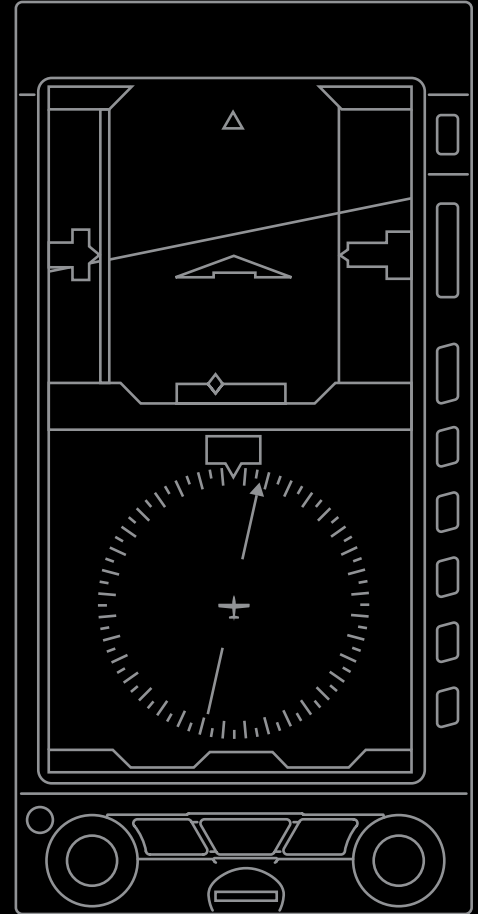


# EVOLUTION

FLIGHT DISPLAY

## EFD1000 PRO MAX PFD Pilot Guide

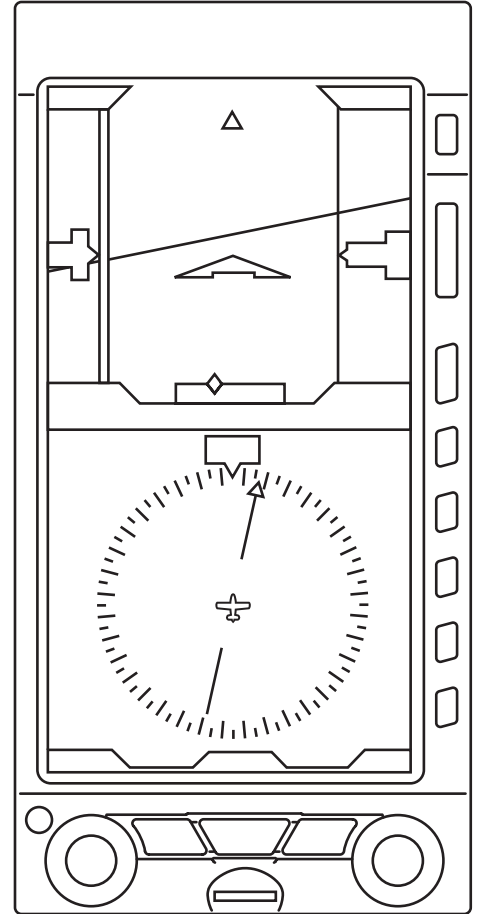
ASPEN  AVIONICS™



# EVOLUTION

FLIGHT DISPLAY

## EFD1000 PRO MAX PFD Pilot Guide



# Document Revisions

REVISION	DESCRIPTION of CHANGE
()	Initial Release
(A)	Corrected clerical errors and added the Runway Extensions feature. Grammatical, pictorial, technical corrections and updates.

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# 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, C165, C157 (Incomplete), C195a (Incomplete), C198 (Incomplete)

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 Flight Display 1000 Pro MAX Primary Flight Display (EFD1000 Pro MAX PFD). 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 EFD1000 Pro MAX PFD in a type-certificated aircraft must be performed in accordance with the latest revision of the EFD1000 Pro MAX and EFD500 Multi-function Display Installation Manual.

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## Warnings, Cautions, and Notes

Where applicable warnings, cautions, and notes are given, Aspen Avionics uses the following icons and definitions (**Table 1**).




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 1  
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 PFD is reasonably intuitive and easy to use, some familiarity with Electronic Flight Instrument Systems (EFIS) and Horizontal Situation Indicators (HSI) is required. Aspen Avionics strongly recommends that new users of the PFD get some dual instruction from an experienced instrument CFI, and spend some time becoming familiar with the PFD in day VFR conditions with a safety pilot, before flying in actual instrument meteorological conditions (IMC). To reduce pilot workload, the use of an autopilot (when available) is strongly encouraged.

## Chapter 1

### Welcome and Introduction

Welcome to Aspen Avionics' Evolution Flight Display (EFD) system, the most flexible, expandable, and upgradable Electronic Flight Instrument System (EFIS) available for General Aviation aircraft. The EFD system is designed to replace traditional, mechanical primary flight instruments—in whole or in part, all at once, or in phases. This modularity and upgradability allow the system to grow with you and your airplane, over time and affordably.

The EFD system is built around the EFD1000 Pro MAX PFD (**Figure 1-1**), which replaces a vertical pair of your six primary flight instruments. The PFD has a bright, high-resolution, six-inch diagonal LCD display, and several knobs, buttons, and keys the pilot uses to control the system. The three-inch diameter, four-inch deep can on the back of the display slides into existing panel cutouts (where the top mechanical instrument used to be).



Figure 1-1  
EFD1000 MAX Primary Flight Display Unit



Figure 1-2  
Single Display EFD1000 Pro MAX PFD System

The center of the EFD System is the EFD1000 Pro MAX Primary Flight Display (PFD), which replaces the traditional mechanical Attitude Indicator (AI) and Directional Gyro (DG) or Horizontal Situation Indicator (HSI) (**Figure 1-2**).



Figure 1-3  
Dual Display System: PFD & MFD

Add a second EFD1000 configured as a Multi-Function Display (MFD) (**Figure 1-3**), replacing the Altimeter and Vertical Speed Indicator (VSI), and you'll double the capabilities of your system, while also providing complete redundancy and backup to your PFD. The EFD1000 MFD contains the same AHRS, ADC, and I/O capabilities as the PFD for full redundancy and can assume the role of the PFD should it ever fail.

Adding another MFD, replacing the Airspeed Indicator (ASI) and Turn Coordinator, to round out a complete six-pack replacement and gain even more capability and flexibility (**Figure 1-4**). When you are ready to upgrade, simply contact an Aspen Avionics Authorized Dealer for more information. .

This Pilot's Guide covers the EFD1000 Pro MAX PFD model. This system is powerfully flexible, and can be configured in a variety of ways, depending on the other aircraft systems with which they are integrated.

