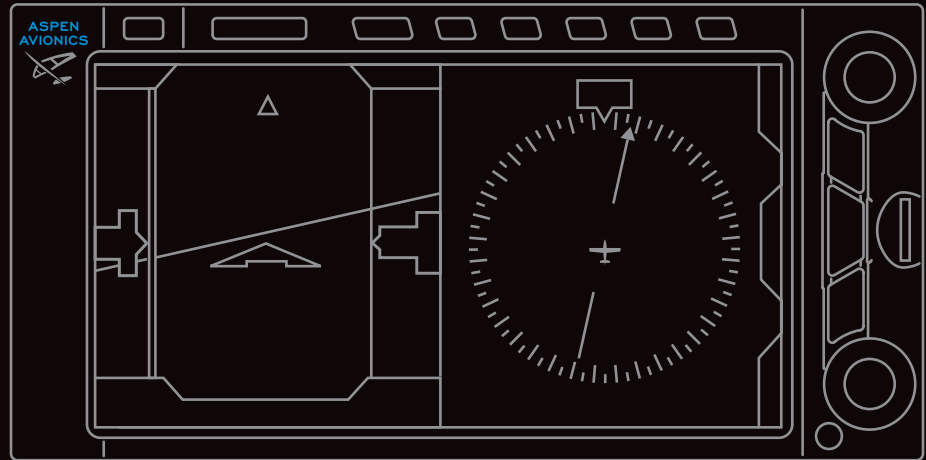


# Evolution Backup Display Pilot's Guide

For Evolution Backup Display Basic

**EVOLUTION**  
FLIGHT DISPLAY



ASPEN AVIONICS™

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# Document Revisions

REVISION	DESCRIPTION of CHANGE
()	Initial release.
Rev A	Complete re-write

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The EFD1000, EFD1000C3, EFD1000H, EFD500, and EFD500H, and derivatives thereof, are protected under U.S. Patent Number 8,085,168 and additional patents pending.

# Approvals

The FAA and the EASA (European Aviation Safety Agency) has approved the EFD1000 PFD under the following TSOs and ETSOs:

## **FAA TSO (Technical Standard Order)**

TSO-C2d, TSO-C3d, TSO-C4c, TSO-C6d, TSO-C8d, TSO-C10b, TSO-C106, TSO-C113

## **EASA ETSO (European Technical Standard Order)**

ETSO-C2D, ETSO-C3D, ETSO-C4C, ETSO-C6D, ETSO-C8D, ETSO-C10B, ETSO-C106, ETSO-C113

The following certification levels also apply to this product:

- Environmental Certification Level: RTCA DO-160E
- Software Certification Level: RTCA DO-178B Level C

This Pilot's Guide provides information on the use and operation of the Evolution Backup Display. This guide is current as of the latest revision listed on the Document Revisions page. Specifications and operational details are subject to change without notice when using an earlier or later software version. Please visit the Aspen Avionics web site for the most up-to-date Pilot's Guide.

Installation of the Evolution Backup Display in a type-certificated aircraft must be performed in accordance with the latest revision of the EFD1000 Installation Manual.

Aspen Avionics, Inc.  
5001 Indian School Road NE  
Albuquerque, NM 87110

Phone: (505) 856-5034  
Fax: (505) 314-5440

[www.aspenavionics.com](http://www.aspenavionics.com)

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# Conventions

The following conventions, functionality, terminology, color philosophy, and definitions are used in this manual and on the Evolution Backup Display.

## Terminology

The term “**EBD**”, is used throughout this Pilot’s Guide and refers to the Evolution Backup Display. This publication is specifically for the Evolution Backup Display, Basic Landscape and Portrait version.

**Figure 1** shows a typical Evolution Backup Display. This guide uses the terminology listed in **Table 1** when referring to specific parts of the EBD and **Chapter 4** provides an in-depth discussion and step-by-step instructions for all the available functionality.

## Example Graphics

There are two configurations of Evolution back up display. A portrait or vertical layout and a landscape or horizontal layout. Many of the figures included in this Pilot’s Guide are screen shots of the Evolution Back up Display Basic Landscape version. The functionality of the units is the same the only difference is the portrait and landscape layout.

The example graphics and screen shots used throughout this Pilot’s Guide are provided for reference only and are taken from a simulated flight. They should not be used for actual flights.



Figure 1  
Evolution Backup Display – Basic, Landscape Version –  
Knobs, Buttons, and Keys

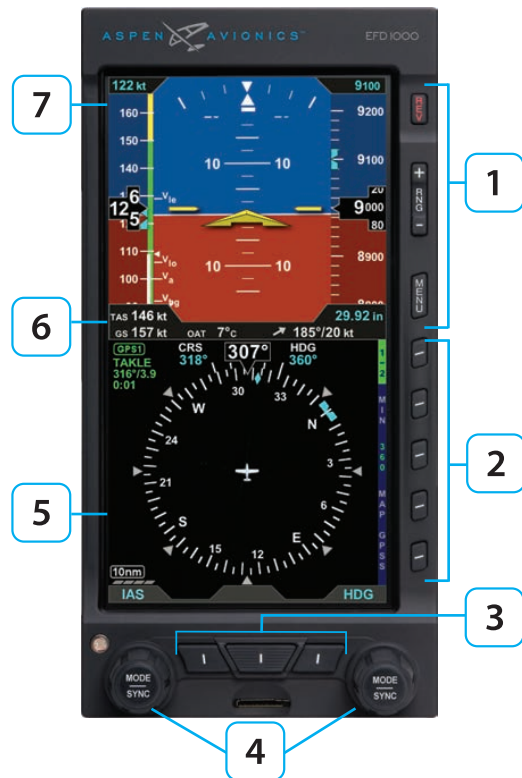


Figure 1a  
Evolution Backup Display – Basic, Portrait Version –  
Knobs, Buttons, and Keys



Term	Example
1 Buttons	PWR (Power) Button, Range Buttons, MENU Button
2 Hot Keys / Menu Keys	Five keys across the top of the display
3 Buttons	Top Button, CDI Navigation Source Select Button (Middle Button), Bottom Button
4 Knobs	Top (HDG) Knob, Bottom (IAS) Knob
5	Navigation Display
6	Data Bar
7	Attitude Display

Table 1  
Evolution Backup Display – Basic, Landscape Version – Knobs, Buttons, and Keys

 **NOTE**

*As the number of colors used on the display is limited, to ensure adequate color differentiation under all lighting conditions, there are a few cases where a given color is used in a slightly different context than described in Table 2.*

## Color Philosophy

Table 2 provides the operational philosophy of color usage on the Evolution Backup Display.

COLOR	PURPOSE	COLOR	PURPOSE
<b>RED</b>	Used to indicate flight envelope and system limits, and for warning annunciations that require immediate pilot recognition and which may require immediate pilot correction or compensatory action.	<b>GREEN</b>	Green is used to indicate the status of user controls (i.e., ON, enabled, or active).
<b>AMBER</b>	Used to indicate abnormal information sources, and for caution information that requires immediate pilot awareness and for which subsequent pilot action may be required.	<b>WHITE</b>	Used to show primary flight data (e.g., IAS, ALT, HDG), scales, and Menu items that are selectable for editing.
<b>MAGENTA</b>	Used for pilot-selectable references (bugs) enabled for editing and for depicting the active GPS navigation leg on a moving map display.	<b>GRAY</b>	Used to show supplemental flight data, and for Hot Key and Menu legends that are OFF, disabled, or inactive.
<b>CYAN</b>	Used to indicate editable values that are not currently selected for editing. CYAN is also used to display bearing pointers, and GPS track marker.	<b>BLUE</b>	Used to indicate the sky.
		<b>BROWN</b>	Used to indicate the ground.

Table 2  
Color Guide

## Warnings, Cautions, and Notes

Where applicable warnings, cautions, and notes are given. Aspen Avionics uses the following icons and definitions (**Table 3**).




Icon	Definition
 <b>Warning</b>	Emphasizes a crucial operating or maintenance procedure, which, if not strictly observed, could result in injury to, or death of, personnel or long term health hazards.  Indicates a hazard that may require immediate corrective action.
 <b>Caution</b>	Indicates an essential operating or maintenance procedure, which, if not strictly observed, could result in damage to, or destruction of, equipment.  Indicates the possible need for future corrective action.
 <b>Note</b>	Highlights an important operating or maintenance procedure, condition, or statement.  Safe operation.

Table 3  
Warning, Caution, and Note

## **Example Graphics**

The example graphics and screen shots used throughout this Pilot's Guide are provided for reference only and are taken from a simulated flight. They should not be used for actual flights.

## **Pilot Familiarity**

While the EBD is reasonably intuitive and easy to use, some familiarity with Electronic Flight Instrument Systems (EFIS) is required. Aspen Avionics strongly recommends that new users of the EBD get some dual instruction from an experienced instrument CFI, and spend some time becoming familiar with the EBD in day VFR conditions with a safety pilot, before flying in actual instrument meteorological conditions (IMC).

## **Information Covered in this Pilot's Guide**

This Pilot's Guide covers all the features available in the EFD 1000 EBD .

# Chapter 1

## Welcome and Introduction

Welcome to Aspen Avionics' Evolution Backup Display system. The EBD Basic version is a fully digital, independent flight instrument display that replaces all traditional mechanical backup instrumentation.

Built to complement existing non-Aspen glass cockpit solutions, the Evolution Backup Display is exceptionally easy to use and is built from the same robust, feature-rich platform as the popular Evolution Flight Display System.

Your transition to glass is fully supported with Aspen's backup solution, giving you better, more reliable situational awareness in an emergency situation.



Figure 1-1  
Evolution Backup Display Basic, Landscape



Figure 1-1a  
Evolution Backup Display Basic, Portrait

## 1.1. System Overview

The EBD system typically consists of three components:

1. Evolution Backup Display Unit (EBD)
2. Configuration Module (CM)
3. Remote Sensor Module (RSM)

The system architecture in **Figure 1-2** shows the relationships of the EBD, RSM, and CM.

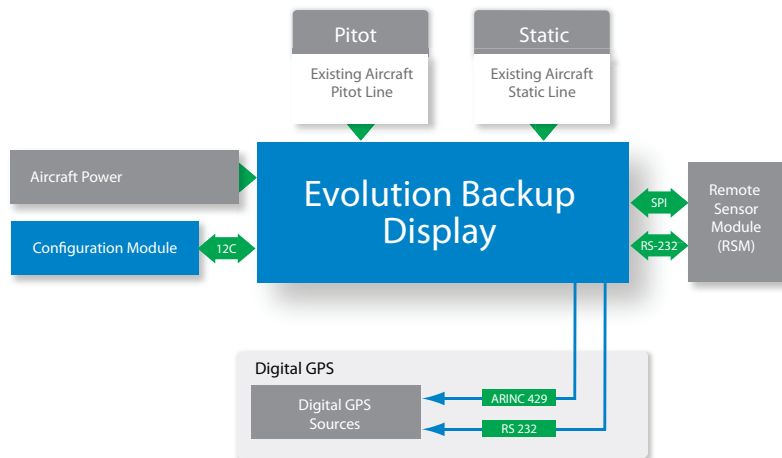


Figure 1-2  
Evolution Backup Display Basic architecture

### 1.1.1. Evolution Backup Display System (EBD)

The EBD is a digital system that consists of a high resolution, six-inch diagonal color LCD display, user controls, photocell, and microSD data card slot. The three-inch diameter, four-inch deep can on the back of the display contains a non-removable electronics module that includes:

- A Sensor Board with solid-state Attitude and Heading Reference System (AHRS) and digital Air Data Computer (ADC)
- A Main Application Processor (MAP) board with Central Processing Unit (CPU), graphics processor and system memory
- An Input-Output Processor (IOP) board for integrating communications with other aircraft systems

Also on the rear of the unit (**Figure 1-3**) are:

- An access cover for removing and replacing the built-in backup battery
- Pneumatic connections to the aircraft's pitot and static systems
- 44-pin D-sub connector for electrical connections to the PFD
- Two cooling fans, to cool the electronics and LCD backlights

The EBD mounts to the front surface of the instrument panel.

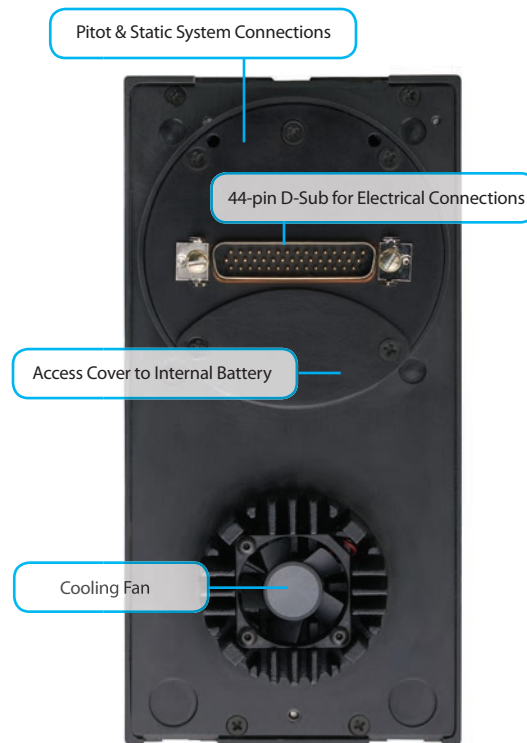


Figure 1-3  
EBD Rear Connections



Figure 1-4  
Configuration Module (CM)

### 1.1.2. Configuration Module (CM)

The Configuration Module (**Figure 1-4**), contains an EEPROM device that retains system configuration and calibration data and provides two primary functions:

- Retains aircraft-specific configuration information, calibration data, and user settings, allowing the EBD to be swapped for service purposes without re-entering or re-calibrating the installation
- Contains a license key that configures the EBD software features

The CM is typically attached to the wire bundle coming out of the D-sub connector on the display unit.



### 1.1.4. Remote Sensor Module (RSM)

The Remote Sensor Module (RSM) (**Figure 1-5**), is an integral part of the EBD system and works together with the display unit sensors as part of the AHRS and ADC. The RSM looks and mounts like a GPS antenna and is mounted on the exterior of the fuselage, typically aft of the cabin.

The RSM contains the following sub-systems:

- 3D magnetic flux (heading) sensors
- Outside Air Temperature (OAT) sensor
- Emergency backup GPS engine and antenna

The RSM communicates with the EBD via a digital cable connection.



Figure 1-5  
Remote Sensor Module (RSM)

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## Chapter 2

### Controls and Display

The Evolution Backup Display (**Figure 2-1**) is a flat-panel LCD primary flight instrument that presents the pilot with all of the information from the traditional six-pack of mechanical instruments: Airspeed, Attitude, Altitude, Turn Coordinator, Directional Gyro (DG), and Vertical Speed Indicator (VSI). Modern technology and standard EFIS symbology enable the consolidation of all six instruments into a single display, tightening the pilot's instrument scan and reducing pilot workload.

The display is divided into three parts: Attitude Display, a Data Bar below the Attitude Display, and Navigation Display.

This chapter gives an overview of all the instruments, information, and controls of the EBD. **Table 2-1** and **Figure 2-3** identify the controls and display orientation (see **Chapter 4, Reference Guide** for more details).



Figure 2-1  
Evolution Backup Display, Landscape



Figure 2-1a  
Evolution Back up Display Basic, Portrait

## 2.1. Controls & Display Orientation

CONTROLS	
1	Power Button
2	Range Buttons
3	Menu Button
4	Hot Key - Unused
5	Hot Key - Unused
6	360/ARC View
7	Hot Key - Unused
8	BARO
9	Top Knob
10	Top Button
11	Middle Button
12	Bottom Button
13	Bottom Knob
14	Automatic Dimming Photocell
15	microSD Card Slot



### NOTE

Any numbered function omitted from this table is intentional: the function is not included in the Basic EBD configuration.

ATTITUDE DISPLAY	
16	Attitude Display
17	Aircraft Reference Symbol
19	Roll Pointer
20	Slip/Skid Indicator
21	Altitude Tape
22	Selected Altitude Field (controls the Altitude Bug)
23	Altitude Alerter
24	Numerical Altitude Indication, Altitude Drum/Pointer
25	Altitude Trend Vector
26	Altitude Bug
32	Airspeed Tape
33	Selected Airspeed Field
34	Airspeed Bug
35	Numerical Airspeed Indicator, Airspeed Drum/Pointer

DATA BAR	
38	True Airspeed (TAS) or Mach number
39	Barometric Pressure Setting Field
40	Wind Direction and Speed
41	Wind Direction Arrow
42	Outside Air Temperature (OAT)
43	Ground Speed

NAVIGATION DISPLAY	
44	Navigation Display
45	Ownship Symbol
48	Rate of Turn Indicator
49	Ground Track Marker
50	Numerical Direction Indicator
52	Selected Heading Field
53	Heading Bug
57	Vertical Speed Tape
66	Bottom Knob State
67	Top Knob State
68	Hot Key Label
69	Basemap Range
70	Declutter Level

Table 2-1 EBD Components



Figure 2-2  
Evolution Backup Display

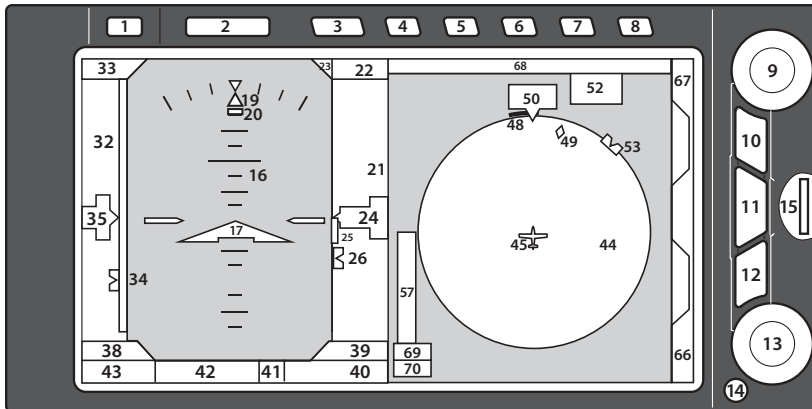


Figure 2-3  
Evolution Backup Display Elements



Figure 2-2a  
Evolution Back up Display Basic, Portrait

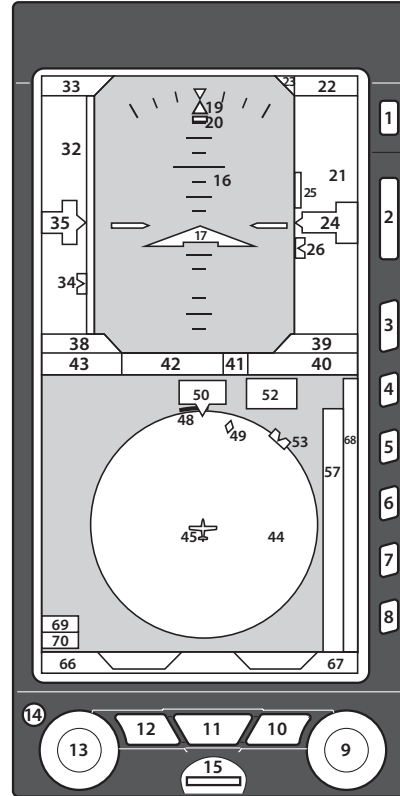


Figure 2-3a  
Evolution Back up Display Basic, Portrait elements

## 2.2. Controls

The primary means for the pilot to control the EBD are the two knobs and three buttons at the right-hand side of the display. The knobs control setting IAS and HDG. The right-hand three buttons control selection of navigation sources for the GPS. There are three additional buttons to the left of the Hot Keys to control entering and exiting the Menu, setting the Map Range, and Manual Power Control (PWR).

