

If valid attitude and heading data becomes unavailable, attitude data, wind vector data, heading data, and HSI navigation data are removed from the display.

Note: You may be able to recover from a failed attitude condition by pulling both PFD circuit breakers for less than 20 seconds. This will initiate a warmstart as described in Section 4.4, "Warmstart Conditions" on page 43.



If warmstart is unsuccessful, use back-up instruments for attitude and heading for the remainder of the flight. During IFR flights, proceed to the nearest VMC conditions and do not re-enter IMC.

Note: For autopilot-equipped aircraft, consider using the autopilot to reduce workload. Use GPSS mode to maintain the flight plan route.

4.7 Invalid Engine Data



Figure 18. Invalid Engine Data

If valid engine data becomes unavailable:

- 1) Engine Instrument needles will be removed from the indicator dials.
- 2) Engine Instrument numeric readouts will be shown as white dashes instead of digits.



It is likely that if data for one engine instrument is lost, that data will be lost for all engine instruments. Use engine instruments on the Multi-Function Display (MFD). If engine sensors have failed and the data is not available on the PFD or MFD, land as soon as practical.

4.8 Nav Source Crosscheck

When receiving valid navigation information from two radios tuned to the same navigation aid, the EXP5000 compares the data from the two and provides an alert if there is a miscompare.

This comparison is only done when one of the radios is selected as the primary navigation source.

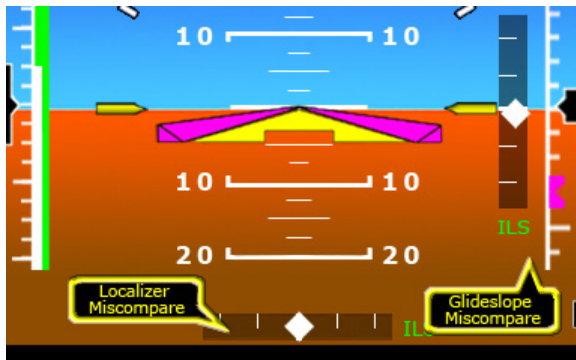


Figure 19. Localizer and Glideslope Crosscheck Errors



Figure 20. VOR Crosscheck Error

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