## NOTE

*Please spend some time with your avionics installer to understand exactly how your PFD is installed and configured in your particular aircraft, to understand the features and capabilities available to you, and to understand how various aircraft system failures and abnormalities may affect your PFD.*



Figure 1-4  
Trio Display System: PFD & Dual MFDs

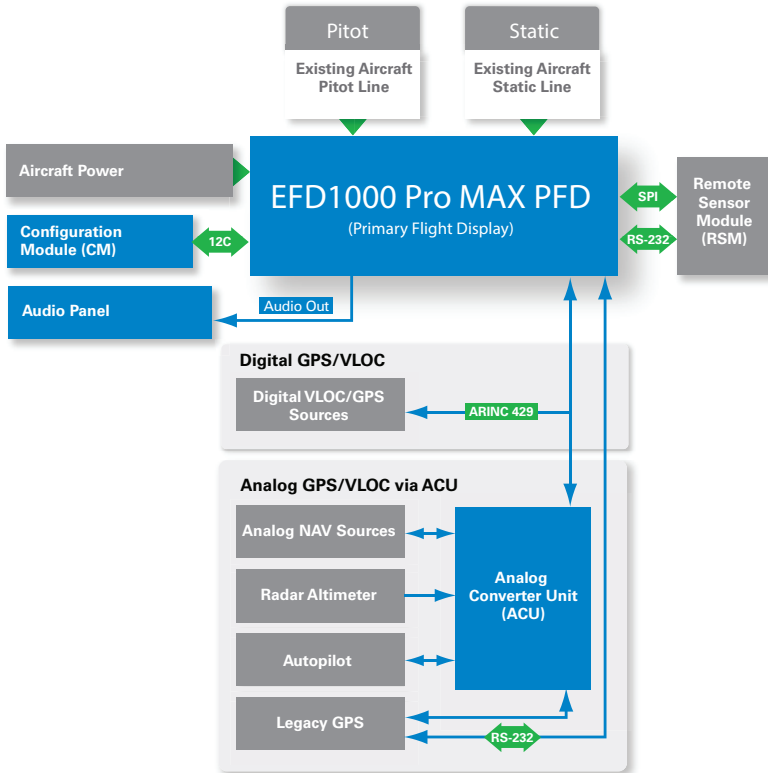


Figure 1-5  
Pro PFD System Architecture

## 1.1 System Overview

The PFD system typically consists of four components:

1. EFD1000 Pro MAX Display Unit (PFD)
2. Configuration Module (CM)
3. Remote Sensor Module (RSM)
4. Analog Converter Unit (ACU)

The ACU converts older analog signals and interfaces to the industry-standard digital ARINC 429 interface, which is the native language of the PFD. In some installations, generally when the aircraft is not equipped with an autopilot and has only digital GPS/Nav/Comm, the ACU may be omitted.

The system architecture in **(Figure 1-5)** shows the relationships of the PFD, RSM, CM and ACU.

## 1.1.1 Primary Flight Display Unit (PFD)

The Primary Flight Display Unit (PFD) 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
- A rechargeable backup battery

Also on the rear of the unit (**Figure 1-6**) 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
- A cooling fan, to cool the electronics and LCD backlights

The PFD mounts to the front surface of the instrument panel using the standard installation kit; an optional flush-mount installation kit is also available.

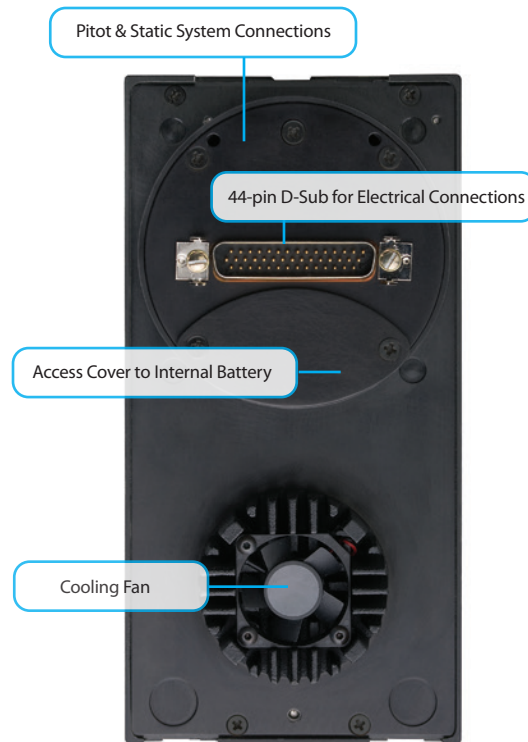


Figure 1-6  
EFD1000 Pro MAX Display Unit  
Rear Connections





Figure 1-7  
Configuration Module (CM)

### 1.1.2 Configuration Module (CM)

The Configuration Module (**Figure 1-7**), 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 PFD to be swapped for service purposes without re-entering or re-calibrating the installation
- Contains a license key that configures the PFD software features

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

### 1.1.3 Analog Converter Unit (ACU)

The Analog Converter Unit (ACU) (**Figure 1-8**), included with most Pro PFD systems, enables the all-digital, EFD1000 System to interface with analog avionics when required. The ACU converts multiple analog interfaces to the digital ARINC 429 buses supported by the PFD. Control parameters, such as desired heading, are also sent from the Pro PFD to the ACU for conversion to analog format for autopilot support. The ACU is required when any of the following capabilities are required in a Pro PFD installation:

- Interface to supported autopilots
- Interface to conventional VHF navigation radios
- Interface to legacy (non-ARINC 429) GPS navigators
- Interface to supported radar altimeter decision height annunciations

If ARINC 429-based digital radios are installed in the aircraft and no other aircraft interfaces are desired, the ACU is not required.



Figure 1-8  
Analog Converter Unit (ACU)

### 1.1.4 Remote Sensor Module (RSM)

The Remote Sensor Module (RSM) (**Figure 1-9**), is an integral part of the EFD1000 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 PFD via a digital cable connection.



Figure 1-9  
Remote Sensor Module (RSM)

## Chapter 2

### Controls and Display

The PFD (**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, Heading Indicator (or HSI) 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 PFD is a single vertical instrument that replaces the existing Attitude Indicator and Heading Indicator/HSI. The display is divided into three parts: an upper Attitude Display, a lower Navigation Display, and a Data Bar between the upper and lower halves. The Attitude and Navigation displays are highly customizable — from stripped down, minimalist presentations, to dense, information-rich displays — depending on pilot preference and phase of flight.

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

The primary means for the pilot to control the PFD are the two knobs and three buttons at the bottom of the display. The knobs control setting CRS and HDG, and additional bugs and altitude settings. The lower three buttons control selection of navigation sources for the CDI and Bearing Pointers. There are three additional buttons above the Hot Keys to control entering and exiting the Menu, setting the Map Range, and Reversion or Manual Power Control.