Five Hot Keys above the Navigation Display toggle various features on and off. The function of each is indicated by the label on the display below each key.

### 2.2.1. Top and Bottom Knobs

The Top and Bottom Knobs are designed to provide immediate operation yet minimize the possibility of an inadvertent operation. This is accomplished by requiring that the first action of the knob “wakes up” the knob and changes the label from cyan to magenta. The first click when the knob is turned or the first press on the knob, “wakes up” the knob function.

Press the knob more than once to cycle through its Menu options in a round-robin sequence or press and hold the knob to synchronize (SYNC) the function’s value (**see Section 2.2.1.3. SYNC Function**). After 10 seconds of inactivity, the knob returns to its default setting.

### 2.2.1.1. Bottom Knob Functions

The Bottom Knob is used to set the Course (CRS) and Airspeed Bug (IAS). Course (CRS) is the default setting for the Bottom Knob.

Refer to **Table 2-1** and **Figure 2-2**

- Rotate the Bottom Knob one click or Press the knob once to set the course (CRS) (**Refs. 52 and 53** and see **NOTE** about Auto Course)
- Press the Bottom Knob twice to set the Airspeed Bug (IAS) and Selected Airspeed Field (**Refs. 33 and 34**)

### 2.2.1.2. Top Knob Functions

The Top Knob is used to set Heading (HDG), Selected Altitude Field (ALT), Barometric Pressure (BARO). Successive presses of the TopKnob will cycle through HDG and ALT in a round-robin sequence. Rotate the Top Knob to the left or right to decrease or increase the value of selected field. Heading (HDG) is the default setting for the Right Knob.

Refer to **Table 2-1** and **Figure 2-2**

- Rotate the Top Knob one click or Press the knob once to set the Selected Heading Field/Heading Bug (HDG) (**Refs. 52 and 53**)
- Press the Top Knob twice to set the Selected Altitude Field (ALT)/Altitude Bug (**Refs. 33 and 34**)  
**Knob SYNC Function**

## NOTE

*When the CDI navigation source is selected to a GPS receiver and the Auto Course is enabled in the Menu, the course is set automatically by the GPS and is not pilot-adjustable (see **Section 4.4.6**). This state is indicated by the CRS field and Knob label shown in green with an inverse "A". In this case, pressing the Left Knob will enable you to set only the Airspeed Bug (IAS).*





Figure 2-4  
Bottom and Top Knobs and  
Corresponding Fields



Figure 2-4a  
Evolution Back up Display Basic, Portrait  
with call outs

### 2.2.1.3. SYNC Function

1. Press the Knob until its state shows the value you want to set in magenta.
2. Press and hold the Knob for approximately one (1) second to SYNC the field's value according to the rules shown in **Table 2-2** and **Figure 2-4**.
3. After 10 seconds of inaction, the knob reverts to its home state (IAS or HDG), and the labels and field turn to cyan (inactive).

Top Knob		
	SYNC Action	
<b>1</b>	ALT	
<b>2</b>	BARO	Set to 29.92 in Hg or 1013 mB.
<b>3</b>	HDG	Set to the current heading.
<b>4</b>	Top Knob -Current State default setting: <b>HDG</b> Cyan indicates field is inactive.	
<b>5</b>	IAS	Set to the current indicated airspeed.
<b>6</b>	Bottom Knob - Current State default setting: <b>IAS</b> Cyan indicates field is inactive.	

Table 2-2  
Bottom and Top Knob SYNC Description

### 2.2.1.4. Using the Knobs (Example)

#### How to Set the Heading Bug (HDG)

1. Rotate the Top Knob to the desired heading value, shown both by the position of the Heading Bug and the numeric value in the Selected Heading Field (**Figure 2-5**). The HDG label, Heading Bug and the Selected Heading Field appears in magenta
2. After 10 seconds of inactivity, the knob defaults to HDG. The HDG label, Heading Bug and Selected Heading Field value will appear in cyan (**Figure 2-6**).



Figure 2-5  
Editing the HDG field



Figure 2-6  
HDG field updated and inactive

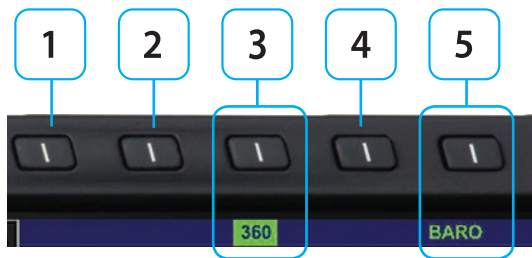


Figure 2-7  
Hot Key Menu 1 of 2

### 2.2.3. Hot Keys

The five keys along the top-right side of the EBD function as either single-action Hot Keys for frequently used commands or as Menu Keys when the Menu has been activated. The Hot Key functions are accessible at any time, except when the Menu is active.

Each Hot Key provides instant access to the assigned command. Each press of a Hot Key toggles between the settings that each key controls (see **Table 2-3** and **Figure 2-7**).

HOT KEY	DESCRIPTION	OPTIONS
1	Not Used	
2	Not Used	
3	360 / ARC Toggles between 360 and ARC modes of Navigation Display (see <b>Section 4.4.1.</b> )	360 360° Compass Mode
		ARC ARC Compass Mode
4	Not Used	
5	BARO Toggles between BARO adjustment on or off for Barometric Pressure setting	BARO BARO adjustment on
		BARO BARO adjustment off

Table 2-3  
Hot Key Descriptions

The Hot Key labels use the following color philosophy (see **Table 2-4**):

- A green label and dark blue letters (also known as inverse green) indicates that the Hot Key function is enabled
- A dark blue label and green letters indicates that the Hot Key function is disabled
- A dark blue label and gray letters indicates that the Hot Key function is not available
- A dark blue label without letters indicates that the Hot Key has no function

The 360/ARC Hot Key labels indicate which mode is currently active on the Navigation Display.

LABEL COLORS	MEANING
<b>TEXT</b>	Hot Key function enabled
<b>TEXT</b>	Hot Key function disabled
<b>TEXT</b>	Hot Key function not available
	Hot Key – no function

Table 2-4  
Hot Key Descriptions

## 2.2.4. Menu

The MENU button is used to access the Evolution Backup Display's Menu to change options, and also to change the EBD's display brightness.

### 2.2.4.1. Using the Menus

Press the MENU button to activate the Menu (**Ref. 3**). The current menu page name is shown on the bottom center of the Navigation Display. Directly below the menu page name is a segmented menu page bar, giving a graphical representation of the current page relative to the total number of menu pages. The current menu page number is shown in the upper-right corner of the Navigation Display.

Menu Page 1, General Settings A, is the one most commonly used in flight. It allows the pilot to display or hide the Vs speeds on the airspeed tape. The other menu pages are used for barometric pressure and Outside Air Temperature (OAT) units of measure settings, Auto Range, Vs speeds and map customization, EBD power management, product version information, and information and option settings, relative to your specific equipment and installed options.

The Menu operates either in the Navigation or Edit mode, as indicated by the label directly to the left of the Top Knob. When the MENU button is first pressed, the Main Menu is in the Navigation mode, indicated by the magenta label SEL PAGE directly to the left of the Top Knob (**Figure 2-8**). When in the Navigation mode, rotating the Top Knob navigates through the menu pages. Rotate the Top Knob clockwise to advance to the next menu page, counterclockwise to return to the previous page.



Figure 2-8  
Menu Navigation Mode

Each Menu Page has up to five selectable options, each adjacent to one of the five Hot Keys which double as Menu Keys when the Menu is active (**Item 1** of **Figure 2-9** and **Table 2-5**). After navigating to the Menu Page containing the option you want to change, press the Menu Key adjacent to that option label, which initiates the Menu's Edit mode. When the Menu is in the Edit mode, the label, EDIT VALUE, is shown to the left of the Top Knob in magenta (**Figure 2-10**), and the label of the item selected for editing is also shown in magenta. Rotate the Top Knob to change the value of the selected item. When finished, either select another displayed Menu option to change, or press the Top Knob to exit the Edit mode and return to Navigation mode to select another Menu Page.

When you are finished changing Menu options, press the MENU Button to exit.

- |   |   |
|---|---|
| 1 | Menu Options                                      |
| 2 | Menu Page number and mode (Navigation mode shown) |
| 3 | Menu Page Name                                    |
| 4 | Brightness Control (see <b>Section 2.2.4.2</b> .) |

Table 2-5  
Menu



Figure 2-9  
Menu Edit Mode

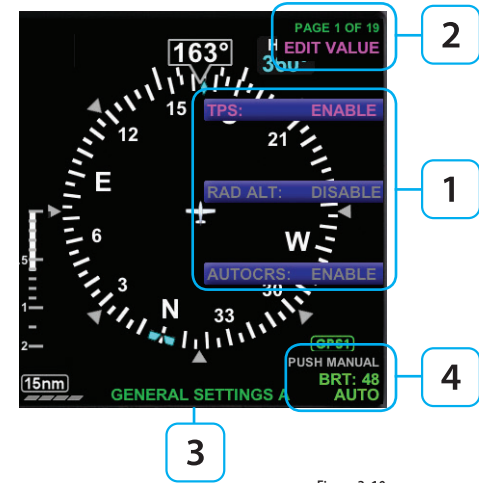


Figure 2-10  
Main Menu

The MENU text will display in one of the four colors listed and described in **Table 2-6**.

DISPLAY TEXT	DESCRIPTION
<b>WHITE</b>	Editable option
<b>MAGENTA</b>	Editable option enabled
<b>GREEN</b>	Status Only
<b>GRAY</b>	Disabled (Not available for selection or editing)

Table 2-6  
Menu Text

## NOTE

*These steps are provided as a basic overview. Each menu command is covered in detail in Chapter 5.*



Figure 2-11  
Menu Display

### Access To and Navigation Within the Menu

1. Press the MENU button. The Menu displays on the Navigation Display adjacent to the Hot Keys (**Figure 2-11**).
2. Rotate the Top Knob to navigate through the different pages of the Menu. Rotating the Top Knob clockwise advances the Menu Pages, counterclockwise returns to previous pages.
3. Press the MENU Button to exit.

## Edit Main Menu Items

1. Press the MENU Button.
2. Navigate to the desired Menu Page.
3. Press the Menu Key of the desired option. The Menu label turns magenta, and the EDIT VALUE label displays to the left of the Top Knob (**Figure 2-12**).
4. Rotate the Top Knob to the desired value.
5. Press the Top Knob to return to Menu navigation mode.
6. Press the MENU Button to exit.

### NOTE

Pressing the Top Knob returns to Navigation mode and allows selection of other menu options on different pages. Pressing another menu key on the current menu page saves any changes made and activates the newly selected option for editing.



Figure 2-12  
EDIT VALUE Displays to the Left  
of Top Knob

### NOTE

Upon reaching the end of a list of editable menu options, continued rotation of the knob will not result in the continuous wrapping through the available editable menu options. Spinning the knob fully clockwise will go to the last menu page, while spinning the knob fully counterclockwise will go to the first menu page.





Figure 2-13  
Display Brightness in BRT AUTO Mode

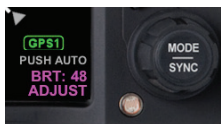


Figure 2-14  
Display Brightness in BRT ADJUST Mode

## NOTE

The BRT AUTO display brightness level is determined by the amount of light detected by the photocell on the front of the EBD. If a light is used to illuminate the instrument panel, the photocell will respond, resulting in a bright display. When this happens, use the manual BRT ADJUST mode to reduce the brightness.

### 2.2.4.2. Display Lighting

When the MENU button is pressed and the Menu is active, the Bottom Knob can be used to adjust the EBD display brightness. **Table 2-7**

By default, the LCD brightness operates in AUTO mode, and is adjusted based on photocell sensing of ambient lighting conditions. When the MENU is active and the LCD is in the BRT AUTO mode, the word, “AUTO”, and a brightness level of 1-100 will be displayed in green to the left of the Bottom Knob (**Figure 2-13**).

To override the AUTO brightness setting, press the Bottom Knob once to switch to the BRT ADJUST mode, and then rotate the Bottom Knob to set the brightness to the desired level (**Figure 2-14**). To return to AUTO brightness control, press the Bottom Knob again.

LCD MODE	DESCRIPTION	DISPLAY
Automatic BRT AUTO	LCD backlight intensity is automatically adjusted based on the ambient lighting conditions sensed by the Automatic Dimming Photocell. The maximum intensity in AUTO mode is 70%.	<b>Figure 2-13</b>
Manual BRT ADJUST	Allows the pilot to adjust the EBD display brightness from 1-100%	<b>Figure 2-14</b>

Table 2-7  
Brightness Control

## 2.2.5. Range Buttons

When the MAP is enabled, the RNG (Range) Button is used to zoom the map in or out. Press the RNG (+) Button to increase map range. Press the RNG (-) Button to decrease map range. Additionally, an Auto Range control feature is available.

Pressing and holding either the RNG (+) or (-) Button will cause the map range to scale continuously to its maximum or minimum range, respectively. When the map range is at its maximum or minimum setting, release and then press and hold the RNG Button again to activate the Auto Range control mode (see **Section 4.4.12.1.** for more details).

## 2.2.6. REV / PWR Button

The red REV / PWR Button on the EBD can be used to override automatic power control in abnormal or emergency situations (see **Chapter 6** for more details).

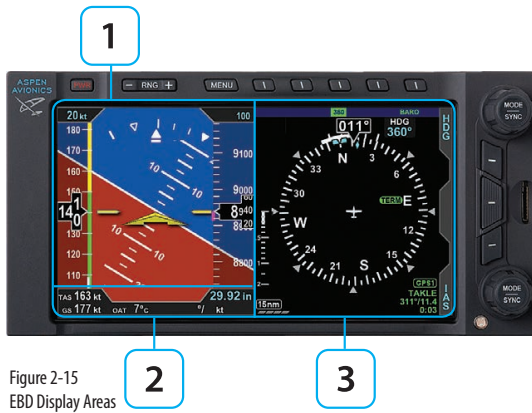


Figure 2-15  
EBD Display Areas



Figure 2-15a  
EBD Display areas with callouts

## 2.3. Display

The EBD Basic is a digital backup for the Attitude Indicator and DG. The left half presents an Attitude Display and the right half contains a Navigation Display (**Figure 2-15** and **Table 2-8**). Between the two halves is the Data Bar. The Data Bar contains a dedicated display of real-time winds, Outside Air Temperature (OAT), True Airspeed (TAS), and GPS Ground Speed (GS).

- 1 Attitude Display
- 2 Data Bar
- 3 Navigation Display

Table 2-8  
EBD Display Areas

This section gives an overview of the main display elements and features. (see **Chapter 4, Reference Guide** for more details).

### 2.3.1. Cleaning the Display Screen

The EBD Display Unit has an LCD screen that is prone to damage from scratches, smudging, and clouding caused by the use of improper cleaning agents and abrasive cloths. Exercise care when cleaning, using the following tips:

- Only clean the display when the unit is off.
- Use a clean, soft, lint-free cloth dampened with a 50/50 solution of isopropyl alcohol and water, a pre-moistened lens cleaning tissue, such as Bausch & Lomb Sight Savers®, or a cleaning solution made especially for LCD displays.
- Never spray any cleaning solutions directly onto the screen; spray it into the cleaning cloth.
- Gently wipe the screen in a circular motion. Do not press hard on the screen.
- Remove all excess moisture to prevent damage to the display.
- The display should be dry before turning on the unit.



#### **CAUTION**

*Use caution when using isopropyl alcohol as it is flammable. Using any other chemicals or materials voids the warranty.*

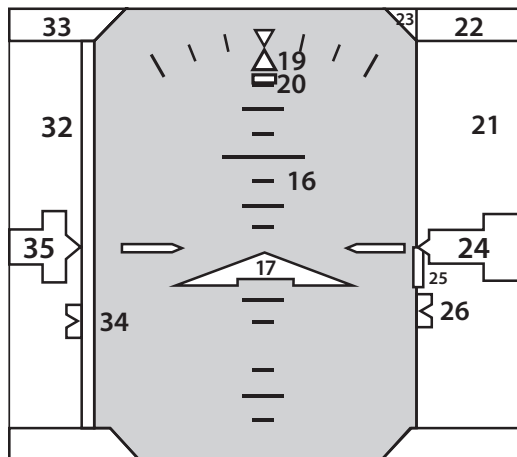


Figure 2-16  
Attitude Display Components

### 2.3.2. Attitude Display

The Attitude Display includes an Attitude Director Indicator (ADI), an Airspeed tape, an Altimeter tape, an Altitude Alerter, and Radio Altitude (Table 2-9 and Figure 2-16), (see Chapter 4, Reference Guide for more details).

ATTITUDE DISPLAY	
16	Attitude Display
17	Aircraft Reference Symbol
19	Roll Pointer
20	Slip/Skid Indicator
21	Altitude Tape
22	Selected Altitude Field
23	Altitude Alerter
24	Numerical Altitude Value, Altitude Drum/Pointer
25	Altitude Trend Vector
26	Altitude Bug
32	Airspeed Tape
33	Selected Airspeed Field
34	Airspeed Bug
35	Numerical Airspeed Value, Airspeed Drum/Pointer

Table 2-9  
Attitude Display Components

### 2.3.2.1. Attitude Director Indicator (ADI)

The Attitude Director Indicator (ADI) features a conventional blue (sky) over brown (ground) background, with a white horizon line dividing the two areas. A triangular Aircraft Reference Symbol (**Ref. 17**) is in a fixed position and shows aircraft attitude relative to the horizon.

The pitch scale (or ladder) indicates degrees of nose up (blue) or nose down (brown) pitch relative to the apex of the aircraft symbol. Minor pitch marks are shown every 2.5° up to +/-20° of pitch, with major pitch marks every 10° up to +/-90° of pitch. The distance between pitch marks is greater than on most mechanical attitude indicators, making it easier for the pilot to fly more precise pitch attitudes.

At extreme pitch attitudes (above 30° nose up or below 25° nose down), red Unusual Attitude Recovery chevrons come into view, pointing towards the horizon or ground as applicable (see **Chapter 4, Section 4.2.1.2. Pitch Scale**). At extreme pitch attitudes, some sky (blue) or ground (brown) will always be displayed to help maintain situational awareness, even though the horizon line may be off-scale.

At the top of the ADI are the roll scale, roll pointer, and slip/skid indicator (**Figure 2-17**). The roll scale is indicated by tick marks at 10°, 20°, 30°, 45°, and 60° on both sides of the zero roll inverted solid white triangle. The 45° marks are represented as hollow triangles.

Slip/skid is indicated by the lateral position of the white rectangle under the roll pointer. One rectangle width is equivalent to one ball width of a conventional inclinometer.