Figure 2-1  
Pro MAX PFD

CONTROLS			
1	Reversion and Power Button	9	Right Knob
2	Range Buttons	10	Right Button, Double-Line Bearing Pointer Source Select
3	Menu Button	11	CDI Navigation Source Select Button (Middle Button)
4	Hot Key Menu select	12	Left Button, Single-Line Bearing Pointer Source Select
5	Feature/Mode Selection Keys	13	Left Knob
6	Feature/Mode Selection Keys	14	Automatic Dimming Photocell
7	Feature/Mode Selection Keys	15	microSD Card Slot
8	BARO		

ATTITUDE DISPLAY			
16	Attitude Display	27	Decision Height Annunciation <sup>2</sup>
17	Aircraft Reference Symbol	28	Selected Minimums Field
18	Single-Cue Flight Director <sup>1</sup>	29	Radio Altitude <sup>2</sup>
19	Roll Pointer	30	MINIMUMS Marker
20	Slip/Skid Indicator	31	LDI Navigation Source Annunciation
21	Altitude Tape	32	Airspeed Tape
22	Selected Altitude Field (controls the Altitude Bug)	33	Selected Airspeed Field (controls the Airspeed Bug)
23	Altitude Alerter	34	Airspeed Bug
24	Numerical Altitude Indication, Altitude Drum/ Pointer	35	Numerical Airspeed Indicator, Airspeed Drum/ Pointer
25	Altitude Trend Vector	36	Vertical Deviation Indicator (VDI)
26	Altitude Bug	37	Lateral Deviation Indicator (LDI)

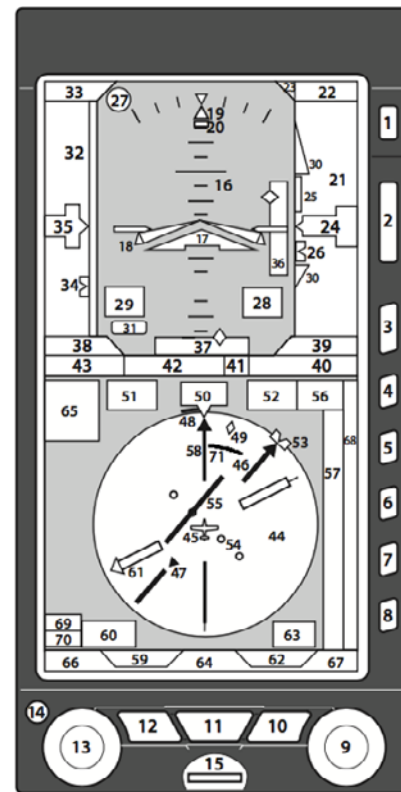


Figure 2-2  
Pro PFD MAX Display Elements

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

NAVIGATION DISPLAY			
44	Navigation Display	58	Single-Line Bearing Pointer
45	Ownship Symbol	59	Single-Line Bearing Pointer Source
46	Course Pointer	60	Single-Line Bearing Pointer Source Info Block
47	TO/FROM Indicator	61	Double-Line Bearing Pointer
48	Rate of Turn Indicator	62	Double-Line Bearing Pointer Source
49	Ground Track Marker	63	Double-Line Bearing Pointer Source Info Block
50	Numerical Direction Indicator	64	Selected CDI Navigation Source
51	Selected Course (CRS) Field	65	Selected CDI Navigation Source Information Block
52	Selected Heading Field	66	Left Knob State
53	Heading Bug	67	Right Knob State
54	Course Deviation Scale	68	Hot Key Label
55	Course Deviation Indicator	69	Range
56	Vertical Speed Numerical Value	70	Declutter Level
57	Vertical Speed Tape	71	Altitude Intercept Arc

Table 2-1  
PFD Components

1. With compatible autopilots
2. With compatible radar altimeters

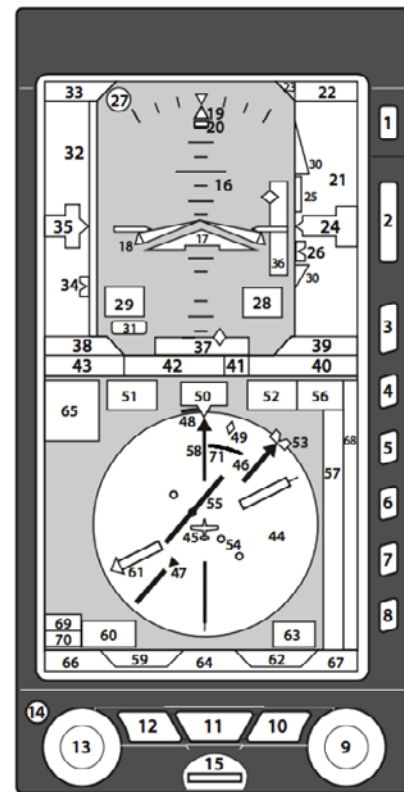


Figure 2-2  
Pro PFD MAX Display Elements

## 2.1 Color Convention

Table 2-2 provides an overview of the color convention used on the EFD1000 PRO MAX PFD 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. Red is used to indicate Weather cell movement and precipitation areas, and terrain and obstruction data.	<b>GREEN</b>	Used for navigation information or mode data related to or provided by the selected navigation source (i.e. navigation deviations, equipment operating state, waypoint information). Green is also used to indicate Weather precipitation areas, terrain data, and 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. Amber is used to indicate Weather precipitation areas, WX-500 data and terrain and obstructions data.	<b>MAGENTA</b>	Used for pilot-selectable references (bugs) enabled for editing, for depicting the active GPS navigation leg on a moving map display, and for depicting the fight director bar.
<b>WHITE</b>	Used to show primary flight data (e.g. IAS, ALT, and HDG), scales, and menu items that are selectable for editing.	<b>GRAY</b>	Used to show supplemental flight data and for hotkey and menu legends that are OFF, disabled, or inactive.
<b>CYAN</b>	Used to indicate editable values that are not currently selected for editing, for bearing pointers depictions, and for areas outside of the terrain database coverage area.	<b>BLUE</b>	Used to indicate the sky, Weather precipitation areas, and navigation map features.
		<b>BROWN</b>	Used to indicate the ground.

Table 2-2 Color Convention

## 2.2 Left and Right Knobs

The Left and Right 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. After 10 seconds of inactivity, the knob returns to its default setting.

### Left Knob Functions

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

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

- Rotate the Left Knob one click or Press the knob once to set the course (CRS) (**Refs. 46** and **51** and see NOTE about Auto Course)
- Press the Left Knob twice to set the Airspeed Bug (IAS) and Selected Airspeed Field (**Refs. 33** and **34**)

### NOTE

*When the MIN function is inactive (blue label with green letters), pressing the MIN Hot Key will both activate the function and immediately make it available for editing.*

*MIN will only be shown if the MIN function is already active. When the MIN function is active, the MIN Hot Key label (**Ref. 5**) is shown in green with dark blue letters, and the MIN value is shown on the Attitude Display (**Ref. 28**).*

### 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).*

### **Right Knob Functions**

The Right Knob is used to set Heading (HDG), Selected Altitude Field (ALT), Barometric Pressure (BARO), and Instrument Approach Minimums (MIN). Successive presses of the Right Knob will cycle through HDG and ALT (and MIN, if selected) in a round-robin sequence. Rotate the Right 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 Right Knob one click or Press the knob once to set the Selected Heading Field/Heading Bug (HDG) (**Refs. 52 and 53**)
- Press the Right Knob twice to set the Selected Altitude Field (ALT)/Altitude Bug (**Refs. 22 and 26**)
- When the MIN Hot Key is selected, press the Right Knob three times to set the Selected Minimums Field (MIN) (**Ref. 28**)



## 2.2.1 SYNC Function

### Knob 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 2-3**.
3. After 10 seconds of inaction, the knob reverts to its home state (CRS or HDG), and the labels and field turn to cyan (inactive).