Figure 2-17  
Slip/Skid



Figure 2-18  
Airspeed Tape

### 2.3.2.2. Airspeed Tape

Airspeed is indicated by a moving airspeed tape against a fixed position airspeed pointer, shown on the left-hand side of the Attitude Display (**Figure 2-18**). A numerical, rolling drum readout indicating airspeed values to the closest one knot or mile per hour is provided adjacent to the fixed pointer. Tick marks are provided on the airspeed tape every 10 knots (or mph, if so configured). Airspeeds between 20 kts (23 mph) to 450 kts (518 mph) are displayed. Outside of this range, the airspeed value is dashed.

Color speed bands are displayed on the indicated airspeed tape, corresponding to the color arcs found on a mechanical airspeed indicator.

Color speed markers are also displayed on the indicated airspeed tape, corresponding to the markers found on traditional airspeed indicators. All aircraft have a red line for aircraft never-exceed speed ( $V_{ne}$ ). Multi-engine aircraft will usually also have another red line for single-engine minimum control speed ( $V_{mc}$ ), and a blue line for single-engine best rate of climb speed ( $V_{yse}$ ). If the aircraft manufacturer has published an initial flap extension speed, a white triangle will be presented on the airspeed tape at this speed.

Redline or Barber Pole airspeed limits that vary with pressure altitude can be displayed when configured by the installer. The colors are configured to correspond with your aircraft's approved markings on the mechanical airspeed indicator.

Textual  $V_{speed}$  markers can also be shown on the airspeed tape (e.g.,  $V_x$ ,  $V_y$ ,  $V_a$ , etc.). These are typically programmed at installation, and (if left unlocked during installation) may also be adjusted by the pilot.  $V_{speed}$  display can be enabled or disabled by the pilot from Page 1 of the Menu (see **Chapter 5**).

The pilot can set a target airspeed using the Bottom Knob (see **Section 4.2.2.1**). The target airspeed is shown on the Airspeed Tape as an Airspeed Bug with its setting displayed numerically above the Airspeed Tape (**Figure 4-10** and **Figure 4-11**). The Airspeed Bug and numerical value are for visual reference only, to help the pilot maintain a target airspeed; there is no alerting for deviations from the target.

### 2.3.2.3. Altitude Tape and Vertical Speed

Altitude is indicated by a moving altitude tape against a fixed position altitude pointer (**Figure 2-2, No. 21, 24**), shown on the right-hand side of the Attitude Display (**Figure 2-19**). A numerical rolling drum readout indicating altitude values to the closest 20 feet is provided adjacent to the fixed pointer. When climbing or descending, a magenta Altitude Trend Vector displays above or below the altitude pointer, indicating the altitude that will be reached in six seconds if the current rate of climb or descent is maintained.

Minor tick marks are provided on the tape at 20-foot intervals, and major tick marks are provided at 100-foot intervals. The thousand and ten-thousand digits are larger than other digits on the tape. Negative altitudes are indicated by a “-” sign preceding the numerical altitude value in the drum.

The current altimeter barometric pressure setting is shown just below the Altitude tape in the Data Bar (**Figure 2-2, No. 39**), and can be adjusted by pressing the BARO Hot Key and rotating the Top Knob.

The Altitude Tape also includes a built-in Altitude Alerter, which consists of an Altitude Bug on the Altitude Tape (**Figure 2-2, No. 26**), a Selected Altitude Field (**Figure 2-2, No. 22**), a visual Altitude alert (**Figure 2-2, No. 19**). For more information on using the Altitude Alerter, see **Chapter 3** and **Chapter 4**.

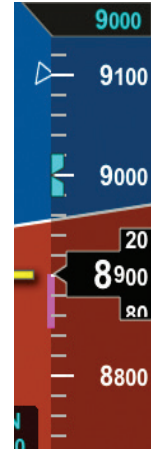


Figure 2-19  
Altitude Tape



38				39
43	42	41	40	

Figure 2-20  
Data Bar Components



## NOTE

*When the winds aloft are less than 10 knots, the wind data is not displayed.*

### 2.3.3. Data Bar

The Data Bar appears below the Attitude Display. When available, True Airspeed (TAS) or Mach Number, GPS Ground Speed (GS), Outside Air Temperature (OAT), Wind Vector arrow, Wind Direction, Wind Speed, and Barometric Pressure Setting are presented in the Data Bar (**Table 2-10** and **Figure 2-20**).

When any of these values are not available or invalid, the corresponding data field is dashed. If the Wind Direction and Speed are not available or invalid the Wind Direction Arrow is removed. A GPS navigator must be connected and providing valid ground speed and ground track to display GS and wind data.

The Data Bar is discussed in detail in **Section 4.3**.

DATA BAR	
38	True Airspeed (TAS) or Mach Number
39	Barometric Pressure Setting Field
40	Wind Direction and Speed
41	Wind Direction Arrow
42	Outside Air Temperature (OAT)
43	Ground Speed (GS)

Table 2-10  
Data Bar Components

## 2.3.4. Navigation Display

The right half of the Landscape EBD and bottom of the Portrait EBD is the Navigation Display (**Table 2-11** and **Figure 2-21**), which shows a wide range of navigation information and flight data, including:

- Directional Gyro (DG) and Heading Bug.
- 360° and ARC Compass rose display modes.
- Numeric displays of current magnetic heading and selected heading (HDG).
- Ground Track Marker.
- Vertical Speed Indicator (VSI) tape.
- Rate of Turn Indicator.
- Situational Awareness Map display.
- GPS annunciations (TERM, APPR, WPT, and MSG).
- Caution annunciations for abnormal GPS status.

NAVIGATION DISPLAY			
44	Navigation Display	56	Vertical Speed Numerical Value
45	Ownship Symbol	57	Vertical Speed Indicator Tape
48	Rate of Turn Indicator	66	Bottom Knob State
49	Ground Track Marker	67	Top Knob State
50	Numerical Direction Indicator	68	Hot Key Legend
52	Selected Heading (HDG) Field	69	Navigation Display Range
53	Heading Bug	70	Navigation Display Declutter Level

Table 2-11  
Navigation Display Components

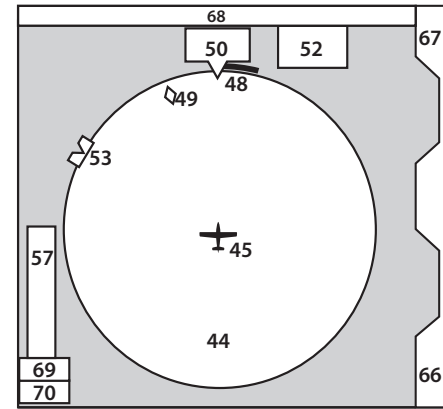


Figure 2-21  
Navigation Display Components

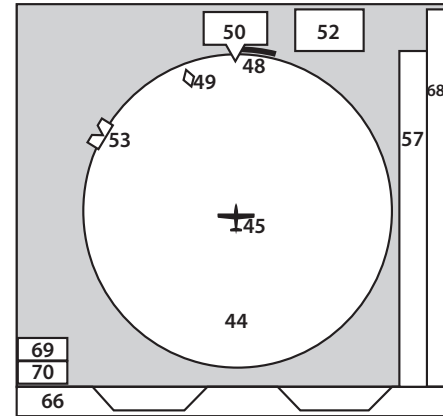


Figure 2-21a  
Portrait Navigation Display Components



Figure 2-22  
360° Compass Mode



Figure 2-23  
ARC CDI Compass  
Mode with Basemap

When connected to a GPS navigator, basic mapping can also be displayed under the DG including GPS flight plan legs and waypoints, (and when connected to a compatible GPS) Basemap data (airports, VORs, NDBs, and intersections).

### 2.3.4.1. Numerical Direction Indicator (Magnetic Compass)

The center of the Navigation Display is the Numerical Direction Indicator. Like a magnetic compass, the NDI always shows the current magnetic heading of the aircraft. This slaved NDI compensates both for the turning and acceleration errors exhibited by wet compasses and for precession errors found in common Directional Gyros. The pilot does not ever need to make adjustments to the NDI.

The EBD's Direction Indicator is a slaved Directional Gyro (DG) with Heading Bug.

#### **Compass Modes: 360° vs. ARC**

The NDI on the EBD can be presented in either a full 360° Compass Mode (shown in **Figure 2-22**), or in a 100° ARC mode (**Figure 2-23**).

The 360° Compass Mode resembles the mechanical instrument, with the ownship position in the center of the display.

The ARC Compass Mode provides an extended forward view with the ownship position near the bottom of the Navigation Display. The ARC Compass is especially good for displaying flight plan and basemap details.

The 360/ARC Hot Key is used to toggle the display between 360° and ARC Compass Modes, with the current mode shown in green adjacent to the Hot Key.

### **Navigation Information**

Regardless of Compass Mode setting, the current magnetic heading is always shown at the top center of the Navigation Display (**Figure 2-2, No. 50** and **Figure 2-24**). The HDG Bug setting is shown in the Selected Heading Field (**Figure 2-2, No. 52**). This field is always visible even if the HDG Bug itself is only partially visible in ARC Compass Mode.

### **Ground Track Marker**

When the EBD is connected to a compatible GPS, a cyan Ground Track Marker is displayed on the compass rose at the value that corresponds to the aircraft's ground track (**Figure 2-2, No. 49** and **Figure 2-25**).



Figure 2-24  
Magnetic Heading



Figure 2-25  
Ground Track Marker



Figure 2-26  
Rate of Turn Indicator, Rate Shown >6°/second



Figure 2-27  
VSI Tape



Figure 2-28  
VSI Tape Capped, Digital Value  
Showing 2,100 FPM Climb

### 2.3.4.2. Rate of Turn Indicator

A Rate of Turn Indicator (**Figure 2-2, No. 48**) with a range of 0 to 6 degrees per second is provided for both the 360 and ARC Compass Modes. The indicator consists of a curved white tape that extends from the Numerical Heading Indicator's lubber line and in the direction of the turn, along the outer curve of the compass card.

The Rate of Turn Indicator features an outer thick white tick mark for a Standard Rate turn, and an inner thin white tick mark for Half-Standard Rate turns. A Standard Rate, two-minute turn equals 3 degrees per second. When the rate of turn exceeds 6 degrees per second, an arrowhead is added to the end of the tape to show that the rate of turn has exceeded the limits of the indicator (**Figure 2-26**).

### 2.3.4.3. Vertical Speed Indicator (VSI)

A Vertical Speed Indicator (VSI) is shown as a tape on the Navigation Display (**Figure 2-27** and **Figure 2-2, No. 57**) to the right of the HSI in 360 Compass mode. A numerical vertical rate is shown in the upper right-hand corner of the Navigation Display during climbs and descents (**Figure 2-2, No. 56**). The VSI tape is not shown in ARC Compass mode, but the numerical value display is shown in both 360 and ARC Compass modes.

Whenever the vertical speed exceeds +/- 100 feet per minute (fpm), the vertical speed is indicated by a rising/sinking white vertical tape and associated scale markers immediately to the right of the compass rose (**Figure 2-2, No. 57** and **Figure 2-26**).

A numerical value of the aircraft's vertical speed is shown directly above the tape, in the upper right-hand corner of the Navigation Display (**Figure 2-2, No. 56**). Rates of up to  $\pm 2,000$  fpm are indicated by the tape, while the numerical value will display rates of up to  $\pm 9,990$  fpm. A white triangle caps the tape whenever rates exceed  $\pm 2,000$  fpm (**Figure 2-28**). The Vertical Speed Numerical Value will be dashed whenever the vertical speed exceeds +/- 10,000 fpm. In the ARC Compass Mode, only the Vertical Speed Numerical Value is presented.

### 2.3.4.4. Situational Awareness Map

When the EBD is connected to a compatible GPS navigator, basemap symbols can be displayed underneath the Direction Indicator in either 360° or ARC Compass Modes. Most GPS navigators output data for the EBD to display the GPS flight plan legs and waypoints. The active GPS flight plan leg, waypoint, and its identifier are shown in magenta. Other waypoints and legs are shown in white.

Some GPS navigators (typically those using the ARINC 429 data protocol, such as the Garmin 400/500 series) output basemap data (e.g., airports, VORs, NDBs, and intersections). Often, these GPS navigators also display curved flight paths, such as arcs, course reversals, and holding patterns.

The basemap is always oriented with magnetic heading up and centered so that the current aircraft position coincides with the aircraft ownship symbol. These basemap symbols underlay all other instruments and annunciators in the Navigation Display.

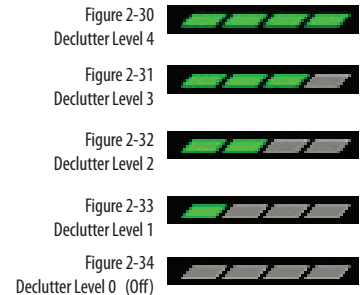
The Map Declutter Settings can be found in the 360 or ARC MAP SETTINGS page of the Menu. Pressing the desired 360 or ARC DCLTR LVL Menu Key and rotating the Top Knob will select Declutter Levels 4, 3, 2, 1, or OFF (**Figure 2-30, 2-31 2-32, 2-33, 2-34**).

The map display range is controlled by the RNG Button (**Figure 2-2, Ref. 2**), enabling the pilot to zoom in or out on the map. Automatic declutter logic changes the map features displayed depending on the selected map range.

The current range and declutter level map settings are shown in the lower left-hand corner of the navigation display (**Figure 2-29**). The map range is displayed in nautical miles, measuring the distance from the ownship symbol to the outside edge of the compass rose. The map declutter level is indicated by one to four green parallelograms below the range value. More parallelograms indicate that more basemap features are displayed.



Figure 2-29  
Map in ARC Compass Mode, 3nm  
Range at Declutter Level 0



## Chapter 3

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### Evolution Backup Display Quick Controls

This chapter provides an overview of the Evolution Backup Display explaining how to access and change the necessary settings of the EBD. Refer to **Chapter 4** for detailed step-by-step instructions for all EBD functionality.

While you can jump right in to using the EBD with this chapter, it may be helpful to first read **Chapter 2** to become more familiar with the controls, operating logic, and display elements of the EBD.

The EBD is a powerful Electronic Flight Instrument System (EFIS), offering the same capabilities and features found in larger glass cockpit systems in airliners, business jets, and newer general aviation aircraft. It is capable of far more than the analog instruments it typically replaces. In its basic configuration, the EBD will look immediately familiar to anyone accustomed to flying mechanical instruments, and its basic operation is very similar and intuitive.



Figure 3-1  
Primary EBD Settings



Page 3-2

FEATURE	SETTING	FEATURE	SETTING	
1	Selected Airspeed	7	Top and Bottom Buttons	
2	Map RNG (Range) Buttons	8	Center Button	
3	Selected Altitude	9	Barometric Pressure Setting Field	on/off
4	Compass Mode Hot Key: 360 or ARC			
5	Barometric Pressure (BARO) Hot Key		Allows for BARO adjustment	
6	Heading Bug Value		Set as desired	

Table 3-1 Primary EBD Settings

Figure 3-1 a  
Evolution Back up Display  
Basic, Portrait + call outs



### 3.1. Quick Controls Overview

Chapter 2 explains the EBD controls in detail. The following is a quick summary:

#### Knobs

(See [Chapter 2, Section 2.2.1](#) for details)

The Top and Bottom control knobs all have a Home State, to which they will return after 10 seconds of inactivity. The Bottom Knob is the IAS Knob, and the Top Knob is the HDG Knob.

- The current function of each knob is shown by its State, displayed immediately to the left of the knob. If the knob state is shown in magenta, turning the knob will change the value of the function shown. If the legend is shown in cyan or green, turning the knob will have no effect.
- From the Home State, pressing the knob once will enable the current function to be set (Knob State color changes from cyan to magenta). Successive presses of the knob will cycle through the functions that knob can control. When the function you want to change is shown in magenta, turning the knob will change its value.
- The Bottom Knob sets the Indicated Air Speed (IAS).
- The Top Knob sets Heading (HDG), Selected Altitude (ALT) and Barometric Pressure Setting (BARO).
- Pressing and holding a knob syncs the selected function.



### Hot Keys

- The five keys on the upper right-hand side of the display are Hot Keys, the function of which is shown by the legend on the screen immediately adjacent to each key.
- The current status of each Hot Key is shown by the legend in a green label and dark blue letters if active or in a blue label and green letters if inactive.
- Each press of a Hot Key will either toggle its function on or off, or will cycle among available settings (see **Chapter 2, Section 2.2.3** for details).

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Figure 3-2  
EBD Initializing

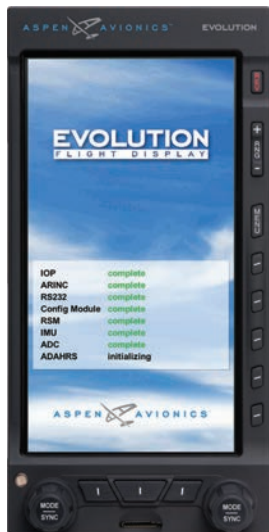


Figure 3-2 a  
EBD Initializing

### 3.2.1. Power Up

Once the pre-flight inspections and checklists are complete, start the engines and turn on the EBD Master switch.

When power is applied to the EBD, the bezel backlighting illuminates and within a few seconds the EBD splash screen displays while it initializes and the AHRS data is validated (Figure 3-2 and Figure 3-2a).

#### **NOTE**

*The graphics used in this chapter illustrate the descriptions of the features and tasks, but do not necessarily correspond to the values associated with this example flight scenario.*

**WARNING**

Whenever there is a new altimeter setting, set the EDB and other altimeters within the aircraft.



Figure 3-6  
BARO Setting  
Field Enabled



Figure 3-7  
BARO Setting  
Field Disabled

**Set the Barometric Pressure**

1. Press the BARO Hot Key. The BARO label above the Right/Top Knob and Barometric Pressure Setting Field appear in magenta - enabled for editing (Figure 3-6).
2. Rotate the Right/Top Knob clockwise to increase or counterclockwise to decrease the value of the Barometric Pressure Setting Field.
3. Once the correct value is selected, press the BARO Hot Key or any knob, button/key to exit the BARO function. After 10 seconds of inaction or if any other button/key is pressed, the BARO function is disabled and the Right/Top Knob returns to normal operation (Figure 3-7).

## Set the Heading Bug

1. Press the Right/Top Knob until HDG displays above the knob and the HDG field is enabled for editing, both rendered in magenta (**Figure 3-8**). The Heading Bug will also be rendered in magenta, and a dashed magenta line will extend from the ownship symbol to the Heading Bug to make it easier to see the bug position.
2. Rotate the Right/Top Knob to change the value of the Selected Heading field. Rotate clockwise to increase, or counterclockwise to decrease, the value. Once the correct heading is selected and after 10 seconds of inaction, the field is disabled, and the label and field are rendered in cyan (**Figure 3-9**).



Figure 3-8  
Selected Heading Field Enabled



Figure 3-9  
Selected Heading Field Disabled

**NOTE**

The Basemap symbols and flight plan legs rendered for each of the map's declutter levels (4, 3, 2, 1, or 0) are based on the selected map range. These are manually configured to display or not in the Main Menu. Detailed information is provided in **Chapter 5, Section 5.2**.

**Select Map Declutter Level**

The Map Declutter function can be found in the 360 MAP SETTINGS page or in the ARC MAP SETTINGS page of the MENU (**Figure 3-13**). The Map Declutter Icon is located on the bottom left of the Nav Display (**Figure 3-13a**) The Declutter settings can be configured to Levels 4, 3, 2, 1, or 0 (**Figures 3-13b thru 3-13f**) (see **Chapter 5, Table 5-9** for more details).