Right Knob		
	SYNC Action	
1	ALT	Altitude Bug and Altitude Alerter are set to the current altitude.
2	MIN	Set to the current altitude.
3	BARO	Set to 29.92 in Hg or 1013 mB.
4	HDG	Set to the current heading.
5	Right Knob -Current State default setting: <b>HDG</b> Cyan indicates field is inactive.	



Figure 2-3  
Left and Right Knobs and Corresponding Fields



Figure 2-4  
Editing the HDG field



Figure 2-5  
HDG field updated and inactive

### Left Knob

	SYNC Action	
<b>6</b>	IAS	Set to the current indicated airspeed.
<b>7</b>	VOR navigation	Course Pointer points to the VOR. CRS value is the reciprocal of the current VOR radial. The deviation bar centers with a "TO" indication.
	ILS navigation	Current aircraft heading.
	GPS	Course Pointer points to the active GPS waypoint. The deviation bar centers with a "TO" indication. (AUTO CRS must be disabled).
	GPS AUTO CRS enabled	No effect.
<b>8</b>	Left Knob - Current State default setting: <b>CRS</b> Cyan indicates field is inactive.	

Table 2-3  
Left and Right Knob SYNC Description

### Using the Knobs (Example) How to Set the Heading Bug (HDG)

1. Rotate the Right 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 2-4**). 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 2-5**).

## 2.3 Menu

The MENU button is used to access the EFD1000 PFD's Menu to change options and customize how information is display on the PFD .

Press the MENU button to activate the Menu. 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 lower right corner of the Navigation Display.

The Menu operates either in the Navigation or Edit mode, as indicated by the label directly above the Right Knob. When the MENU button is first pressed, the Main Menu is in the Navigation mode, indicated by the magenta label SEL PAGE directly above the Right Knob (**Figure 2-6**). When in the Navigation mode, rotating the Right Knob navigates through the menu pages. Rotate the Right Knob clockwise to advance to the next menu page, counterclockwise to return to the previous page.

Each Menu Page has up to five selectable hot keys, each adjacent to one of the five Hot Keys which double as Menu Keys when the Menu is active item 1 of (**Figure 2-7**). 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 above the Right Knob in magenta (**Figure 2-8**), and the label of the item selected for editing is also shown in magenta. Rotate the Right Knob to change the value of the selected item. When finished, either select another displayed Menu option to change , or press the Right 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.



Figure 2-6  
Menu Navigation Mode



Figure 2-7  
Menu Display



Figure 2-8  
EDIT VALUE Displays Above Right Knob

**TPS: ENABLE**

Figure 2-9  
Menu Text - Editable

**TPS: ENABLE**

Figure 2-10  
Menu Text - Enabled for Editing

**US NXRD AGE: 16**

Figure 2-11  
Menu Text - Status Only

**Vle: 129**

Figure 2-12  
Menu Text - Disabled

The MENU text will display in one of the four colors listed and described in **Table 2-4**.

DISPLAY TEXT	DESCRIPTION	DISPLAY
<b>WHITE</b>	Editable option	<b>Figure 2-9</b>
<b>MAGENTA</b>	Editable option enabled	<b>Figure 2-10</b>
<b>GREEN</b>	Status Only	<b>Figure 2-11</b>
<b>GRAY</b>	Disabled (Not available for selection or editing)	<b>Figure 2-12</b>

Table 2-4 Menu Text

### **NOTE**

*Pressing the Right 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.*

### 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 2-13**).
2. Rotate the Right Knob to navigate through the different pages of the Menu. Rotating the Right 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 Hot Key of the desired option. The Menu label turns magenta, and the EDIT VALUE label displays above the Right Knob (**Figure 2-14**).
4. Rotate the Right Knob to the desired value.
5. Press the Right Knob or press the active hot key to return to Menu navigation mode.
6. Press the MENU Button to exit.



Figure 2-13  
Menu Display



Figure 2-14  
EDIT VALUE Displays Above Right Knob

## 2.3.1 Menu Pages

**Table 2-5** list all the available options in the Main Menu.

Menu Name	Menu Item	Description	OPTIONS
GENERAL SETTINGS -A	TPS	Displays Airspeed and Altitude Tapes	ENABLE, DISABLE
GENERAL SETTINGS -A	RAD ALT	Radio Altitude	ENABLE, DISABLE
GENERAL SETTINGS -A	AUTOCRS	Auto Course Select	ENABLE, DISABLE
GENERAL SETTINGS -A	ARC MODE	Selects the HSI/CDI display format when in ARC mode	HSI , CDI
GENERAL SETTINGS -A	AHRS RESET?	Causes the AHRS to re-initialize to the current sensor data	Press to Reset
GENERAL SETTINGS -B	BARO (in/mB)	Barometer Pressure Setting Units of Measure	in Hg, mB
GENERAL SETTINGS -B	OAT (C/F)	Outside Air Temperature Units of Measure	°C, °F
GENERAL SETTINGS -B	CLEAR STRIKES	Clear WX-500 Strike/Cell Count	Press to Clear
GENERAL SETTINGS -B	STRIKE TEST	WX-500 Strike Test 1	Press to Test
GENERAL SETTINGS -B	AUTO RNG	Auto Range	ENABLE, DISABLE
GENERAL SETTINGS -C	AOA DISP	Controls when the AOA indicate is display on the PFD	OFF, ON AUTO