**To change the Map Declutter Level**

1. Press the MENU Button and rotate the Top Knob to the 360 MAP SETTINGS or the ARC MAP SETTINGS page.
2. Press the DCLTR LVL Menu Key and rotate the Top Knob to select the desired declutter level, then press MENU Button to exit.



Figure 3-13a  
Map Declutter Icon Location



Figure 3-13b  
Declutter Level 4



Figure 3-13c  
Declutter Level 3



Figure 3-13d  
Declutter Level 2



Figure 3-13e  
Declutter Level 1



Figure 3-13f  
Declutter Level 0



Figure 3-13  
Changing the Map Declutter Level

## NOTE

Setting the Altitude Alerter provides visual to help the pilot capture and maintain target altitudes. When set to a new altitude, the Alerter will illuminate a yellow flag adjacent to the target altitude display; 15 seconds (or 200 feet) before the aircraft will reach the target altitude (based on current rate of climb or descent). The yellow flag will extinguish once the target is reached. Subsequently, if the aircraft deviates more than 200 feet above or below the target altitude, the flag will again illuminate, to alert the pilot to the deviation.

### Set the Altitude Alerter

1. Press the Right Knob until ALT displays above the Right Knob and the Selected Altitude numerical field and Bug are enabled for editing, all three rendered in magenta (Figures 3-20 and 3-21).
2. Rotate the Right Knob to change the value of the Selected Altitude field. Rotate clockwise to increase, or counterclockwise to decrease, the value.
3. Once the correct value is selected, and after 10 seconds of inaction, the field is disabled and the label, Selected Altitude field, and Bug are rendered in cyan (Figure 3-22).

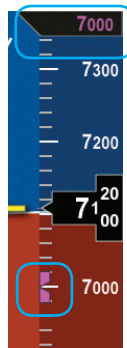


Figure 3-20  
Altitude Bug Enabled



Figure 3-21  
Altitude Field Enabled

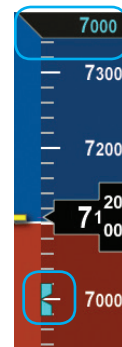


Figure 3-22  
Altitude Bug Disabled

## NOTE

Synchronizing the altitude sets the selected altitude to the current altitude (see **Chapter 2, Section 2.2.1.3.**)



**NOTE**

*Synchronizing the airspeed sets the selected airspeed to the current airspeed (see **Chapter 2, Section 2.2.1.3.**)*

**Airspeed Bug**

Press the bottom knob twice, until it shows IAS in magenta above the knob. Then turn the knob until it shows the desired airspeed in the Selected Airspeed Field.



Figure 3-14  
Range Button

### Change the Map Range

- Press the RNG (Range) Buttons (**Figure 3-14**) UP (+) to increase the range, or DOWN (-) to decrease the range, until the desired range is shown (**Figures 3-15** and **3-16**).



Figure 3-15  
Current Range 2nm from Ownship to Edge of Compass Rose



Figure 3-16  
Current Range 30nm from Ownship to Edge of Compass Rose



Figure 3-32  
360° Compass Mode



Figure 3-33  
ARC CDI Compass Mode

### Select a Compass Mode

- Press the 360/ARC Hot Key to alternately select either the 360° (Figure 3-32) or the ARC (Figure 3-33) Compass Mode.



### NOTE

Each DG Compass Mode (360 and ARC) retains its own Range and Map declutter settings when switching between the two.

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## Chapter 4

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### Reference Guide

The Evolution Backup Display is a panel-mounted digital backup flight display system that presents the pilot with displays of attitude, altitude, indicated airspeed, heading, rate of turn, slip/skid, and navigation course deviation information. The system also displays supplemental flight data, such as winds, TAS, OAT, groundspeed, moving maps, pilot-selectable indices (bugs), and various annunciations to increase situational awareness and enhance flight safety. Moving map situational awareness information is displayed when the unit is connected to compatible GPS equipment.

## 4.1. Air Data, Attitude and Heading Reference System (ADAHRS)

One of the many benefits of glass cockpit systems like the Aspen Evolution system is that they replace old, less-reliable mechanical instruments and sensors with electronic equivalents. For aircraft primary flight instruments, spinning metal gyros are replaced with electronic gyros and accelerometers, and mechanical air data instruments (airspeed indicator, altimeter, and VSI) are replaced by electronic sensors to measure static and ram air pressures. As we've all seen with computers and consumer goods, these modern electronic systems tend to be smaller, faster, cheaper, and more reliable than the older technologies they replace, while also enabling many new, advanced features and capabilities.

An electronic system that replaces the functions of the six primary flight instruments is often called an ADAHRS (Air Data, Attitude, and Heading Reference System). Sometimes, two separate systems work together to deliver those functions: an AHRS for attitude and heading, and an ADC (Air Data Computer) for airspeed, altitude, and vertical speed. Aspen uses an integrated ADAHRS mounted to the back of the display. While such systems deliver the same basic information to the pilot as the old mechanical instruments, they work in very different ways. It is important that the pilot have at least a basic understanding of how an ADAHRS works to better understand the sorts of failure modes or degraded performance that can occur, how to recognize the symptoms, and what corrective actions the pilot can take.

The EBD uses Micro Electro-Mechanical Systems (MEMS) technology and solid-state accelerometers and magnetometers on all three axes to provide the attitude reference. Generally, MEMS attitude solutions use multiple sensors and inputs, processed through Kalman filter software, to derive and validate the attitude solution.

The Aspen system uses more than a dozen different inputs to determine and monitor the aircraft attitude. In this way, the system can validate the derived attitude indication by cross-checking the various inputs to the solution for consistency.

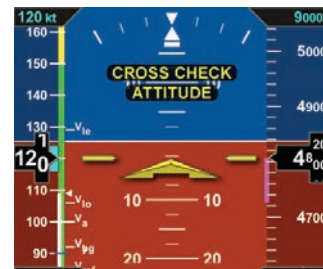
### 4.1.1. Attitude

The Aspen ADAHRS attitude solution uses inputs from its internal three-axis accelerometers, rate gyros, and magnetometers, supplemented by ram and static air pressure inputs from the aircraft pitot-static system. Failures or incorrect input from any of these sensors (such as might occur if the pitot tube or static system become blocked) will affect the attitude solution. The EBD is designed to be robust to such failures, either by being tolerant to incorrect inputs, or by detecting and annunciating a degraded attitude solution.

The Aspen ADAHRS includes a Cross-Check Monitor, which predicts the quality of the attitude solution by performing a continuous, real-time statistical analysis of the various parameters computed within the AHRS Kalman filter. When the predicted quality of the attitude calculation drops below a certain threshold, CROSS CHECK ATTITUDE is annunciated on the attitude indicator (**Figure 4-1**). The annunciation thresholds for the CROSS CHECK ATTITUDE message were determined during company flight tests, and strike a balance between minimizing nuisance annunciations (when the attitude solution is fine) and failing to annunciate (when the attitude solution is significantly degraded). This balance can occasionally result in momentary CROSS CHECK ATTITUDE annunciations, especially during aggressive maneuvering, steep or high-G turns, abrupt pitch changes, etc.

In such situations, these annunciations indicate that the statistical quality of the attitude solution is less than nominal, and that the pilot should cross-check the AHRS against alternate attitude indications. Should the annunciation persist, then degraded AHRS performance is statistically more likely to be experienced. In other words, momentary CROSS CHECK ATTITUDE annunciations indicate that the AHRS solution is working hard enough that the AHRS quality measure has degraded to something less than that associated with normal, unaccelerated flight. This situation demands increased pilot vigilance and cross-monitoring of other cockpit instrumentation.

Figure 4-1  
Cross Check Attitude  
Annunciation



## 4.1.2. Pitot Obstruction Monitor

Most light aircraft have only a single pitot and static system available for flight instrument use. As such, a common pitot and static input is shared between the EBD and analog standby instruments. Should one or both of these pitot and static lines become blocked, both the EBD and any standby airspeed and altitude indicators could display erroneous airspeed and altitude information. Furthermore, because the EBD uses pitot and static pressures as part of the AHRS attitude calculations, loss or corruption of the pitot or static pressures can also influence the accuracy of the displayed attitude information.

The EBD has been tested to be robust to these failures, either by being tolerant to incorrect pitot or static inputs, or by detecting and annunciating a degraded attitude solution. When connected to an IFR-certified GPS, the system is further able to detect and annunciate blockages in the pitot system and will fail the attitude solution before it becomes degraded. In that case, the system will red X the attitude and heading information, and display a CHECK PITOT HEAT message as a reminder to the pilot to check for ice accumulating on the pitot probe.

Once the system detects that the pitot obstruction has been cleared, the CHECK PITOT HEAT annunciation is removed and the system automatically performs an AHRS in-flight reset.

Should a GPS failure be experienced in flight, the Pitot Obstruction Monitor continues to operate in a fail-safe mode and will continue to detect obstructions in the pitot system that may occur while airborne. However, after landing, the monitor remains active, and, as the airplane slows to taxi speeds, the system will indicate a failure of the AHRS and annunciate CHECK PITOT HEAT. **(Figure 4-8)** In this circumstance, restoring the GPS will restore normal monitor operation.



In summary, loss or degradation of the EBD attitude solution is unlikely if the pilot assures the proper operation of the pitot-static system. If the pitot or static system becomes blocked, an ADAHRS internal sensor fails, or a CROSS CHECK ATTITUDE indication is frequent or persists, the attitude indication on the EBD should be considered to be compromised. In this case, the pilot must use the backup attitude indicator for attitude reference until the cause of the problem has been identified and resolved and normal system operation has been restored.

### 4.1.3. Heading

The EBD ADAHRS also includes a slaved compass system that provides accurate magnetic heading indications throughout most operating conditions and phases of flight. Its electronic gyros compensate for turning and acceleration errors, and its remote fluxgate compensates for gyroscopic precession errors, so there is no need for the pilot to adjust heading throughout the flight. Nonetheless, all compass systems are subject to some error, and the pilot should be aware of when and how the EBD heading indication can be affected.

The earth's magnetic field is measured directly by a 3-axis fluxgate magnetometer built into the Remote Sensor Module (RSM), and magnetic heading is derived from the flux on a plane perpendicular to gravity, providing immunity from pitching and rolling effects. Electronic gyros and accelerometers in the EBD system are then used to stabilize that raw heading data to eliminate the short-term turning and acceleration errors seen in traditional magnetic compasses.

Together, these systems provide accurate heading indications even during aggressive maneuvering. The gyros stabilize magnetic errors while maneuvering and are slaved to the fluxgate, which continuously updates heading to compensate for gyroscopic precession. The end result is a compass system that requires no pilot action to show accurate magnetic heading throughout the flight.

Just like other compass systems, the accuracy of the fluxgate is affected by its location on the airframe. Ferrous metal structures, electrical fields produced by motors, pumps, wiring, magnets in cabin speakers and other airframe-related sources of interference either constant or momentary (i.e. operating an electric trim motor, windshield heat, pumps, etc) can all affect the accuracy of the compass. The installer can compensate for much of this interference when calibrating the RSM, but some effects cannot be eliminated. Proper location of the RSM during installation is critical to the AHRS performance and accuracy.

Furthermore, all magnetic compass systems are susceptible to local disturbances in the earth's magnetic field (some of which are shown on aviation charts or by NOTAM) and will exhibit degraded performance when operating in extreme northern and southern latitudes close to the earth's magnetic poles.

#### 4.1.4. Free Gyro Mode

When the EBD system detects that the horizontal component of the earth's magnetic field is no longer strong enough to provide reliable heading data, the EBD will detect the condition and annunciate that the heading system is no longer slaved to magnetic north. If the condition persists, attitude and heading indications are removed.

While the condition can occur at greater distances, it is most likely to be observed within 750 nautical miles from the magnetic poles. In the Northern Hemisphere, this equates to operations in the Arctic Islands found north of continental North America.

Two minutes after detection, a FREE GYRO MODE annunciation will be presented across the HSI, indicating the heading system no longer can be aligned with magnetic north. Some precession of the heading is possible, especially during abrupt maneuvers. If the condition persists for four more minutes (six minutes total) the attitude and heading indicators will be removed and replaced with red X indications. When the conditions causing Free Gyro Mode are no longer present, attitude and heading indications will be restored after an automatic AHRS reset.

### 4.1.5. Degraded ADAHRS Performance

For Degraded ADAHRS Performance, reference the following:

- **Sections 6.1. Pitot/Static System Blockage**
- **Sections 6.8. In-Flight AHRS Reset**
- **Geographic Limitations** in the **Aircraft Flight Manual Supplement** that was installed in the aircraft with your EBD.

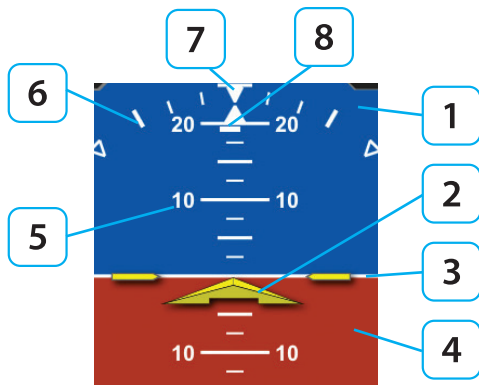


Figure 4-2  
Attitude Indicator



Figure 4-3  
Pitch and/or Roll Data Invalid

## NOTE

A red X and the annunciation ATTITUDE FAIL displays on the Attitude Indicator as long as pitch or roll attitude data is invalid (Figure 4-3).

## 4.2. Attitude Display

### 4.2.1. Attitude Indicator

The Attitude Indicator consists of an aircraft reference symbol on a blue (sky) and brown (ground) background. The white horizon line separates the sky from the ground and extends to the edge of the display. The Roll Scale curves over the top of the Attitude Indicator while the Pitch Scale extends vertically in the middle. The slip/skid rectangle is directly underneath the roll pointer (Figure 4-2).

- |          |                           |          |                     |
|----------|---------------------------|----------|---------------------|
| <b>1</b> | Sky                       | <b>5</b> | Pitch Scale         |
| <b>2</b> | Aircraft Reference Symbol | <b>6</b> | Roll Scale          |
| <b>3</b> | Horizon Line              | <b>7</b> | Roll Pointer        |
| <b>4</b> | Ground                    | <b>8</b> | Slip/Skid Indicator |

The Attitude Indicator cannot be disabled by the pilot. The Aircraft Reference Symbol is fixed relative to the Attitude Indicator and overlays all other Attitude Indicator symbols. Pitch and roll panel tilt adjustments are provided to installers to compensate for variations in installations and tilted panels.

#### 4.2.1.1. Roll Scale

The Roll Scale is displayed at the top of the Attitude Indicator and comprises a moving scale set against a fixed, white, triangle roll pointer. Tick marks are displayed at 0°, 10°, 20°, 30°, 45°, and 60° of roll. The 45° marks are triangles.

#### 4.2.1.2. Pitch Scale

The pitch scale consists of minor pitch marks in 2.5° increments up to  $\pm 20^\circ$  and major pitch marks in 10° increments up to  $\pm 90^\circ$ . Red chevrons come into view for nose-up pitch angles of 15° or more (**Figure 4-4**), and nose-down pitch angles of 10° or less (**Figure 4-5**). The pitch chevrons aid the pilot in unusual attitude recovery.

The range of movement of the background sky and ground boundaries are limited so that some sky or ground is always visible.

#### 4.2.1.3. Slip/Skid Indicator

The Slip/Skid Indicator is the small white rectangle under the roll pointer. The Slip/Skid Indicator moves left and right relative to the roll pointer in proportion to lateral acceleration. The width of the rectangle is equivalent to the width of the ball in a mechanical inclinometer.

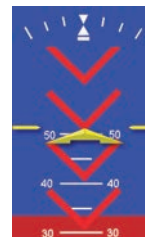
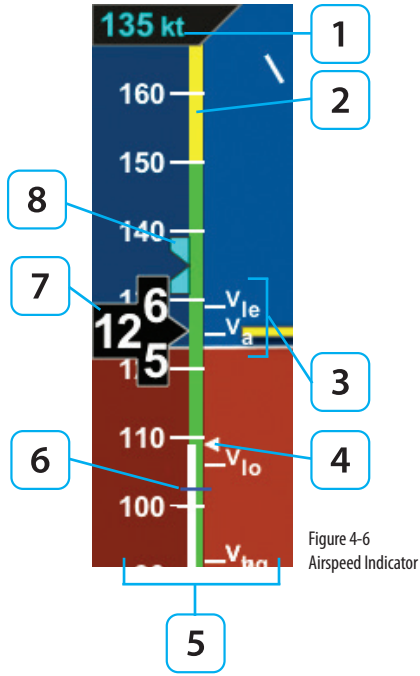


Figure 4-4  
Pitch Markings  
Large Pitch Down



Figure 4-5  
Pitch Markings  
Large Pitch Up



## 4.2.2. Airspeed Indicator

The Airspeed Indicator comprises a moving tape, airspeed bug, and numerical airspeed value (drum). Textual Vspeeds, color Speed Bands, and Speed Markers are also rendered on the moving tape (**Figure 4-7**).

- 1 Selected Airspeed Field
- 2 Color Speed Bands
- 3 Textual Vspeeds
- 4 Initial Flap Extension Speed Marker
- 5 Airspeed Tape
- 6 Speed Marker
- 7 Numerical Airspeed Value (drum)
- 8 Selected Airspeed Bug

Indicated airspeed is displayed in knots, miles per hour or Mach number, set at installation, with tick marks rendered on the Airspeed tape every ten (10) units. Speed Bands and Speed Markers are configured during installation and cannot be changed or removed by the pilot. The textual Vspeeds are pilot-configurable and are discussed in **Chapter 5, Customizing the EBD**.

The numerical airspeed value is displayed in a rolling drum format in the center of the airspeed tape with numbers moving downward as speed increases, and upward as speed decreases. The display range of the indicated airspeed is 20–450 (knots or miles per hour). The numerical airspeed value is displayed in red when Vne is exceeded or when the airspeed drops below Vs0 during stalls or landing roll-outs (**Figure 4-7**).

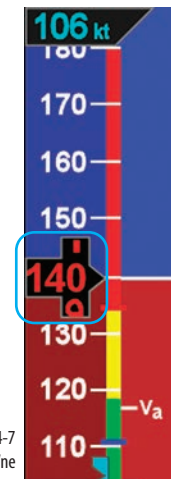


Figure 4-7  
Actual Airspeed Greater Than the Vne

## NOTE

When airspeed is less than 30 knots but ground GPS speed is greater than 50 knots, a red X and annunciation of CHECK PITOT HEAT is displayed on the Attitude Indicator (**Figure 4-8**).

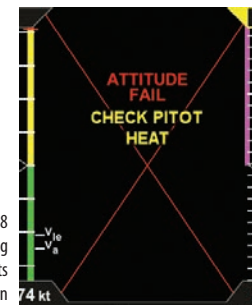


Figure 4-8  
Pitot Obstruction Monitoring  
Airspeed <30kts, Ground Speed >50kts  
Annunciation

## NOTE

The Altitude Tape can also be turned off for screen declutter. Setting will be retained when EBD is turned off.