Menu Name	Menu Item	Description	OPTIONS
GENERAL SETTINGS -C	MACH DISP	Altitude or MACH number when display switches to MACH instead of TAS on the Data Bar	OFF, Altitude: ON>5K, ON>6K, ON>7K, ON>8K, ON>9K, ON>10K, ON>11K, ON>12K, ON>13K, ON>14K, ON>15K, ON>16K, ON>17K, ON>18K,  Mach Number: ON>0.1, ON>0.2, ON>0.3, ON>0.4, ON>0.5, ON>0.6, ON>0.7
GENERAL SETTINGS -C	OVERSPEED WARN TEST	Issues an Overspeed Warning Audio test	Press to Test
GENERAL SETTINGS -C	SEL ALT ARC	Enables the display of the Altitude intercept Arc on the HSI/CDI	ON, OFF
SV SETTINGS	DB EXP: XX XXX XX	Displays the expiration data for the currently load Navigation Database	n/a
SV SETTINGS	TERR WRN SYS (TWS)	Inhibits the Terrian Warning System	ON, INH, SV ONLY
SV SETTINGS	SV APT FLG DISP	Enables displaying the Airport Identifier flag when in Synthetic Vision mode	ALL ON, NONE, FP APT ONLY, ON>4500, ON>4000, ON>3500, ON>3000, ON>2500, ALL HRD SFC
SV SETTINGS	FLIGHT PLATH MARKER	Enabled display of the Flight Path Marker when in Synthetic Vision Mode	ENABLE, DISABLE
SV SETTINGS	TERR EFF XX XXX XX	Displays the Effectivity date for the currently load Terrian Database	n/a
360 MAP SETTINGS	360 DCLTR LVL	Declutter Level used when drawing the basemap when in 360 mode	0, 1, 2, 3, 4
360 MAP SETTINGS	360 FLT PLN	Flight Plan is displayed on the basemap when in 360 mode	OFF, AUTO
360 MAP SETTINGS	360 APTS	Airports are displayed on the basemap when in 360 mode	OFF, AUTO

Menu Name	Menu Item	Description	OPTIONS
360 MAP SETTINGS	360 VOR	VORs are displayed on the basemap when in 360 mode	OFF, AUTO
360 MAP SETTINGS	360 INT/NDB	Intersections / NDB are displayed on the basemap when in 360 mode	OFF, AUTO
ARC MAP SETTINGS	ARC DCLTR LVL	Declutter Level used when drawing the basemap when in ARC mode	0, 1, 2, 3, 4
ARC MAP SETTINGS	ARC FLT PLN	Flight Plan is displayed on the basemap when in ARC mode	OFF, AUTO
ARC MAP SETTINGS	ARC APTS	Airports are displayed on the basemap when in ARC mode	OFF, AUTO
ARC MAP SETTINGS	ARC VOR	VORs are displayed on the basemap when in ARC mode	OFF, AUTO
ARC MAP SETTINGS	ARC INT/NDB	Intersections / NDB are displayed on the basemap when in ARC mode	OFF, AUTO
VSPEEDS A	VSPEEDS	Enables the display of Vspeed markers on the Airspeed Tape	ENABLE, DISABLE
VSPEEDS A	Va	Adjust Design maneuvering speed	0 to 450 or LOCKED
VSPEEDS A	Vbg	Adjust Best glide speed	0 to 450 or LOCKED
VSPEEDS A	Vref	Adjust Landing reference speed	0 to 450 or LOCKED
VSPEEDS A	Vr	Adjust Rotation speed	0 to 450 or LOCKED
VSPEEDS B	Vx	Adjust Best angle of climb	0 to 450 or LOCKED



Menu Name	Menu Item	Description	OPTIONS
VSPEEDS B	Vy	Adjust Best rate of climb	0 to 450 or LOCKED
VSPEEDS B	Vlo	Adjust Maximum landing gear operating speed	0 to 450 or LOCKED
VSPEEDS B	Vle	Adjust Maximum landing gear extended speed	0 to 450 or LOCKED
STEC55X AP	VERT SPD CNTL	Selects which unit controls the Selected Vertical Speed Setting	STEC55X, PFD
XM RECEIVER A	XM SN: XXXXXX	XM Serial Number	n/a
XM RECEIVER A	SGNL QUAL: XXXXX	XM Receiver Signal Quality	n/a
XM RECEIVER A	STATUS: XXXX	XM Status	n/a
XM RECEIVER B	US NXRD AGE XX	Age of the US NEXRAD Weather data in Minutes	n/a
XM RECEIVER B	PR NXRD AGE XX	Age of the Puerto Rico NEXRAD Weather data in Minutes	n/a
XM RECEIVER B	LTNG AGE XX	Age of the Lightning Weather data in Minutes	n/a
XM RECEIVER B	PRECEP AGE XX	Age of the Preceptitation Weather data in Minutes	n/a
XM RECEIVER B	US CVRG AGE XX	Age of the US Coverage Weather data in Minutes	n/a
XM RECEIVER C	CA RDR AGE: XX	Age of the Canada Radar Weather data in Minutes	n/a

Menu Name	Menu Item	Description	OPTIONS
XM RECEIVER C	CA CVRG AGE XX	Age of the Candada Coverage Weather data in Minutes	n/a
XM RECEIVER C	HOLD FOR WX LGND	Displays the XM Weather Legend	Press/Hold to Display
UAT	UAT STATUS	UAT STATUS	n/a
UAT	UAT CODE: ---	Manual UAT Ident setting (only with certain UAT installations and only if automatic Transponder connection fails)	4 digit ident
UAT	PUSH TO IDENT	Manual "Push to Ident" on the UAT (only with certain UAT installations and only if automatic Transponder connection fails)	Press to send Ident
UAT	HORZ VECT SCALE	Adjust the length of the displayed Traffic velocity vector	0,10,20,30,40,50,60 Sec
UAT	HOLD FOR WX LGND	Displays the ADS-B Weather Legend	Press/Hold to Display
POWER SETTINGS	BATTERY	Switches the EFD from External Power to Battery power	Press to switch to Battery Pwr
POWER SETTINGS	EXT POWER	Switches the EFD from Battery Power to External Power (IF external power is valid)	Press to switch to External Pwr
POWER SETTINGS	RESTART	Causes the EFD to shutdown and restart.	Press to Restart
POWER SETTINGS	EXT PWR: XX.XV	External Power Volage	n/a
POWER SETTINGS	BAT: XXXXXXX	Battery Status	n/a

Menu Name	Menu Item	Description	OPTIONS
SYSTEM STATUS	MAP VER: XXXXXXXX	Software Version of the Main Application Processor	n/a
SYSTEM STATUS	IOP VER: XXXXXXXX	Software Version of the I/O Processor	n/a
SYSTEM STATUS	S/N: XXXXXXXX	Serial Number of the EFD Unit	n/a

Table 2-5 Navigation Source Select Buttons Table

## 2.4 Hot Keys

The five keys along the lower right side of the PFD 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 2-6**).

The Hot Key labels use the following color philosophy (see **Figure 2-15**).

- 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

Figure 2-15  
Hot Key Menus

Navigation Display.