## NOTE

When the Airspeed Tape is disabled, the numerical display of the selected airspeed remains. An installer can disable and remove the Selected Airspeed Field from the display.



Figure 4-9  
Editing Airspeed Tape Display

### 4.2.2.1. Airspeed Display

In some configurations, such as a stand-alone EBD, the airspeed tape can be turned off at the pilot's discretion to facilitate screen declutter. This setting will be retained when the EBD system is turned off then powered on again.

#### Hide/Display Airspeed Tape

1. Press MENU Button.
2. Rotate Top Knob until first Menu Key displays TPS (**Figure 4-9**).
3. Press TPS Menu Key.

TPS label and EDIT VALUE label (above Top Knob) appear in magenta.

4. Rotate Top Knob to the desired value: ENABLE or DISABLE (**Figure 4-10**).
5. Press MENU Button to exit.



Figure 4-10  
Airspeed Tape Disabled



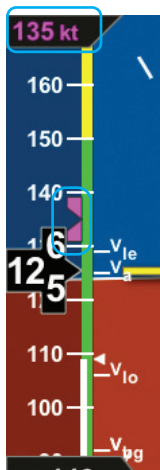


Figure 4-10  
Airspeed Bug Selected to Edit

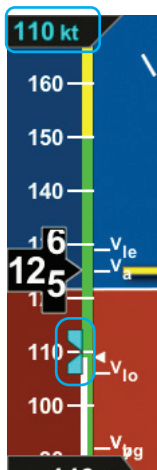


Figure 4-11  
New Airspeed Selected

#### 4.2.2.2. Selected Airspeed

The Selected Airspeed Field value and associated Airspeed Bug are shown on the Airspeed Tape. The Selected Airspeed Field value is shown at the top of the Airspeed Tape. The Airspeed Bug is displayed next to the Airspeed Tape when the Selected Airspeed value is within the visible range of the tape. The Selected Airspeed Field's default value is 20 knots Indicated Airspeed (IAS), or the value previously set. SYNCing the IAS field sets the Selected Airspeed Field value to the current indicated airspeed (**Section 2.2.1.3**). Setting the Selected Airspeed Field to a value less than 20 disables the Airspeed Bug and dashes the Selected Airspeed Field value.

#### Set Airspeed Bug

1. Press the Left Knob until IAS is shown above the Left Knob.

The Airspeed Field and Airspeed Bug appear in magenta - enabled for editing (**Figure 4-10**).

2. Rotate the Left Knob clockwise to increase, or counterclockwise to decrease the airspeed value in the Selected Airspeed Field.

After 10 seconds of inactivity, label, field and bug appear in cyan (**Figure 4-11**).

### NOTE

A typical installation sets the Tapes (TPS) display to UNLOCKED, allowing the pilot to display or hide the Airspeed and Altitude Tapes as desired. If the Airspeed and Altitude Tapes were LOCKED ON during installation, the Tapes will remain on. If the Airspeed and Altitude Tapes were LOCKED OFF during installation, the Tapes will not display.

### 4.2.3. Altimeter

The altimeter comprises an Altitude Bug, Numerical Altitude Value (drum), Altitude Tape, Altitude Trend Vector, MINIMUMS annunciation, Selected Altitude Field value, Decision Height Annunciation, and an aural tone (when configured) DH (Figure 4-11).

- 1 Selected Altitude Field
- 2 Numerical Altitude Value
- 3 Altitude Trend Vector
- 4 Altitude Tape
- 5 Altitude Alerter

The Altitude Tape range is from -1,600 to 51,000 feet. Major tick marks are provided every 100 feet and minor tick marks every 20 feet. A barometric pressure adjustment (BARO) is provided to the pilot to accurately display the aircraft's altitude above mean sea level.

The Numerical Altitude Value is shown in a rolling drum format in the center of the Altimeter Tape, with numbers moving downward as the altitude increases and upward as altitude decreases. The Numerical Altitude Value shows the altitude to the nearest 20 feet.

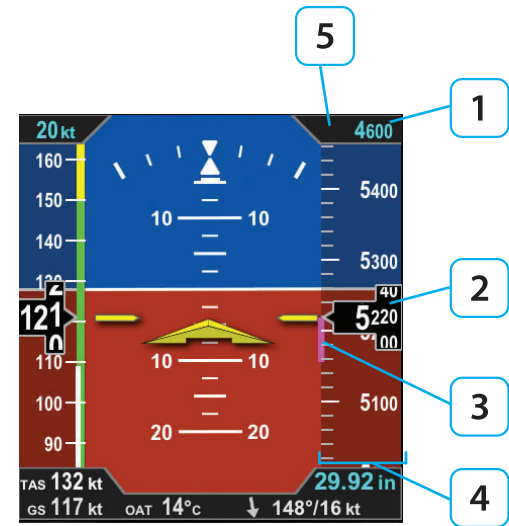


Figure 4-11  
Altimeter



Figure 4-18  
Editing BARO  
Units of Measure  
GENERAL SETTINGS B



Figure 4-19  
Editing BARO  
from in to mB



Figure 4-20  
BARO Set to mB  
(millibars)

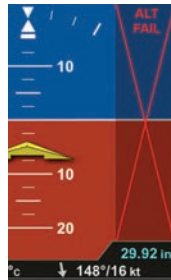


Figure 4-15  
Altitude Failure

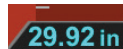


Figure 4-16  
Baro Shown in  
Inches of Mercury

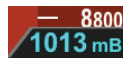


Figure 4-17  
Baro Shown in Millibars

An adjacent, magenta Altitude Trend Vector predicts the anticipated altitude, in the next six seconds, if the current rate of climb or descent is maintained. Like the VSI, there is a slight lag in the indication. If the ribbon meets or exceeds the display limit, the vertical trend is large. The Altitude Trend Vector does not display when the altitude remains constant.

If the altitude exceeds 51,000 feet, the Numerical Altitude Value is dashed, and the tape is frozen at this limit. All altitude information is removed and replaced with a red X with the textual annunciation of ALT FAIL when altitude data is invalid (**Figure 4-15**).

#### 4.2.3.1. Barometric Units of Measure

Barometric units of measure adjustment may be made in either inches of mercury (in) (**Figure 4-16**) or millibars (mB) (**Figure 4-17**), as configured by the pilot in the Menu. The adjustment range is 28.10 – 30.99 inches Hg or 946 – 1049 mB. The barometric pressure default value is 29.92 inches, or as previously set.

#### Set Barometric Units of Measure

1. Press the MENU Button.
2. Rotate the Top Knob to select the GENERAL SETTINGS B page (**Figure 4-18**).
3. Press the BARO Menu Key.

The Menu label turns magenta, and the EDIT VALUE label displays above the Top Knob (**Figure 4-19**).

4. Rotate the Top Knob to select either in or mB (**Figure 4-20**).
5. Press the MENU Button to exit.

### Set the Barometric Pressure

1. Press the BARO Hot Key.

The BARO label above the Top Knob and Barometric Pressure Setting Field appear in magenta (**Figure 4-21**).

2. Rotate the Top Knob to change the value of the Barometric Pressure Setting Field.
3. Press the BARO Hot Key or any knob, button/key to exit.

If no action is taken, after 10 seconds of inactivity, the label, and field are rendered in cyan.

#### 4.2.3.2. Selected Altitude Field

The Selected Altitude Field value is displayed at the top of the Altitude Tape. The Selected Altitude Field range is 100 to 51,000 feet, in 100 foot increments. The default value for the Selected Altitude value is 100 feet, or the previously set value. Additionally, the Altitude Bug is displayed adjacent to the Altitude Tape and at the Selected Altitude Field value when within the visible range of the current altitude.

### Set Altitude Bug and Altitude Alerter

1. Press the Right Knob until ALT displays above the Right Knob.

The Selected Altitude Field and bug are enabled for editing, all rendered in magenta (**Figure 4-22**).

2. Rotate the Right Knob (clockwise to increase, or counterclockwise to decrease) to change the value of the Selected Altitude Field.

Once the correct value is selected, and after 10 seconds of inaction, the field is disabled, and the label, field, and bug are rendered in cyan.



Figure 4-21  
BARO Field Enabled

### **WARNING**

*Always check and set the EBD BARO whenever the mechanical altimeter is adjusted*

### **NOTE**

*Since the altitude tape display is limited to approximately 400 feet, the altitude bug symbol is shown on the altitude tape when the Selected Altitude Field value is within the visible range of the current altitude.*



Figure 4-34  
Editing Airspeed and Altitude Tape Display



Figure 4-35  
Airspeed and Altitude Tape Disabled

#### 4.2.3.3. Altitude Display

In some configurations, such as a stand-alone EBD, the altitude tape can be turned off, at the pilot's discretion, to facilitate screen declutter. Both Airspeed and Altitude tapes are affected by this action.

##### Hide/Display Airspeed and Altitude Tape

1. Press the MENU Button.
2. Rotate the Top Knob counterclockwise until GENERAL SETTINGS A page displays (Figure 4-34).
3. Press the TPS Menu Key.

The Menu label turns magenta, and the EDIT VALUE label displays above the Top Knob.

4. Rotate the Top Knob to the desired value, ENABLE (On) or DISABLE (Off) (Figure 4-35).
5. Press the MENU Button to exit.

#### **NOTE**

*When the Altitude tape is disabled, the numerical display of the selected altitude and altitude minimums remain on. However, an installer can disable and remove the Selected Altitude and Minimums Fields, and the MINIMUMS Annunciation and Markers from the display.*

## NOTE

Rotating the knob quickly will change the altitude value in larger increments.

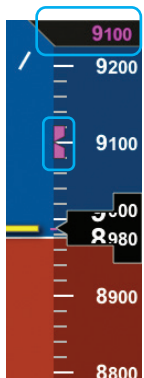


Figure 4-22  
Altitude Bug and Altitude Alerter Enabled

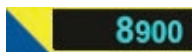


Figure 4-23  
Altitude Alert

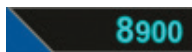


Figure 4-24  
Altitude Alert Extinguishes at  
Selected Altitude

### 4.2.3.4. Altitude Level-Off and Deviation Alert

The Altitude (level-off) Alert is ARMED and rendered on-screen as a yellow alert flag next to the Selected Altitude value when the aircraft altitude transitions to within 200 feet or 15 seconds of reaching the selected altitude (**Figure 4-23**). If an optional Sonalert tone generator device is installed, a one-second tone also sounds. Once the current altitude is within  $\pm 25$  feet of the Selected Altitude, the Altitude Alert extinguishes (**Figure 4-24**).

After reaching the Selected Altitude, if the aircraft's current altitude differs from the selected altitude by more than 200 feet, the yellow alert flag flashes. If an optional Sonalert tone generator device is installed, a one-second tone also sounds.

## NOTE

Setting the Altitude Alerter provides visual cues to help the pilot capture and maintain target altitudes. When set to a new altitude, the Alerter will illuminate a yellow flag adjacent to the target altitude display; 15 seconds (or 200 feet) before the aircraft will reach the target altitude (based on current rate of climb or descent). The yellow flag will extinguish once the target is reached. Subsequently, if the aircraft deviates more than 200 feet above or below the target altitude, the flag will again illuminate to the deviation.

## 4.3. Data Bar

The Data Bar presents True Airspeed (TAS) or the Mach number, GPS Ground Speed (GS), Outside Air Temperature (OAT), Wind Direction, Wind Speed, and Barometric Pressure Setting, as shown in **Figure 4-36**. The Data Bar is always present on the display. Invalid or out-of-range Data Bar values are dashed.

- |  |  |
|--|--|
| <b>1</b> True Airspeed (TAS)               | <b>5</b> Wind Direction Arrow          |
| <b>2</b> Barometric Pressure Setting Field | <b>6</b> Outside Air Temperature (OAT) |
| <b>3</b> Wind Speed                        | <b>7</b> Ground Speed (GS)             |
| <b>4</b> Wind Direction                    |  |

### 4.3.1. True Airspeed

The True Airspeed (TAS) is displayed in the upper left of the Data Bar. The TAS has a range of 20–999 knots or mph, using the same unit of measurement as the aircraft's Airspeed Indicator. The TAS is a correction of the IAS for nonstandard pressure and temperature.

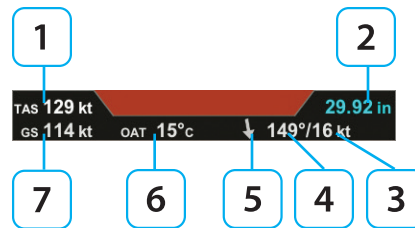


Figure 4-36  
Data Bar

#### **NOTE**

*If the OAT was set to disabled during installation, as would be the case if the RSM is mounted internally to the aircraft structure, then the OAT, TAS, and Wind Speed and Direction are not displayed.*



Figure 4-37  
Select OAT Units of Measure

### 4.3.2. Ground Speed

The Ground Speed (GS) comes from a configured GPS navigator and is digitally displayed in the lower left corner of the Data Bar with a value range of 5–999 knots or mph, using the same unit of measurement as the Airspeed Indicator.

### 4.3.3. Outside Air Temperature (when enabled)

The Outside Air Temperature (OAT) is displayed in the center of the Data Bar (**Figure 4-36**). The temperature is obtained from the temperature sensor located in the RSM. Temperature sensor ranges from -55°C to +80°C (-67°F to +176°F).

#### Set OAT Units of Measure

1. Press the MENU Button.
2. Rotate the Top Knob counterclockwise until GENERAL SETTINGS B page displays.
3. Press the OAT Menu Key.

The Menu label turns magenta and the EDIT VALUE label displays above the Top Knob (**Figure 4-37**).

4. Rotate the Top Knob to select either °C or °F (**Figure 4-37**).
5. Press the MENU Button to exit.



### 4.3.4. Wind Speed, Direction, and Arrow (when enabled)

The Wind Speed, Direction, and Direction Arrow are displayed in the lower right portion of the Data Bar. The Wind Speed has a range of 10–999 knots or mph, using the same unit of measure as the Airspeed Indicator.

The Wind Direction and Arrow (**Figure 4-38**) have a range of 001°–360°, using the same direction reference used by the Direction Indicator. The arrow points in the direction of the wind and is displayed relative to the current direction of flight. For example, if the current direction of flight is 360° and the wind is from 360°, the arrow will point straight down on the display (a headwind blowing toward your aircraft).

When the computed wind speed is below 10 knots or mph (depending on aircraft configuration) the wind speed and direction values are blank, and the wind arrow is removed. If the wind data is out of range or invalid, the values are dashed, and the wind arrow is removed.

### 4.3.5. Barometric Pressure Setting Display

The Barometric Pressure Setting Field is displayed on the upper right corner of the Data Bar and is pilot-adjustable, as discussed in **Section 4.2.3.1**. When the Altitude Tape is disabled, the Barometric Pressure Setting field remains visible. However, an installer can disable the field and remove it from the display. **Section 4.2.3.1** provides complete information and step-by-step instructions for setting the barometric pressure.



Figure 4-38  
Wind Direction Arrow

#### NOTE

*The wind computations require a GPS-provided ground track and ground speed to compute the wind direction and speed. If a GPS is not connected to the EBD or the data are invalid, the wind direction and speed are dashed and the wind direction arrow is removed.*

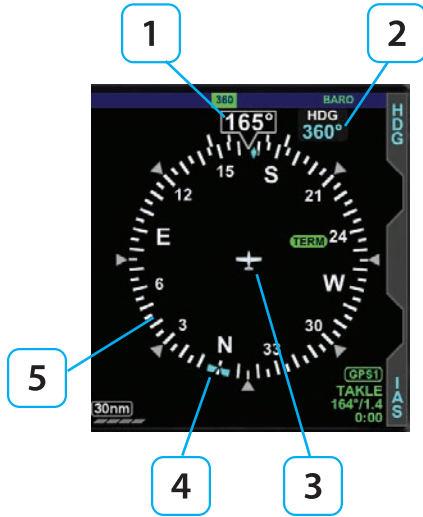


Figure 4-39  
Horizontal Situation Indicator

## 4.4. Navigation Display

Figure 4-39).

The Direction Indicator comprises a compass, numerical direction indication, heading bug, Ground Track Marker (when GPS ground track information is available), rate of turn indicator, and aircraft ownship symbol.

- |          |                         |          |               |
|----------|-------------------------|----------|---------------|
| <b>1</b> | Magnetic Heading        | <b>4</b> | Heading Bug   |
| <b>2</b> | Selected Heading Field  | <b>5</b> | Compass Scale |
| <b>3</b> | Aircraft Ownship Symbol |          |               |

All Magnetic Headings are displayed in degrees. The value range is from 001° - 360°, always displayed in three digits, and use leading zeros when applicable. The Magnetic North is expressed as 360°.

#### 4.4.1. Compass

The EBD offers two Compass Modes: 360° and ARC. The default Compass Mode is 360°. The aircraft's heading is always expressed in degrees magnetic. The magnetic headings inside of the compass scale omit the last zero for brevity (i.e., 30°, 60°, 120°, 150°, 210°, 240°, 300°, and 330° are labeled 3, 6, 12, 15, 21, 24, 30, and 33, respectively). The four cardinal compass headings are shown as letters (i.e., N for 360°, E for 090°, S for 180°, and W for 270°).

##### 4.4.1.1. 360° Compass Mode

The 360° Compass Mode displays a full 360° compass rose with all other components of the Direction Indicator. The 360° compass rose rotation centers on the aircraft ownship symbol so that the numerical direction indication corresponds to the current aircraft heading (Figure 4-40).

##### 4.4.1.2. ARC Compass Mode

The two ARC Compass Modes have an abbreviated 100° ARC compass scale. All other elements of the Direction Indicator are retained. The ARC Compass Mode's scale rotation centers on the aircraft ownship symbol so that the numerical direction indication corresponds to the current aircraft heading.



Figure 4-40  
360° Compass Mode



Figure 4-46  
360/ARC Hot Key



Figure 4-47  
ARC CDI Compass Mode



Figure 4-48  
360° Compass Mode

### Select Compass Type

1. Press the 360/ARC Hot Key (**Figure 4-46**) to alternately select either the 360° or ARC Compass Mode.

The Navigation Display changes and the Hot Key label reflects the currently selected Compass Mode (**Figures 4-47 and 4-48**).

## 4.4.2. Heading Bug

The EBD offers a pilot-selectable Heading Bug. The Heading Bug symbol is positioned on the compass scale according to the Selected Heading Field value (HDG) set by the pilot (**Figure 4-82**).

When the Selected HDG Field value is outside the visible compass scale range in the ARC Compass mode, only a portion of the Heading Bug is shown at the edge of the compass arc, closest to the HDG value (**Figure 4-83**).

When selected for editing, the Heading Bug and the Selected HDG Field value are shown in magenta. Additionally, a dashed magenta line extends from the Ownship Symbol to the Heading Bug, corresponding to the HDG value. When the Heading Bug is SYNCed, the HDG value is set to the current heading.

### Set Heading Bug

1. Press the Top Knob.

The HDG label above the Top Knob and the Selected Heading Field are enabled for editing, both rendered in magenta (**Figure 4-84**).

2. Rotate the Top Knob to change the value of the Selected Heading Field.

Once the HDG value is set, and after 10 seconds of inaction, the Selected HDG Field is disabled, and both the Top Knob State and the Selected Heading Field are displayed in cyan.



Figure 4-82  
Heading Bug and Selected  
Heading Field



Figure 4-83  
Selected Heading Bug Outside of  
the ARC Compass Scale Range



Figure 4-84  
Heading Selected to Edit



Figure 4-86  
Direction Indicator Fail

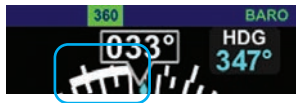


Figure 4-87  
Rate of Turn Indicator  
(360° Compass Mode)



Figure 4-88  
Rate of Turn Indicator  
(ARC Compass Mode)



Figure 4-85  
Direction of Flight  
Numerical Display

### 4.4.3. Aircraft Heading Display

The aircraft heading is displayed in degrees magnetic (**Figure 4-85**).

If the aircraft's heading is unavailable or invalid, all heading and navigation information is removed and replaced with a single red X covering the entire lower display area, along with the annunciation DIRECTION INDICATOR FAIL (**Figure 4-86**).

### 4.4.4. Rate of Turn Indicator

The Rate of Turn Indicator consists of a curved white line originating from the corresponding side of the aircraft heading (i.e., a left turn indication starts on the left side of the index mark) and extends in the direction of the turn along the outer radius of the compass scale. The turn rate indication is provided for every compass mode, 360° (**Figure 4-87**) and ARC (**Figure 4-88**).

The Rate of Turn Indicator features tick marks for full and half-standard rate turns (a standard rate turn = 3° per second).

The Rate of Turn Indicator has a range of 0° – 6° per second. When the turn rate exceeds 6° per second, an arrowhead is added to the end of the tape to show that the rate of turn has exceeded the limits of the instrument.

## 4.4.5. Basemap Overlays

The Basemap comprises symbols depicting the location of flight plan waypoints and legs, airports, VORs, DMEs, NDBs, and intersections. The Basemap is always oriented with magnetic heading up and centered so that the current aircraft position coincides with the aircraft's Ownship Symbol. The current Basemap declutter level and range are shown on the lower left side of the display (**Figure 4-89**).

- 1 Basemap Symbols
- 2 Aircraft Ownship Symbol
- 3 Basemap Range
- 4 Basemap Declutter Level

When enabled, the Basemap features on the Navigation Display are displayed and layered as detailed in **Table 5-12**. The GPS flight plan is rendered in either straight or curved lines, as supported by the configured GPS navigator. The displayed symbol set includes active waypoints, active flight plan leg, flight plan waypoints, flight plan legs, airports, VORs, VORTACs, TACANs, DMEs, intersections, and NDBs (**Figure 4-90**).

### NOTE

All map and flight plan elements are received from the GPS and are only available from compatible GPS navigators (e.g. GNS 430/530).

### NOTE

A VORTAC is shown as a combined VOR and DME symbol. A TACAN is rendered as a DME symbol.



Figure 4-89  
Basemap (ARC CDI Compass Mode Shown)

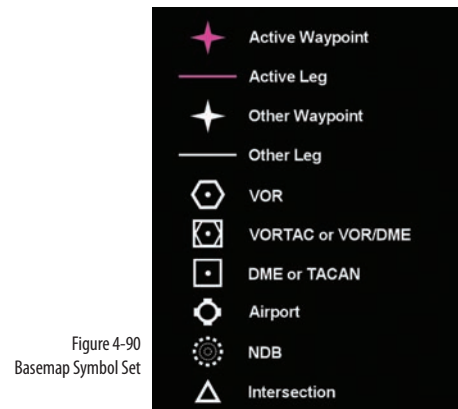


Figure 4-90  
Basemap Symbol Set



Figure 4-91  
MAP Hot Key



Figure 4-93  
Basemap Range Buttons

## NOTE

When connected to a GPS that does not provide compatible Basemap data, only OFF and FP ONLY declutter levels are available.

### 4.4.5.1. Basemap Declutter and Range

To turn the Basemap on or off, the pilot selects one of the declutter levels as described in **Section 5.2**. The default map declutter level is Level 4. The map range corresponds to the outside radius of the compass scale, 2, 3, 5, 10, 15, 20, 30, 40, 60, 80, 100, or 200 nautical miles from the aircraft Ownship Symbol. The default range is 15nm. Both the map declutter level and range are pilot-adjustable.

#### Select Map Declutter Level

1. Press the MENU Button and rotate the Top Knob to MAP SETTINGS page.
2. Press the DCLTR LVL Menu Key (**Figure 4-91**) and rotate the Top Knob to select the desired map declutter level.
3. Press the MENU Button to exit.

The new Basemap display level appears above the Bottom Knob (**Figure 4-92**).

#### Change Map Range

1. Press the Range Up (RNG +) or the Range Down (RNG -) Button (**Figure 4-93**), until the desired range is displayed (**Figure 4-94**).



Figure 4-92  
New Basemap  
Display Level



Figure 4-94  
New Basemap  
Range





Figure 4-95  
Auto Range Mode



Figure 4-96  
GENERAL SETTINGS B Page Editing Auto  
Range Setting

## NOTE

The map range increases or decreases one increment each time the RNG + or - Button is pressed. Press and hold to continuously increase or decrease the range.

## NOTE

The Basemap declutter setting can determine what is displayed for a particular range. Refer to **Chapter 5, Table 5-9** for more information.

The EBD has an Auto Range feature that automatically scales the range (to the closest range setting) to fit the Aircraft Ownship and the active waypoint within the Navigation Display, e.g., if the active waypoint is 84 miles away, Auto Range will select a 100nm range (the closest range setting is 100nm). When Auto Range is active, an inverse white A is shown next to the range value (**Figure 4-95**).

### Enable Auto Range

1. Press the MENU Button.
2. Rotate the Right Knob to the GENERAL SETTINGS B Menu page.
3. Press the AUTO RNG Menu Key.

The AUTO RNG label turns magenta (**Figure 4-96**).

4. Rotate the Right Knob to the desired value, either ENABLE or DISABLE.
5. Press the MENU Button to exit.

### Activate Auto Range

1. Press the RNG +/- button to select the highest or lowest map range.
2. Release and then press and hold the RNG +/- button for two seconds.

The map range changes and the new map range is indicated on the map. An inverse white A displays next to the numeric range value.

### Deactivate Auto Range

1. Press the RNG +/- Button once to deactivate Auto Range mode.

The inverse white A next to the numeric range value is removed.

Pressing RNG + moves to the next higher range; pressing RNG - moves to the next lower range.

Auto Range is only available when a flight plan is active. Since Auto Range uses the distance between the present position and the next active waypoint to compute the appropriate map range, if the currently Selected CDI Navigation Source does not have a valid flight plan, then Auto Range is not selectable. If Auto Range cannot be selected check:

- To ensure a flight plan is active
- The GPS source with the flight plan is the Selected CDI Navigation Source
- That Auto Range is enabled from the General Settings B Menu page

#### 4.4.5.2. Flight Plan

When a flight plan is provided by a configured GPS, the map shows flight plan waypoints and legs. The active leg and waypoint and associated identifier are displayed in magenta. Other waypoints and legs are white. Straight and curved flight plan details are rotated within the map display to maintain their correct relative orientations at all times.

#### 4.4.5.3. Map Data Source and Reversion

If the selected GPS data is unavailable or invalid:

- The associated flight plan and map data are retained and displayed, as long as an alternate source of position information remains available.
- The flight plan and waypoints become inactive and are displayed in white.
- Position is provided from:
  1. The RSM GPS, if enabled, and position data are available. In this case, a RSM GPS REVERSION EMER USE ONLY annunciation is shown above the Selected CDI Navigation Source (**Figure 4-98**).

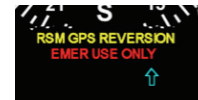


Figure 4-98  
RSM GPS Reversionary Navigation



Figure 4-99  
Invalid or Failed GPS Annunciations



Figure 4-100  
ARC Compass Mode, Ground Track Marker



Figure 4-101  
360° Compass Mode, Ground Track Marker

When a GPS source's position data are invalid or no longer available, an amber annunciation, GPS1, GPS2, or RSM GPS, is shown in the lower left corner of the Navigation Display to indicate which has failed (**Figure 4-99**).

#### 4.4.6. Ground Track Marker

When configured with a GPS that provides ground track data, a Ground Track Marker is displayed on the compass scale to indicate the aircraft's ground track. This marker may be used to compensate for wind drift during flight (**Figures 4-100 and 4-101**). The Ground Track Marker is removed from the display when ground track is not available or invalid.

## 4.6. Vertical Speed Indicator

When the 360° Compass Mode is selected, the Vertical Speed Indicator (VSI) is rendered on the right side of the Navigation Display, showing a numerical and graphical representations of vertical speed. The VSI shows the change in pressure altitude over time. The graphical display is a white VSI Tape, with the numerical value at the top (Figure 4-106). In either ARC Compass mode, only the numerical value is shown.

The VSI Tape displays rates of  $\pm 2,000$  FPM while the numerical value displays rates up to  $\pm 9,990$  FPM. When the vertical speed exceeds  $\pm 2,000$  FPM, a triangle caps the VSI Tape (Figure 4-107).

The VSI Tape is nonlinear, giving more display area to the 0 to  $\pm 1,000$  FPM range than to the  $\pm 1,000$  to  $\pm 2,000$  FPM range. Tick marks are presented only in the direction of the climb or descent to provide visual cues for trends. The VSI's numerical value, tape, and scale are only shown if the aircraft is climbing or descending more than  $\pm 100$  FPM. During level flight in calm air conditions, the Tape, scale, and zero reference line are removed from the display. The numerical value is always enabled and shows dashes when vertical rates are out of range.

### NOTE

The map range increases or decreases one increment each time the RNG + or - Button is pressed. Press and hold to continuously increase or decrease the range.

### NOTE

The Basemap declutter setting can determine what is displayed for a particular range. Refer to **Chapter 5, Table 5-9** for more information.



Figure 4-106  
VSI



Figure 4-107  
VSI Tape Off-Scale

# Chapter 5

## Customizing the Evolution Backup Display

### 5.1. Menu Overview

The following tables and figures provide a brief overview of each menu page and its menu options.

KEY DESCRIPTION		OPTIONS
1	Displays Airspeed and Altitude Tapes	
2	Not Used	
3	Not Used	

Table 5-1  
Menu – GENERAL SETTINGS A



Figure 5-1  
GENERAL SETTINGS A



Figure 5-2  
GENERAL SETTINGS B

KEY DESCRIPTION		OPTIONS
1	Not Used	
2	AHRS Reset	Action
3	Barometer Pressure Setting Units of Measure	in Hg or mB

Table 5-2  
Menu – GENERAL SETTINGS B



Figure 5-3  
GENERAL SETTINGS C

KEY DESCRIPTION		OPTIONS
1	Outside Air Temperature Units of Measure	°C or °F
2	Not Used	
3	Not Used	

Table 5-3  
Menu – GENERAL SETTINGS C

KEY DESCRIPTION		OPTIONS
1	Mach Display	OFF, ON (>0.1, ->0.6)
2	Not Used	

Table 5-4  
Menu – 360° MAP SETTINGS



Figure 5-4  
GENERAL SETTINGS D

KEY DESCRIPTION		OPTIONS
1	360° Declutter Level	0, 1, 2, 3, 4
2	360° Flight Plan	OFF, AUTO
3	360° Airports	OFF, AUTO

Table 5-5  
Menu – 360° MAP SETTINGS A



Figure 5-5  
360° MAP SETTINGS A



Figure 5-6  
360° MAP SETTINGS B

KEY DESCRIPTION		OPTIONS
1	360° VOR	OFF, AUTO
2	360° INT/NDB	OFF, AUTO

Table 5-6  
Menu – 360° MAP SETTINGS B



Figure 5-7  
ARC MAP SETTINGS A

KEY DESCRIPTION		OPTIONS
1	ARC Declutter Level	0, 1, 2, 3, 4
2	ARC Flight Plan	OFF, AUTO
3	ARC Airports	OFF, AUTO

Table 5-7  
Menu – ARC MAP SETTINGS A



KEY DESCRIPTION		OPTIONS
1	ARC VOR	OFF, AUTO
2	ARC INT/NDB	OFF, AUTO

Table 5-8  
Menu – ARC MAP SETTINGS B



Figure 5-8  
ARC MAP SETTINGS B

**NOTE**

When V Speeds are LOCKED at installation, the legend and set value are shown in gray. Setting any of the above values to zero removes the affected V Speed.

KEY DESCRIPTION		OPTIONS
1	VSPPEEDS	DISABLE or ENABLE
2	Va	0 - 450
3	Vbg	0 - 450

Table 5-9  
Menu – VSPPEEDS



Figure 5-9  
VSPPEEDS A



Figure 5-10  
VSPEEDS B

KEY DESCRIPTION		OPTIONS
<b>1</b>	Vref	0 - 450
<b>2</b>	Vr	0 - 450
<b>3</b>	Vx	0 - 450

Table 5-10  
Menu – VSPEEDS B



Figure 5-11  
VSPEEDS C

KEY DESCRIPTION		OPTIONS
<b>1</b>	Vy	0 - 450
<b>2</b>	Vlo	0 - 450
<b>3</b>	Vle	0 - 450

Table 5-11  
Menu – VSPEEDS V

KEY DESCRIPTION		OPTIONS
1	Not Used	
2	Not Used	
3	Not Used	

Table 5-12  
XM RECEIVER A



Figure 5-12  
XM RECEIVER A

KEY DESCRIPTION		OPTIONS
1	Not Used	
2	Not Used	
3	Not Used	

Table 5-13  
XM RECEIVER B



Figure 5-13  
XM RECEIVER B



Figure 5-14  
XM RECEIVER C



Figure 5-15  
XM RECEIVER D

KEY DESCRIPTION	OPTIONS
1	Not Used
2	Not Used

Table 5-14  
XM RECEIVER C

KEY DESCRIPTION	OPTIONS
1	Not Used
2	Not Used
3	Not Used

Table 5-15  
XM RECEIVER C

KEY DESCRIPTION		OPTIONS
1	Operating from or Switch to Battery Power. Green when current state (Pressing key performs no action). White if selection is possible.	Status or Action
2	Operating from or Switch to External Power. Green when current state (Pressing key performs no action). White if selection is possible.	Status or Action
3	Restart (Depending on Air/Ground Logic State).	Action

Table 5-16  
Menu – POWER SETTINGS



## NOTE

For external/battery power control, the legend of the current power source is shown in green; pressing the associated menu key will perform no action. The legend of an available power source is shown in white, and pressing the associated menu key changes input power to that power source.



Figure 5-16  
POWER SETTINGS A



Figure 5-17  
POWER SETTINGS B

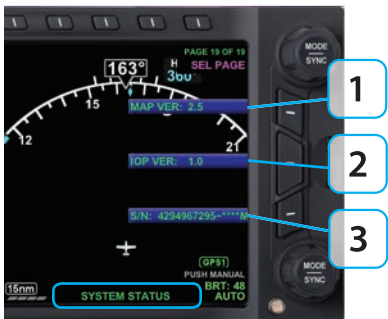


Figure 5-18  
SYSTEM STATUS

KEY DESCRIPTION		OPTIONS
1	External Power Source Voltage. Displays voltage level of input power.	Status Only
2	Battery Status	Description
	##%	Displays battery % charge.
	CHARGING	The battery has sufficient voltage and can accept charging, aircraft power is available, and the temperature sensor is within limits (0°C to +55°C).
	FAILED	The battery voltage is less than 6 volts; i.e. insufficient for charging.
	READY	The connected battery and battery voltage are satisfactory.
		Status Only

Table 5-17  
Menu – POWER SETTINGS

KEY DESCRIPTION		OPTIONS
1	Main Application Processor Software Version	Status Only
2	Input Output Processor Software Version	Status Only
3	Unit Serial Number	Status Only

Table 5-18  
Menu – SYSTEM STATUS

## 5.2. Customizing Basemap Symbol Declutter Settings

The pilot can customize the Basemap symbol declutter settings to Level 4, Level 3, Level 2, Level 1, or Level 0 (OFF) by pressing the MENU Button and selecting the 360 MAP SETTINGS Menu page or the ARC MAP SETTINGS Menu page.

Each Compass Mode has its own Menu page for Map Setting basemap symbol display.

- The 360 MAP SETTINGS Menu page offers Map Setting options for the 360° Compass Mode (Figure 5-19 and 5-20).
- The ARC MAP SETTINGS Menu page offers Map Setting options for the ARC Compass Mode (Figure 5-21 and 5-22).



Figure 5-19  
360° MAP SETTINGS A



Figure 5-20  
360° MAP SETTINGS B



Figure 5-21  
ARC MAP SETTINGS A



Figure 5-22  
ARC MAP SETTINGS B

As described in **Table 5-5** and **Table 5-7**, the selected declutter level and range determine which Basemap symbols are displayed. Basemap symbol identifiers may also be shown next to their symbol.

See **Chapter 4, Section 4.4.1** for more details about Compass Mode options.






Feature Group and Layer Order (from Top to Bottom)		Max Range	Declutter Setting					
			 Figure 5-16 Level 4	 Figure 5-17 Level 3	 Figure 5-18 Level 2	 Figure 5-19 Level 1	 Figure 5-20 Level 0 (Off)	
Traffic Overlay Symbols	1	Overlay – enabled via Hot Key	Always ON, regardless of declutter level					No symbols, legs, or waypoints—regardless of selected range—are displayed. When selected, the basemap declutter and range display for two seconds and then are removed from view. The MAP Hot Key legend is shown in gray.
Ownship Symbol	2		Always ON, regardless of declutter level					
Instruments <sup>1</sup> and Annunciations <sup>2</sup>	3		Always ON, regardless of declutter level					
Flight Plan Legs and Waypoints <sup>3</sup>	4	200	●	●	●	●		
Airports <sup>3</sup>	5	100	●	●	●			
NDBs <sup>3</sup>	6	15	●					
VORs, (HIGH, LOW, Terminal) <sup>3</sup>	7	200	●	●				
Intersections	8	15	●					

Table 5-19  
Map Feature Group Layering, Range, and Declutter Levels

1. e.g., VSI, Direction Indicator, TO/FROM.
2. e.g., NAV INFO Block, Range.
3. Shown only when data is provided by a compatible and connected GPS system.
4. Removed at ranges less than 20nm.



## 5.3. Configuring Vspeeds

Vspeeds are used to designate different operating speeds of the aircraft and are defined in **Table 5-20**.

Vspeed	DEFINITION	PRE-SET BANDS	ADJUSTABLE TEXT LABELS	PRE-SET MARKERS
Vne	Never exceed	●		● (Red Line)
Vno	Maximum structural cruising speed	●		
Vfe	Maximum full flap extension speed	●		
Vs	No flap stall	●		
Vso	Stall speed in landing configuration	●		
Va	Design maneuvering speed		●	
Vbg	Best glide		●	
Vr	Rotation speed		●	
Vref	Landing reference speed		●	
Vx	Best angle of climb		●	
Vy	Best rate of climb		●	
Vle	Maximum landing gear extended speed		●	

 **NOTE**

Setting the value of the white triangle,  $V_{yse}$ , and  $V_{mc}$  markers to zero (0) during installation disables the markers. Setting any of the adjustable  $V_{speed}$  values to zero (0) disables the associated label.