Hot Key	Menu 1/3	Hot Key	Menu 2/3	Hot Key	Menu 3/3
1/2 or 1/3	First Hot Key menu displayed	2/2 or 2.3	Second Hot Key menu displayed	3/3	<i>Third Hot Key menu displayed. Only displayed if at least one of the menu 3 Hot Keys are configured.</i>
MIN	Enables and displays, or disables and hides, Minimums Alerter	LTNG STRK CELL	Toggles between Lightning options	SV SV1 SV2 SV3	<i>Selects the Synthetic Vision display Mode,</i>
360 ARC	Selects the range ring type. Toggles between 360 and ARC modes of Navigation Display	NXRD	Turns the Weather feature ON	METR	
GPSS or VSI	GPSS - Toggles between GPS Steering (GPSS) Mode and HDG mode for Autopilot/ Flight Director  VSI – Selects Vertical Speed adjustment (If adv Autopilot Integration enabled)	TFC TFCU TFCA TFCB	Controls the Display of Traffic		
BARO	Toggles between BARO adjustment on or off for Barometric Pressure setting	BARO	Toggles between BARO adjustment on or off for Barometric Pressure setting	BARO	Toggles between BARO adjustment on or off for Barometric Pressure setting

Table 2-6 Navigation Map Hot Keys

## 2.5 Navigation Source Select Buttons

The three buttons on the bottom of the PFD (**Figure 2-16**) allow the pilot to select the navigation source for the CDI and Bearing Pointers

### 2.5.1 CDI Navigation Source Select Button

The CDI Nav Source Select Button is the center button (**Figure 2-16**). It selects which of the available navigation sources will couple to the CDI, which in turn couples to the autopilot (if available). Each press of the CDI Nav Source Button selects the next available nav source, cycling through all available sources in a round-robin sequence. The currently coupled CDI nav source is displayed directly above the CDI Nav Source Select Button.

The available navigation sources are configured when the PFD was installed (depending on what is installed in the aircraft and connected to the PFD). The available navigation source choices are: GPS1, GPS2, VLOC1, and VLOC2.

If a navigation source is configured to be available, but is not providing valid navigation data, its navigation source annunciation will be shown with a red slash through it, and the CDI will not be shown with the Course Pointer. The pilot is able to select the invalid source, but no navigation data is provided.

When one or more of the connected navigation sources is a combined GPS/Nav device, the list of navigation sources available for selection will be determined by the current CDI mode of the GPS navigator.

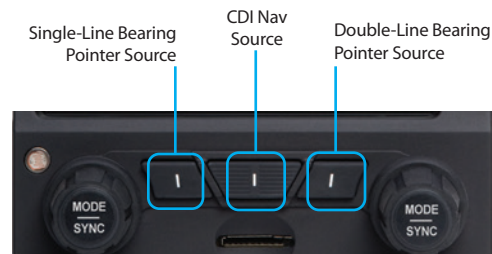


Figure 2-16  
CDI and Bearing Pointer Source Select Buttons

#### **NOTE**

*When GPS is selected as the CDI's nav source, but no active waypoint is programmed in the GPS navigator, that source will be shown as invalid until an active flight plan or direct-to waypoint is programmed into the GPS.*

## 2.5.2 Bearing Pointer Source Select Buttons

The Left Button and the Right Button are the Bearing Pointer Nav Source Select Buttons (**Figure 2-16**). The Left Button controls the Single-Line Bearing Pointer and the Right Button controls the Double-Line Bearing Pointer. Each button controls which nav source is connected to the respective Bearing Pointer.

The Bearing Pointers act like a conventional RMI (Radio Magnetic Indicator); the needle points to the station. Unlike a conventional RMI, the PFD Bearing Pointers can also point to the active waypoint of a GPS navigator whether that is a VOR, NDB, airport, intersection, or missed approach point.

Each Bearing Pointer can be connected to any of the available navigation sources; GPS1, VOR1, GPS2, VOR2, ADF1 or ADF2 (depending on configuration), or to none. Each press of the Bearing Pointer Nav Source Select Button selects the next available nav source, cycling through all available nav sources and none, in a round-robin sequence. The currently connected nav source is displayed directly above its respective button; blank with only the Bearing Pointer icon indicates that no nav source is selected, and the Bearing Pointer is removed from the display.

If the selected nav source is a valid choice, but no usable nav data is being received (e.g., the VOR station is out of range, or the VLOC is tuned to a localizer frequency), the Bearing Pointer will not be displayed.

## 2.6 Display Brightness

When the MENU button is pressed and the Menu is active, the Left Knob can be used to adjust the PFD display brightness.

### NOTE

When the PFD is operation on the internal battery, the maximum brightness level is limited to 40% in automatic mode and 70% in manual mode to preserve battery operating time.

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 will be displayed in green above the Left Knob (**Figure 2-17**). The maximum intensity in AUTO mode is 70%.

To override the AUTO brightness setting, press the Left Knob once to switch to the BRT ADJUST mode, and then rotate the Left Knob to set the brightness to the desired level (**Figure 2-18**). To return to AUTO brightness control, press the Left Knob again.

### NOTE

To facilitate cooling, the display brightness shall be limited to 30% when the backlight temperature is at or above 70 deg C in automatic mode and 70% in manual mode. The limit shall not be removed until the temperature drops below 60 deg C.



Figure 2-17  
Display Brightness in BRT AUTO Mode



Figure 2-18  
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 PFD. 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.

## 2.7 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.

## 2.8 REV Button

The red REV Button on the PFD can be used to override automatic power control in abnormal or emergency situations. The PFD is typically powered through an PFD master switch that is connected to the aircraft's Battery bus. Normally, the PFD will power down when the PFD Master switch is turned OFF or when aircraft power is removed when on the ground. To force the PFD to power down, the following procedures are provided.

### To Shut Down

1. Press and hold the REV Button until the display turns off
- Or
1. Press the MENU Button.
  2. Rotate the Right Knob to the POWER SETTINGS Menu page
  3. Press the SHUT DOWN Menu Key

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 REV Button until the PFD powers on.



## 2.9 Audio Output

The EFD1000 PRO MAX PFD can generate audio output tones and/or audio voice alerts for the following conditions:

### **Altitude Alert**

- “Altitude”

### **Timer Expired**

- “Timer” (when paired with an EFD1000 PRO MAX MFD)

### **ESV Terrain Alert**

- “Caution Terrain Terrain”
- “Caution Obstacle Obstacle”
- “Warning Terrain Terrain”
- “Warning Obstacle Obstacle”

### **Maximum Operating Limit Exceeded**

- “Overspeed”

### **Min**

- “Minimums”
- “Approaching Minimums”

## Chapter 3

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### Flying the Pro PFD

This chapter provides an overview of flying the Pro MAX PFD, explaining how to access and change the necessary settings of the PFD. Refer to **Chapter 4** for detailed step-by-step instructions for all PFD functionality.

While you can jump right in to using the PFD 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 PFD.

The PFD 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. It will take some time and experience to master all of its advanced capabilities, especially if this is your first exposure to flying an EFIS and a glass cockpit. Nonetheless, in its most basic configuration, the PFD will look immediately familiar to anyone accustomed to flying mechanical instruments, and its basic operation is very similar and intuitive.

Before flying your new PFD on an actual IFR flight, first be sure to spend some time with your installer to understand exactly how your aircraft is configured. It's also recommended to get some dual instruction and practice in VFR conditions until you are comfortable with how the PFD performs and integrates with the other avionics in your airplane.

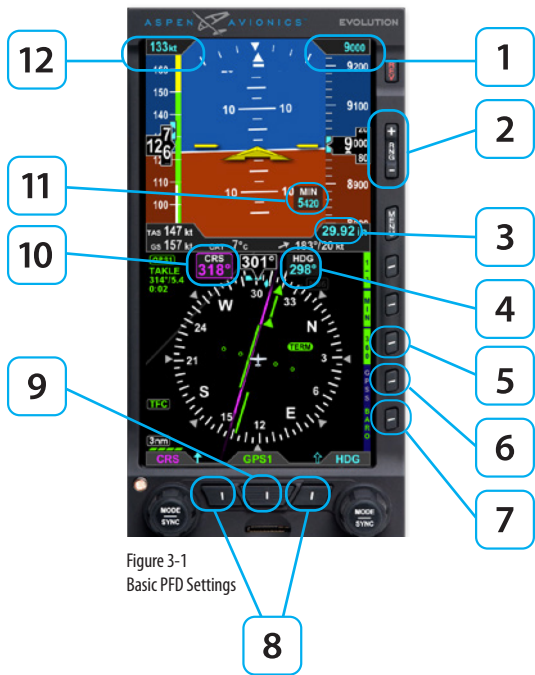


Figure 3-1  
Basic PFD Settings

FEATURE		FEATURE	
1	Selected Altitude	7	Barometric Pressure (BARO) Hot Key
2	Map RNG (Range) Buttons	8	Left and Right Buttons, Bearing Pointers Nav Source <sup>1</sup>
3	Barometric Pressure Setting Field	9	CDI Navigation Source Select (Middle Button)
4	Heading Bug Value	10	Selected Course (CRS) Pointer Field <sup>1</sup>
5	Compass Mode Hot Key: 360 or ARC	11	MINIMUMS Setting <sup>1</sup>
6	GPS Steering (GPSS) Hot Key	12	Selected Airspeed

Table 3-1 Basic PFD Settings

## 3.1 Startup

When the EFD1000 PRO MAX PFD initializes you are presented with the default PAGES pre-configured with what we thought would be the most useful VIEWS. This section will give you a quick overview of the default settings so that you can start flying with the EFD1000 PRO MAX PFD right away. You will learn how to change the backlighting, how to manually power the system off and on, and how to navigate PAGES, VIEWS, Weather Products, and other screen elements.

When the EFD1000 PRO MAX PFD powers up the first screen you see is the Initializing Screen which displays the system configuration and any status annunciations (**Figure 3-2**).

After the Initializing Screen, the EFD1000 PRO MAX PFD presents the Jeppesen Database Confirmation Screen, overlaid on the lower half of the EFD1000 PRO MAX PFD display. The confirmation screen displays the validity dates of the currently loaded Jeppesen Database and the terrain awareness message (**Figure 3-3**).

Press either the Left or Right Knob to acknowledge and accept the information and display the first PAGE of the EFD1000 PRO MAX PFD. The validity and expiration date of all databases is displayed in the Main Menu, on the Database Menu page.

### View Database Validity and Expiration Dates

1. Access the Main Menu.
2. Navigate to the SV SETTINGS page.
3. The database expiration dates are displayed next to the database titles.
4. Push the MENU key to exit the Main Menu.



Figure 3-2  
EFD1000 Pro MAX PFD Startup



Figure 3-3  
Jeppesen Database Message

## 3.2 Quick Controls Overview

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

### Knobs

The Left or Right Knob each has a Home State, to which it returns after 10 seconds of inactivity. The Left Knob is the CRS Knob, and the Right Knob is the HDG Knob.

- The current function of each knob is shown by its State, displayed immediately above 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 Left Knob sets the Course Pointer (CRS, except when Auto Course Select is enabled) and Indicated Airspeed Bug (IAS).
- The Right Knob sets Heading (HDG), Selected Altitude (ALT), Barometric Pressure Setting (BARO), and Approach Minimums (MIN).
- Pressing and holding a knob syncs the selected function.

### Navigation Source Buttons

- Three Buttons at the bottom of the display couple the available navigation sources to the CDI and the Bearing Pointers.
- The Center Button - CDI Navigation Source Select Button
- selects the nav source to couple to the CDI and to drive the autopilot (if installed).
- The Left Button and Right Button select which nav source couples to each of the two Bearing Pointers or none to hide the bearing pointers

### Hot Keys

- The five keys on the lower 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.

### **NOTE**

*The tasks and procedures you will use in your airplane will vary depending on your aircraft and equipment, and on how they are configured and integrated with the PFD in your specific installation*



Figure 3-4  
EFD1000 PRO MAX PFD photocell

### 3.3 Display Lighting

The EFD1000 PRO MAX PFD contains various lighting controls to maintain readability under all lighting conditions. Each EFD1000 PRO MAX PFD has an LED backlight, which illuminates textual content for better night operation. The controls are also backlit, at a fixed brightness, for visual location in dark conditions.

The display itself contains an adjustable backlight with a wide dimmable range. The pilot can choose between Automatic or Manual display lighting mode. The front mounted photocell measures the ambient light and adjusts the backlighting automatically to a readable level (**Figure 3-4**).

When the MENU Button is pressed and the menu system is active, the Left Knob can be used to adjust the EFD1000 PRO MAX PFD display brightness.

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 display brightness is in AUTO, the word AUTO and a brightness level of 1-100 will be displayed in green above the Left Knob.

To override the AUTO brightness setting, press the Left Knob once to switch into Manual mode, and then rotate the Left Knob to set the brightness to the desired level. To return to AUTO brightness control, press the Left Knob again.

### Change the Display Brightness

1. Press the MENU Button. The Main MENU displays and the Left Knob label displays AUTO (**Figure 3-5**). When the display brightness is in MANUAL mode the Left Knob label reads ADJUST. If so, skip step 2.
2. When the Left Knob label is AUTO, press the Left Knob once to change the display mode to ADJUST (**Figure 3-6**).
3. Rotate the Left Knob to change the brightness to the level desired.
4. Press the MENU Button to exit the Main

DISPLAY LIGHTING MODE	DESCRIPTION
Automatic AUTO	LCD backlight intensity is automatically adjusted based on the current light conditions sensed by the Automatic Dimming Photocell. When using the auto-brightness the display brightness will display up to 70%.
Manual ADJUST	Allows the pilot to adjust the LCD backlight intensity manually, from 1 - 100%.

Table 3-2 Menu Text



Figure 3-5  
Display Brightness in  
ADJUST Mode



Figure 3-6  
Display Brightness in  
AUTO Mode





Figure 3-7  
Internal Battery Annunciation

## 3.4 Backup Battery

The EFD units all have an internal backup battery in case of degraded external power. The internal battery provides sufficient power for 30 minutes of display operation at temperatures that would be comfortable to the aircraft occupants. The battery is charged by the EFD1000 PRO MAX PFD whenever the EFD unit is running on aircraft power.