Vspeed	DEFINITION	PRE-SET BANDS	ADJUSTABLE TEXT LABELS	PRE-SET MARKERS
$V_{lo}$	Maximum landing gear operating speed		●	
$V_{mc}$	(Multi-engine) Single-engine minimum control airspeed			● (Red Line)
$V_{yse}$	(Multi-engine) Best single-engine rate of climb			● (Blue Line)
	Maximum initial flap extension speed			●

Table 5-20  
Vspeed Definitions

The EBD uses color speed bands, color speed markers, and textual labels to help the pilot recall Vspeed settings and limits. The speed band markings are determined by the Federal Regulations and correspond to the aircraft operating speeds that are identified in the Aircraft Flight Manual. They have a range between two speeds that are pre-set at installation as outlined in **Table 5-21** and shown in **Figure 5-23**.

Speed markers are also pre-set during installation, indicating important aircraft-specific speeds, where applicable. The textual Vspeed labels are made pilot adjustable or locked during the EBD installation.

BAND COLOR	SPEED RANGE	
Red Band (High Speed)	Vne (Top of tape)	Never Exceed
Yellow Band	Vno – Vne	Caution Range
Green Band	Vs – Vno	Normal Operating Range
White Band	Vs0 – Vfe	Flap Operating Range
Red Band (Low Speed)	Vs0 (Bottom of tape)	Disabled on the ground and during takeoff

Table 5-21  
Speed Band Ranges



Figure 5-23  
Speed Bands

### NOTE

On aircraft without flaps, the white band is disabled, and the green band is shown full width, as there isn't an applicable Flap Extend (Vfe) or Full Flap Stall (Vs0) speed. These two speeds are set to the same speed as the No Flap Stall (Vs) speed. This gives the white band a value of zero, effectively disabling it.

### NOTE

The color speed bands and color speed markers on the EBD Airspeed Tape are configured to match the certified mechanical airspeed indicator.



Figure 5-24  
VSPEEDS A



Figure 5-25  
Editing VSPEEDS



Figure 5-26  
VSPEEDS Disabled

On aircraft with flaps, setting the upper and lower thresholds of the white and/or yellow bands to the same value disables the applicable band. When disabled, the band does not display.

When using the Vspeed textual markers, the pilot must first ENABLE the display of the markers and then set values for each Vspeed. The value range for Vspeed textual markers is 0 – 450 or LOCKED. The default setting is 0 unless previously set to another value. When the value is 0, the Vspeed is individually disabled, and the marker is not shown on the Airspeed Tape. Once the values are set, the pilot can choose to disable all the Vspeed textual markers to declutter the Airspeed Tape.

### Display or Hide the Vspeed Textual Markers on the Airspeed Tape

1. Press the MENU Button.
2. Rotate the Top Knob to the VSPEEDS A Menu page (**Figure 5-24**).
3. Press the VSPEEDS Menu Key.  
The Menu label turns magenta, and the EDIT VALUE label displays above the Top Knob (**Figure 5-25**).
4. Rotate the Top Knob to select ENABLE or DISABLE (**Figure 5-26**).  
ENABLE will display the Vspeeds on the Airspeed Tape and DISABLE will hide the Vspeeds to declutter the Airspeed Tape
5. Press the MENU Button to exit.

## 5.4. LCD Brightness Control

The LCD brightness of the EBD operates in either of two modes, Automatic or Manual (Figures 5-27 and 5-28). The LCD brightness range is displayed as a value from 1–100, displayed above the Bottom Knob.

LCD MODE	DESCRIPTION
AUTOMATIC BRT AUTO	LCD backlight intensity is automatically adjusted based on the ambient lighting conditions sensed by the Automatic Dimming Photocell (Figure 5-27). When using the auto-brightness, the maximum brightness level is 70%.
MANUAL BRT ADJUST	Allows the pilot to adjust the LCD backlight intensity. (Figure 5-28) from 1–100%.

Table 5-22  
Brightness Control

### Change Brightness Mode

1. Press the MENU Button.
2. Press the Bottom Knob to select the desired LCD Brightness Control mode, either Automatic (BRT AUTO) (Figure 5-27), or Manual (BRT ADJUST) (Figure 5-28).
3. Press the MENU Button to exit.

### Adjust Display Brightness Manually

1. Switch to manual LCD Brightness Control mode (BRT ADJUST) (Figure 5-28).
2. Rotate the Bottom Knob clockwise to increase the display brightness or counterclockwise to decrease the display brightness. The BRT: value changes accordingly.
3. Press the MENU Button to exit and retain the selected brightness level.



Figure 5-27  
Display Brightness in  
BRT AUTO Mode



Figure 5-28  
Display Brightness in  
BRT ADJUST Mode

### NOTE

When the EBD is operating on the internal battery, the maximum brightness level is capped at 40% in automatic mode and 70% in manual mode to preserve battery operating time.

### NOTE

To facilitate cooling of the EBD display unit, when the backlight temperature is greater than or equal to 70°C, the display brightness level is limited to 30% in automatic mode and 70% in manual mode. The limits are removed when the EBD display temperature drops below 60°C.

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## Chapter 6

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# Expanded Emergency and Abnormal Procedures

This section supplements and provides an expanded description of the emergency and abnormal procedures included in the FAA-approved Aircraft Flight Manual Supplement. The information provided here is intended to provide additional background information to enhance the pilot's understanding of the emergency and abnormal conditions and the associated procedures provided in the AFMS. This pilot guide is provided for supplementary purposes only. The approved cockpit reference for in-flight use is the AFMS. Both the Pilot Guide and the AFMS must be immediately available to the pilot at all times in flight. In the event of any conflict between this document and the FAA-approved AFMS, the AFMS instructions must be followed.

## 6.1. Pitot/Static System Blockage

A pitot line blockage will result in the airspeed indicator behaving like an altimeter when the aircraft's altitude changes, and it will not respond to airspeed changes. A pitot line blockage can also affect the EBD's attitude indication.

A static line blockage will result in altitude remaining fixed and a zero vertical speed despite aircraft pitch and/or power setting changes. In addition, IAS indications will be incorrect if the static line is blocked. Errors will typically be noticed during climbs or descents. When descending, ambient pressure increases which will result in the indicated airspeed reading more than the actual airspeed. The opposite effect will be observed in a climb. A static line blockage can also affect the EBD's attitude indication.

Indication of an obstructed pitot system is provided for EBD when the EBD's indicated airspeed is less than 30 KIAS (35 mph) and GPS ground speed is greater than 50 kts (58 mph), then attitude and heading instruments are replaced with red Xs and textual annunciations to indicate their failure. In this case, an amber CHECK PITOT HEAT annunciation accompanies the ATTITUDE FAIL annunciation. When the pitot obstruction is subsequently removed and indicated airspeed  $\geq$  30 KIAS (35 mph), the CHECK PITOT HEAT annunciation will be removed in 15 seconds. This indicates that the EBD is performing an automatic AHRS reset in the background. No pilot action is required to reset the system.



### **Blocked Pitot or Static Line Suspected**

1. Turn Pitot heat ON
2. Open the Alternate Static Source
3. Refer to alternate attitude, airspeed, altitude, and heading sources for primary flight information
4. Consider exiting IMC
5. Land as soon as practicable



### **CAUTION**

*Most light aircraft have only a single pitot and static port available for flight instrument use. As such, the pitot and static lines used by the EBD are shared with those lines used by the standby airspeed indicator and altimeter. Should these lines become blocked, such as might occur due to an inadvertent icing encounter, the EBD, the standby airspeed indicators and the altimeters will display erroneous information.*

*Because the EBD uses pitot and static pressures as part of the ADAHRS solution, loss or corruption of this data, such as from a line blockage, will affect the attitude and heading information.*

*Whenever an erroneous pitot input is detected by the EBD in flight, it will replace the affected instruments with red Function Fail Xs and display a CHECK PITOT HEAT annunciation. In this case, the pilot should check pitot heat, select the aircraft's alternate static source and refer to secondary sources of attitude, airspeed, and heading information.*

### 6.1.1. Identifying and Handling Suspected Pitot and/or Static System Failures

Blocked pitot and/or static system ports will compromise the EBD's attitude solution and soon cause it to Red-X (fail). Immediately begin flying by reference to backup attitude sources. Therefore, the pilot must be especially vigilant about verifying proper operation of the pitot and static systems both before and during flight.

It is important to check the pitot tube and static system ports, and to verify pitot heater performance, as part of a thorough pre-flight inspection, especially when anticipating flight in low IMC.

On takeoff roll, it is good practice to note and call out "airspeeds alive" when the airspeed indicators (both primary and backup) begin moving and to compare and call out readings at a pre-determined airspeed close to, but before rotation speed (e.g. "60 knots cross check"), consciously noting the performance on each takeoff. If the airspeed indicators do not come "alive" when they usually do or whenever there is a significant difference between the primary and backup indicators and sufficient runway is remaining, aborting the takeoff may be a prudent decision. Follow the Flight Manual procedures for your aircraft.

When the static port is blocked on takeoff, it is imperative to quickly recognize the condition. Sometimes the airspeed indicator will show substantially less than normal and the airspeed will reduce in the climb. The natural—but incorrect—response is to lower the nose. In this situation, maintaining proper pitch attitude to climb is vital. The airspeed will continue to reduce as you climb, and at about 1,000 feet AGL the EBD attitude and heading indications will be Red-X due to the reduced airspeed indication. As soon as you suspect a blocked static port, try switching to an alternate static source. Know the location of the alternate static air control in your airplane and learn how it works.

On the initial climb-out after takeoff, it is also good practice to note and call out passing through a pre-determined altitude above ground level (AGL) a couple of minutes after takeoff and ideally before entering the clouds (e.g., "2,000 feet"). If your primary and backup instruments are not showing the altitude and airspeed you normally expect to see at that point, you might have partially blocked static system ports. This AGL check and call-out is also a good time to verify that no fuel is siphoning out from the fuel caps, etc. If indications suggest a static system blockage, try switching to an alternate static air source and consider landing to correct the problem.

In flight, if airspeed or altitude anomalies consistent with an obstructed pitot or static line are observed, the pilot should recognize that the EBD's attitude indication will soon be compromised. If in IMC, immediately use the backup attitude indicator to fly the airplane and turn pitot heat ON if icing is suspected. If at any time there is suspicion of an obstructed pitot or static line, use the EBD attitude indicator until the situation is resolved.

If the pitot tube becomes blocked in flight, the most common cause is icing. In-flight indications of a blocked pitot tube are typically:

- 1) All airspeed indicators incorrectly show zero (or close to zero);  
or
- 2) Airspeed in level flight does not change in response to changes in power or drag and airspeed indications act like an altimeter (decreasing in a descent and increasing in a climb, exactly the opposite of normal behavior).

Airspeed going to zero is by far the most common symptom of a blocked pitot tube.

If you see either of these indications of a blocked pitot tube, the first thing to do is turn on the pitot heat to remove any ice blockage. This will quickly restore the attitude and airspeed indications on the EBD systems (it takes about 40 seconds to recover after the pitot pressure is restored).

To maintain proper aircraft attitude during the event (and if the heated pitot does not work), use the outside horizon if possible, or use the backup attitude indicator to continue safe flight. The autopilot attitude source is also independent of the EBD's attitude indicator and may be another means to maintain level flight. Use the autopilot carefully and constantly monitor its performance against other flight instruments.

If in flight you suspect blocked static ports (probably due to icing), try switching to the alternate static air source. If the static air sources are blocked, recognize that the readout from the transponder and reports from ATC will be in error because of the blocked static system.

If GPS altitude is available on your GPS navigator, become familiar with how the GPS altitude is displayed. Although it can be in error, it might be your only source of altitude information (WAAS GPS altitude is reasonably accurate).

If an instrument approach is necessary, consider a precision approach that will permit vertical guidance with less reliance on the barometric pressure altitude indications.

## 6.2. Frequent or Persistent CROSS CHECK ATTITUDE Annunciation

Refer to alternate attitude, airspeed, altitude, and heading sources for primary flight information. Consider the following:

### CROSS CHECK ATTITUDE

1. Reference standby mechanical attitude indicator – do not rely on the EBD attitude display.
2. Turn Pitot heat ON.
3. Consider exiting IMC.
4. Land as soon as practicable

For a detailed explanation of when and why the EBD may display a CROSS CHECK ATTITUDE annunciation, either momentarily or persistently, *see Chapter 4, Section 4.1. Air Data, Attitude and Heading Reference System (ADAHRs)*.

## 6.3. Difference Detected Between the EBD and Mechanical Attitude Indicators

Once diagnosed, ensure the correct attitude source is the only one referenced during the remainder of the flight.

### Compare Alternate Sources of Available Attitude, Airspeed, and Attitude

1. Compare all available sources of attitude, airspeed, and attitude information to diagnose a faulty indicator.
2. Consider exiting IMC.
3. Land as soon as practicable .



Figure 6-1  
Powering Off the  
EBD

## 6.4. Abnormal Shutdown Procedure

The EBD is typically powered through an EBD master switch that is connected to the aircraft's Battery bus. Normally, the EBD will power down when the EBD Master switch is turned OFF or when aircraft power is removed when on the ground. To force the EBD to power down, the following procedures are provided.

### Shutdown EBD (on ground)

1. EBD Master switch OFF
2. Press and hold the PWR Button until the display turns off (**Figure 6-1**)

Or

1. Press the MENU Button.
2. Rotate the Top Knob to the POWER SETTINGS Menu page
3. Press the SHUT DOWN Menu Key. The power down sequence initiates, and a power down message displays

A powering off annunciation displays indicating that the unit will shut down in 5 seconds. The pilot can press any control to abort the power-down sequence.

### Power On Manually

- Press and hold the PWR Button until the EBD powers on.

## 6.5. Loss of Aircraft Electrical Power

In the event that aircraft generated power is degraded or fails, the EBD will automatically switch to its own dedicated battery (Figure 6-2). When continued safe operation depends on the EBD, **UNRESTORABLE LOSS OF EXTERNAL POWER IS AN EMERGENCY SITUATION**. The aircraft should divert to the nearest suitable airport.

### Loss of or Degraded Aircraft Power or ON BAT Annunciation

1. Electrical System .....Follow AFM procedures to restore power
2. If unable to restore power .....Land as soon as possible

The internal battery will normally provide between 30-60 minutes of operation at approximately 20°C and warmer. At extreme cold temperatures, operation of the internal battery is not assured.

When on battery the auto backlight intensity level defaults to 40% and manual backlight intensity is limited to 70%. Changing the backlight intensity will affect the battery duration, which is reflected in the % remaining indication.

A fully charged battery will indicate a charge level of 99% for some time before beginning to discharge. The charge level will steadily decrease when below 95%, with a slight acceleration as the battery nears 0%.

The “ON BAT” annunciation, along with the estimated battery charge remaining, is displayed whenever the system is operating on battery.



Figure 6-2  
Battery Charge Remaining

 **NOTE**

When operating on the internal battery, the display backlight intensity is limited to a value of 70.

 **NOTE**

Setting the brightness to a value of greater than 40% will reduce the battery operation time to less than 30 minutes.

 **WARNING**

When fully charged, the internal battery will power the EBD to provide ADAHRS and emergency RSM GPS position (if enabled) for approximately 30 minutes. When continued safe operation depends on the EBD's primary flight data, **UNRESTORABLE LOSS OF EXTERNAL POWER IS AN EMERGENCY SITUATION**. The pilot should follow the electrical failure checklist in the Aircraft Flight Manual land as soon as possible.

 **CAUTION**

During situations where a high electrical demand is placed on the aircraft electrical system, electrical transients that cause aircraft voltage to drop below 9.0V momentarily or 12.3V for 2 minutes (14V electrical system) or 18.0V momentarily or 24.6V for 2 minutes (28V electrical system) will cause the EBD display to automatically switch to its internal battery.

This will be accompanied by an ON BAT annunciation.

The ON BAT annunciation should extinguish shortly after the electric transient demand goes away. If the ON BAT annunciation does not extinguish, then an aircraft power source failure has most likely occurred.



## 6.5.1. Overvoltage Protection

In the event of an overvoltage condition in the aircraft's electrical system, (greater than 33 volts) the EBD will automatically switch to its battery power and continue to operate without any pilot action. Operation from the aircraft electrical system will not be possible while the overvoltage condition is present. When aircraft power decreases below 33 volts, pilot action is required to manually switch from the EBD battery power.

### Restore Aircraft Power to the EBD

1. Press the MENU Button and rotate the Top Knob to the POWER Settings page
2. Press the EXT PWR Menu Key
3. Press the MENU Button to exit

## 6.6. GPS Failures and RSM Emergency GPS Use

Position and flight plan data for the PFD is provided from aircraft panel-mounted GPS equipment. The PFD may be configured to receive data from one or two external GPS receivers. In addition, if all aircraft GPS receivers fail, the RSM's emergency GPS receiver will provide position data if enabled by the installer.

The Basemap will follow an automatic position reversion scheme to determine which GPS is used to provide position data to the map. The primary GPS is always the one selected by the pilot using CDI Navigation Source Select Button. If the selected GPS fails, the PFD automatically switches to the other aircraft's GPS (if installed) and will annunciate GPS# REVERSION, where # represents the GPS source providing the position data (**Figure 6-22**).

## NOTE

When airborne, if the PFD's input voltage is below the 12.8V (14V Electrical System) or 25.6V (28V Electrical System) automatic battery transition threshold, and EXT PWR is selected through the POWER SETTINGS Menu, the PFD will automatically remain connected to its internal battery.



Figure 6-3  
External Power Voltage Status



Figure 6-4  
Battery Status

If all aircraft panel-mounted GPS receivers experience a failure, the RSM Emergency GPS receiver will provide position data that is shared among all EFDs. In addition, a text alert is presented at the bottom center of the Navigation Display annunciating RSM GPS REVERSION EMER USE ONLY (**Figure 6-23**). This “sharing” feature permits any EFD (as configured by the installer), to receive and display the RSM GPS position data, thus assuring continuous navigational awareness to the pilot. In this case, the Basemap data is approved for emergency use only

Whenever the map has reverted to an alternate position source, all map features and capabilities are retained, including the display of the flight plan from the selected panel-mount GPS. However, when the selected GPS is no longer providing position data, the flight plan is displayed without an active (magenta) leg. The flight plan and Basemap data from each of the aircraft's GPS receivers is retained independently. If two external GPSs were connected prior to failure of both, and if each had a different flight plan at the time of failure, both retained flight plans remain available to the pilot and may be selected using the PFD's Navigation Source Select Button.

In the unlikely event that there is a complete loss of all GPS data to the EFD, including failure of the RSM GPS receiver, all mapping information would be removed from the EFD display.

## NOTE

When airborne, if the EBD's input voltage is below the 12.8V (14V Electrical System) or 25.6V (28V Electrical System) automatic battery transition threshold, and EXT PWR is selected through the POWER SETTINGS Menu, the EBD will automatically remain connected to its internal battery.



Figure 6-3  
External Power Voltage Status



Figure 6-4  
Battery Status

## 6.7. Power Override

In the event that the pilot wishes to override the EBD's automatic power configuration, proceed as follows:

### Power Override<sup>1</sup>

1. MENU ..... "POWER SETTINGS" Page

To switch FROM aircraft power to Internal Battery:

2. "BATTERY" LINE SELECT KEY.....PRESS

To switch FROM internal Battery TO aircraft power:

3. "EXT PWR" LINE SELECT KEY .....PRESS

### View External Voltage Status

1. Press the MENU Button.
2. Rotate the Top Knob to the POWER SETTINGS Menu displays.
3. The EXT PWR Menu Key (**Figure 6-3**) displays the external power voltage.
4. Press the MENU Button to exit.

### View Internal Battery Status

1. Press the MENU Button.
2. Rotate the Top Knob to the POWER SETTINGS Menu displays.
3. The BAT Menu Key (**Figure 6-4**) displays the current Battery Status as either Charging or a Percentage of Charge.
4. Press the MENU Button to exit.

1. In some installations the power setting will be set for 14 volts on a 28 volt system. Refer to the AFMS for detailed information.

## 6.8. In-Flight AHRS Reset

In the unlikely event the EBD determines a potential degradation of attitude information, a warning annunciation, CROSS CHECK ATTITUDE, is shown (Figure 6-5). If the attitude pitch or roll data become invalid, a red X and the textual annunciation of ATTITUDE FAIL replaces the Attitude Indicator, and all aircraft roll, pitch, and slip information is removed from the Attitude Display (Figure 6-6). Use alternate, mechanical flight instruments for primary flight information and reset the EBD's AHRS as soon as possible.

During the In-Flight AHRS Reset, the aircraft should not be subjected to excessive turn rates. Typical in-flight Resets will take approximately 30 seconds, but can take longer if the reset is initiated while banked or maneuvering.



Figure 6-5  
Attitude Degraded Performance

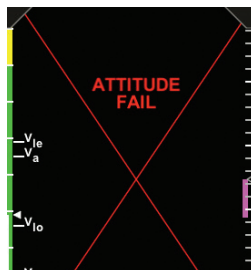


Figure 6-6  
Attitude Failure

### NOTE

*When the EBD's AHRS is reset in flight, it performs an abbreviated initialization.*

*The AHRS Reset is considered complete when the EBD's attitude and heading is once again displayed, stable, and correct with respect to the horizon or standby attitude indicator.*



Figure 6-7  
AHRS Reset Menu Key



Figure 6-8  
AHRS Reset  
Confirmation  
Message

### Perform an In-Flight AHRS Reset

1. Maintain straight and level flight.
2. Consider exiting IMC.
3. Fly by visual reference or by standby instruments.
4. Disconnect the autopilot.
5. Press the MENU Button.
6. Rotate the Top Knob to display the GENERAL SETTINGS A Menu page.
7. Press the AHRS RESET? Menu Key (**Figure 6-7**).  
A confirmation message displays, prompting the user to confirm the reset request (**Figure 6-8**).
8. Press the AHRS Menu Key again to confirm the AHRS reset. The AHRS reset is performed, and the confirmation messages clears.
9. Press the MENU Button to exit.

#### NOTE

*Pressing any other key, button, or knob cancels the AHRS reset and clears the confirmation message.*



Figure 6-9  
Operating in GPSS Mode



Figure 6-10  
GPSS in Wings Level Mode

## 6.9. GPSS Operation, Annunciations, and Autopilot Modes<sup>1</sup>

The Pro PFD offers GPSS. Three modes, Enabled, Wings Level, and Disabled, are possible and annunciated in the PFD's Navigation Display. When enabled, the configured GPS source not only provides the Basemap and flight plan data, but also passes GPSS as the heading input to a configured autopilot. When engaged, a configured autopilot will interpret GPSS commands as heading inputs and follow the active GPS flight plan, including anticipated turns, if provided. The GPSS Enabled mode is indicated by a green GPSS Hot Key label and a GPSS1 with an inverse A placed next to the Selected Heading Field to describe the source (Figure 6-9).

If GPSS is enabled and the GPS source is lost or changed, the GPSS mode automatically changes to the Wings Level mode and annunciates as shown in Figure 6-10.

### NOTE

When using GPSS with combined GPS / VLOC navigators (e.g. GNS 430/530), VLOC may be selected as the navigation source while GPSS is engaged. To avoid confusion, note the PFD Selected CDI Navigation Source controls the CDI and the autopilot's navigation and approach modes when engaged. GPSS reflects the heading commands required to navigate the active flight plan leg and controls the autopilot's heading mode when engaged. Complete understanding of autopilot mode functions and their proper selection is recommended.

1. GPSS - Not supported in Evolution backup display

## 6.10. Warning, Caution, and Advisory Summary

### WARNINGS



Figure 6-9  
Battery Countdown

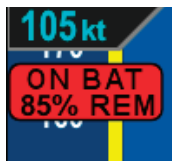


Figure 6-10  
Battery Charge Remaining

Presented when the EBD is operating on the internal battery. The countdown timer begins at 15 seconds and is then replaced by the ON BAT annunciation with the battery's % charge remaining.

### NOTE

*If the battery temperature is less than 0°C, the countdown timer will begin at 10 minutes.*



Figure 6-11  
Attitude Fail



Figure 6-12  
Direction Indicator Fail

Presented when the EBD has determined that the associated function is invalid or failed and should not be used. The data is removed from the display and replaced by a red X over the affected display feature.

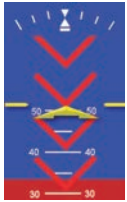
**WARNINGS**

Figure 6-13  
Chevrons indicate Pitch Down



Figure 6-14  
Chevrons indicate Pitch Up

When the Attitude Indicator display extreme pitch up or extreme pitch down attitudes, the red chevrons indicate the direction to restore level flight.

Table 6-1  
Warning Annunciations




**CAUTION**


Figure 6-15  
Cross Check Attitude

Presented when the EBD AHRS internal integrity monitor determines that attitude is potentially degraded. When a CROSS CHECK ATTITUDE annunciation is presented, the pilot should cross check attitude, airspeed, and altitude indications with other sources of primary flight information.



Figure 6-16  
Check Pitot Heat

The CHECK PITOT HEAT annunciation accompanies the ATTITUDE FAIL annunciation and is presented when the software detects an obstruction in the pitot system that could potentially degrade the attitude solution. This annunciation is removed when the detected condition is resolved, which would be followed by an automatic AHRS reset. A GPS is required for this monitor to be enabled.



Figure 6-17  
GPS Invalid

Presented when a configured GPS source's data is invalid or unavailable.


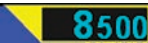






 <b>CAUTION</b>	
 Figure 6-18 Altitude Caution	<p>Presented to indicate the aircraft is reaching (steady) or deviating (flashing) from the preset altitude. May be accompanied by a one-second steady tone from an optional tone generator<sup>1</sup>.</p>
<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">             Figure 6-20            GPS Invalid         </div> <div style="text-align: center;">             Figure 6-21            RSM GPS         </div> </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="text-align: center;">             Figure 6-22            GPS Reversion         </div> <div style="text-align: center;">             Figure 6-23            GPS Reversion Emergency         </div> </div>	<p>Presented when a configured GPS source's data is invalid or unavailable. GPS# or RSM REVERSION annunciations indicate the current GPS Basemap source</p>
 Figure 6-24 GPS Integrity Flag	<p>Presented when the PFD's Selected CDI Navigation Source is a GPS and that GPS is sending an Integrity alert. See the GPS AFMS for more information</p>
 Figure 6-25 Altitude Caution	<p>Presented to indicate the aircraft is reaching (steady) or deviating (flashing) from the preset altitude.</p>

Table 6-3 Caution Annunciations

## ADVISORY



Figure 6-19  
PWR Button Off

Presented when the PWR Button is pressed.



Figure 6-32  
GPS Annunciations

Associated with the GPS and the Selected CDI Navigation Source. See the GPS AFMS for more information.

## NOTE

*These annunciations do not display for RS232-based GPS.*

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# Chapter 7

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## Appendices

### 7.2. Software Versions and Serial Number

The system software versions for the Main Application Processor (MAP), the Input-Output Processor (IOP), and the unit Serial Number (S/N) are recorded in the SYSTEM STATUS page of the Menu.

 **NOTE**

*To view the software version, press the MENU Button and rotate the Top Knob to the Systems Status page. The “MAP VER:” (Main Application Processor Version) displays the software version your unit is operating (see **Figure 7-1**).*



Figure 7-1  
View Main Application Processor  
Software Version

### View the Main Application Processor Software Version

1. Press the MENU Button.
2. Rotate the Top Knob to the SYSTEM STATUS Menu page.
3. The MAP VER Menu Key displays the current Main Application Processor Software Version (**Figure 7-1**).
4. Press the MENU Button to exit.



Figure 7-2  
View Input/Output Processor  
Software Version

### View the Input/Output Processor Software Version

1. Press the MENU Button.
2. Rotate the Top Knob to the SYSTEM STATUS Menu page.
3. The IOP VER Menu Key displays the current Input/Output Processor Software Version (**Figure 7-2**).
4. Press the MENU Button to exit.

## View the Primary Flight Display Unit's Serial Number

1. Press the MENU Button.
2. Rotate the Top Knob to the SYSTEM STATUS Menu page.
3. The S/N Menu Key displays the unit's serial number (**Figure 7-3**).
4. Press the MENU Button to exit.



Figure 7-3  
View Unit Serial Number

## 7.3. Specifications

### 7.3.1. Evolution Display Unit (EBD)

GENERAL SPECIFICATIONS	
Width	7.00 in. (Measured at Bezel)
Height	3.50 in. (Measured at Bezel)
Can Depth	4.15 in. (Rear of Bezel to Rear of Can)
Overall Depth	6.35 in. (Knob to Rear Pressure Fitting)
Weight	2.9 lbs. (with Mounting Bracket)
Display Type	6.0 in. Diagonal TFT Active Matrix LCD (400x760)
Display Colors	32,768
Face	Anti-Reflective Coated Glass
Backlight	High Intensity White LED
Rotary Knobs	Optical Encoder with Momentary Press
Dimming	Manual & Automatic (Front Bezel Mounted Sensor)
OPERATIONAL SPECIFICATIONS	
Operating Temp	-20°C to +70°C
Storage Temp	-55°C to +85°C
Max Un-Pressurized Operating Altitude	35,000 ft.
Max Pressurized Operating Altitude	55,000 ft.
Cooling	Integral Fan
Max Humidity	95% at 50°C
Input Voltage	+8 to +32 Volts DC



Max Current – Steady State	2.4 Amps @ 28 VDC
	4.8 Amps @ 14 VDC
Max Current – Peak	7.0 Amps @ Maximum
<b>I/O SPECIFICATIONS</b>	
ARINC 429 Inputs	1
ARINC 429 Outputs	
RS-232 Inputs	
RS-232 Outputs	
Pitot / Static	Quick Connect
<b>CERTIFICATION SPECIFICATIONS</b>	
FAA Technical Standard Order	TSO-C2d / ETSO-C2D.....Airspeed Instruments
EASA (European Aviation Safety Agency)	TSO-C3d / ETSO-C3D.....Turn and Slip Instrument
ETSO (European Technical Standard Order)	TSO-C4c / ETSO-C4C.....Bank and Pitch Instruments
	TSO-C6d / ETSO-C6D.....Direction Instrument Magnetic (Gyroscopically Stabilized)
	TSO-C8d / ETSO-C8D.....Vertical Velocity Instrument (Rate of Climb)
	TSO-C10b / ETSO-C10B.....Altitude Pressure Activated Sensitive Type
	TSO-C106 / ETSO-C106.....Air Data Computer
	TSO-C113 / ETSO-C113.....Airborne Multipurpose Electronic Displays
Software	RTCA DO-178B Level C
Environmental	RTCA DO-160E
Categories	See Environmental Qualification Sheet found in the Installation Manual.

Table 7-1  
Evolution Backup Display Unit (EBD) Specifications

### 7.3.2. Remote Sensor Module (RSM)

Width	2.65 in.
Length	4.40 in.
Height	1.00 in.
Weight	0.2 lbs.
Input Voltage	Provided by EBD
Max Current	Included in EBD Current

Table 7-2  
Remote Sensor Module (RSM) Specifications

### 7.3.3. Analog Converter Unit (ACU)

Width	5.75 in. (including mounting flange)
Length	4.30 in. (including connector)
Height	1.60 in. (including mounting flange)
Weight	0.8 lbs.
Input Voltage	+10 to +32 VDC
Max Current	0.5 Amps @ 28 VDC 1.0 Amps @ 14 VDC
Interfaces	ARINC-429 and RS-232

Table 7-3  
Analog Converter Unit (ACU) Specifications

### 7.3.4. Operational Specifications

Airspeed Range	Minimum displayed airspeed	20 KIAS
	Maximum displayed airspeed	500 KIAS
Altitude Range	Minimum displayed altitude	-1,600 ft. MSL
	Maximum displayed altitude	51,000 ft. MSL
Vertical Speed Range	Maximum displayed vertical speed rates (tape)	+/-2,000 fpm
	Maximum displayed vertical speed rates (numerical value)	+/- 9,990 fpm
Turn Rate	Maximum displayed turn rate	6.0 °/second
Barometric Pressure Correction Range	28.10 to 30.99 In Hg (946 to 1049 mB)	
Internal Battery	Minimum operating time while on internal battery	30 minutes <sup>1</sup>

Table 7-3  
Operational Specifications

- 
1. At extreme cold temperatures the internal current limiting protections of the internal battery may cause the battery to shut off and not power the display.

## 7.4. Glossary

°C	Degrees Celsius	AWOS	Automated Weather Observation System
°F	Degrees Fahrenheit	Back Course	Localizer back course approach where the signal on the back side of the localizer is used for alignment to the runway opposite of normal localizer alignment.
Accuracy	Estimated position accuracy in feet or meters	Battery Time	The time remaining on the battery before it is fully discharged.
A/D	Analog to Digital	BC	Back Course
AC	Alternating Current	Bearing	The compass direction from the current position to the destination.
ACU	Analog Converter Unit	BP	Bearing Pointer
ADC	Air Data Computer	Calibrated Airspeed	Indicated airspeed corrected for installation and instrument errors.
ADI	Attitude Director Indicator	CDI	Course Deviation Indicator
AFMS	Airplane Flight Manual Supplement	CFR	Code of Federal Regulations
AGL	Above Ground Level	CM	Configuration Module
AHRS	Attitude Heading Reference System	Comm	Communication radio
AI	Attitude Indicator	Course	The route taken from the starting position to destination.
AIM	Aeronautical Information Manual	Course to Steer	The recommended direction to steer in order to reduce cross-track error and return to the course line.
AIRMET	Airman's Meteorological Information	Cross Track	The perpendicular distance, left or right, away from the selected course.
Altitude	Elevation above mean sea level		
APPR	Approach		
APT	Airport		
ARC	Partial Compass Rose, arc format (100°)		
ARINC	Aeronautical Radio, Inc.		
ATC	Air Traffic Control		
ATIS	Automatic Terminal Information Service		

Crosstrack Error	The distance the aircraft is off the desired course.	EFD	Evolution Flight Display
CTS	Course to Steer	EFIS	Electronic Flight Instrument System
dBZ	decibels 'Z' (radar return)	Elevation	The height above mean sea level.
DC	Direct Current	ETA (Destination)	Estimated Time of Arrival. The estimated time you will reach a Go To destination or the final waypoint in a route.
Decision Height	A specified height or altitude in the precision approach at which a missed approach must be initiated if the required visual reference to continue the approach has not been acquired. This allows the pilot sufficient time to safely reconfigure the aircraft to climb and execute the missed approach procedures while avoiding terrain and obstacles.	ETA (Next)	Estimated Time of Arrival. The estimated time you will reach a Go To destination or the next waypoint in a route.
Declutter	Reduce the number of basemap symbols displayed on screen.	ETE (Destination)	Estimated Time Enroute. The estimated time required to reach a Go To destination or the final waypoint in a route.
Deg	Degree	ETE (Next)	Estimated Time Enroute. The estimated time required to reach a Go To destination or the next waypoint in a route.
Desired Track	The desired course between the active "FROM" and "TO" waypoints.	ETSO	European Technical Standard Order
DH	Decision Height	FAA	Federal Aviation Administration
Distance (Next)	The great circle distance from current location to a Go To destination or the final waypoint in a route.	FAF	Final Approach Fix
DME	Distance Measuring Equipment	FD	Flight Director
DTK	Desired Track	fpm	Feet Per Minute
EASA	European Aviation Safety Agency	ft	Feet
EBD	Evolution Backup Display	GPS	Global Positioning System
		GPSS	GPS Steering
		Ground Track	see Track

Ground Speed	The velocity that the aircraft is travelling relative to a ground position.	LAT	Latitude
GS	Glide Slope or Ground Speed	LCD	Liquid Crystal Display
Heading	The direction an aircraft is pointed, based upon indications from a magnetic compass or a properly set directional gyro.	LDI	Lateral Deviation Indicator
Hg	Mercury	Leg	The portion of a flight plan between two waypoints
HSI	Horizontal Situation Indicator	LOC	Localizer
Hz	Hertz (frequency)	MAP	Main Application Processor
IAF	Initial Approach Fix	mB	Millibars
IAS	Indicated Air Speed	MFD	Multi-Function Display
IFR	Instrument Flight Rules	MHz	Megahertz
ILS	Instrument Landing System	MSG	Message
IMC	Instrument Meteorological Conditions	MSL	Mean Sea Level
in Hg	Inches of Mercury	NAVAID	Navigation Aid
Indicated	Information provided by properly calibrated and set instruments on the aircraft panel.	NDB	Non-Directional Beacon
IOP	Input/Output Processor	NDI	Numerical Direction Indicator or Magnetic Compass
JSUM	Jeppesen Services Update Manager	NXRD	Next Generation Weather Radar
kHz	Kilohertz	nm	Nautical Miles
KLAS	Knots Indicated Air Speed	NRST	Nearest
km	Kilometer	OAT	Outside Air Temperature
kt	Knots	OBS	Omni-Bearing Selector
		PFD	Primary Flight Display

RMI	Radio Magnetic Indicator	VFR	Visual Flight Rules
RSM	Remote Sensor Module	VHF	Very High Frequency
SDHC	Secure Digital High Capacity (microSDHC card)	VLOC	VOR/Localizer
TA	Traffic Advisory	VOR	VHF Omni-Directional Radio Range
TACAN	Tactical Air Navigation System	VORTAC	VHF Omni-Directional Radio Range and Tactical Air Navigation
TAS	True Air Speed	VSI	Vertical Speed Indicator
TCAS	Traffic Collision Avoidance System	WAAS	Wide Area Augmentation System
TERM	Terminal Mode	WPT	Waypoint
TIS	Traffic Information System	WX	Weather
Track	Direction of aircraft movement relative to a ground position; also Ground Track'		
TSO	Technical Standard Order		
VAC	Volts, Alternating Current		
VDC	Volts, Direct Current		
VDI	Vertical Deviation Indicator		

## 7.5. Index

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Aspen Avionics, Inc.

5001 Indian School Road NE

Albuquerque, NM 87110

Phone: 888-99ASPEN (888-992-7736)

Phone, International: (505) 856-5034

Fax: (505) 314-5440

[info@aspenavionics.com](mailto:info@aspenavionics.com)

[www.aspenavionics.com](http://www.aspenavionics.com)