In the event that external power to the unit is degraded or fails, the MFD will automatically switch to its internal battery. When operating on internal battery, the display backlight intensity is limited to 40% in automatic mode and 70% in manual mode. An "ON BAT" annunciation and the estimated battery charge remaining is displayed on the display (**Figure 3-7**).

### CAUTION

*During situations where a high electrical demand is placed on the aircraft electrical system, electrical transients that cause aircraft voltage to momentarily drop below  $12.5 \pm 0.3V$  (14V Electrical System) or  $25.0 \pm 0.6V$  (28V Electrical System) will cause the MFD to automatically switch to the backup battery and display 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 external power source failure has most likely occurred.*

## 3.5 Power Override

To override the automatic power configuration, the following methods can be used to shut off the PFD.

### Switching between Battery and External Power

1. Push the MENU Button. The Main Menu displays.
2. Rotate the Right Knob until the POWER SETTINGS Menu page displays.
3. MENU Button 1 and 2 show the power source options of BATTERY and EXT PWR respectively. The current power source label is green; the other label is white (**Figure 3-8**). Push either button to alternately switch between external power (EXT PWR) or the internal battery (BATTERY).



Figure 3-8  
Power Settings Menu

### View External Voltage Status

1. Push the MENU Button. The Main Menu displays.
2. Rotate the Right Knob until the POWER SETTINGS Menu page displays.
3. The EXT PWR MENU Button, (**Figure 3-8**) displays the external power voltage.
4. Push the MENU Button to exit the Menu.

### View Battery Status

1. Push the MENU Button. The Main Menu displays.
2. Rotate the Right Knob until the POWER SETTINGS Menu page displays.
3. The BAT MENU Button (**Figure 4-31**) displays the current battery status as a percentage of charge .
4. Push the MENU Button to exit the Menu.

**Power Off Manually**

1. Press and hold the REV Button for 5 seconds.

OR

1. Push the MENU Button. The Main Menu displays.
2. Rotate the Right Knob until the POWER SETTINGS Menu page displays.
3. Press the RESTART MENU Button. The power down sequence initiates.

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**

1. Press and hold the REV Button until the EFD1000 PRO MAX PFD powers on.

## 3.6 Cleaning the Display Screen

The PFD 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 like 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 cloth.
- Remove all excess moisture to prevent damage to the display.
- The display should be dry before turning on the PFD.

 **NOTE**

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

## Chapter 4

### Reference Guide

The PFD is a panel-mounted Electronic Flight Instrument System (EFIS) 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.

The PFD system components include the PFD display head, a Remote Sensor Module (RSM), a Configuration Module (CM), and the optional Analog Converter Unit (ACU). **Chapter 1, Welcome and Introduction,** provides a detailed discussion on the PFD system components.

When interfaced with a compatible autopilot, the Pro MAX PFD system provides heading and course information to the autopilot, which enables the autopilot to follow the Course and Heading values set by the pilot on the PFD in much the same way as with a mechanical HSI. When interfaced with a compatible GPS, the Pro PFD can provide GPS Steering (GPSS) to an autopilot.



*The optional ACU enables the interface of the Pro MAX PFD system with legacy panel-mounted GPS navigators, VOR/Localizer radios, and autopilots.*

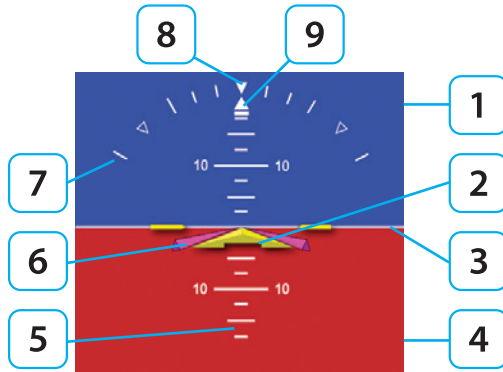


Figure 4-1  
Attitude Indicator

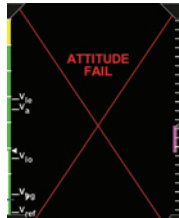


Figure 4-2  
Pitch and/or Roll Data Invalid

## 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 4-2).

## 4.1 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 4-1).

- |   |                           |   |                     |
|---|---------------------------|---|---------------------|
| 1 | Sky                       | 6 | Flight Director     |
| 2 | Aircraft Reference Symbol | 7 | Roll Scale          |
| 3 | Horizon Line              | 8 | Roll Pointer        |
| 4 | Ground                    | 9 | Slip/Skid Indicator |
| 5 | Pitch Scale               |   |                     |

The Attitude Indicator cannot be adjusted 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.

## 4.1.1 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.

## 4.1.2 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 4-3**), and nose-down pitch angles of 10° or less (**Figure 4-4**). 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.

## 4.1.3 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.

## 4.1.4 Flight Director

When connected to a compatible autopilot and configured through an ACU during installation, the PFD displays a single-cue (two-axis) flight director on the Attitude Indicator (**Figure 4-5**). The pilot may follow the flight director's pitch and roll cues, even when the autopilot is not engaged, to remain on heading or altitude, climb or descend, turn, or navigate along a programmed flight path.

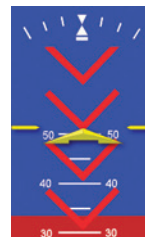


Figure 4-3  
Pitch Markings  
Extreme Nose Up

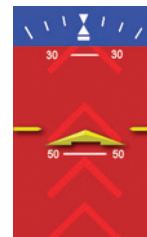


Figure 4-4  
Pitch Markings  
Extreme Nose Down

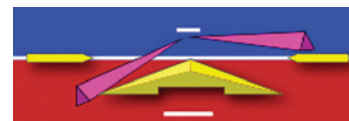


Figure 4-5  
Flight Director

### NOTE

Refer to the autopilot's AFMS for information on the operation of the flight director. The Flight Director is a visual representation of the pitch and roll commands from the autopilot. The Flight Director's pitch and bank limits are based on the emulation mode set at installation and are limited to  $\pm 45^\circ$  roll and  $\pm 25^\circ$  pitch.

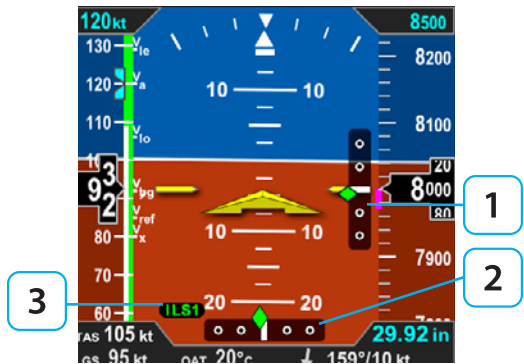


Figure 4-6  
Lateral and Vertical Deviation Indicators  
and Source Information

### 4.1.5 Lateral and Vertical Deviation Indicator

Both lateral and vertical deviation indicators are shown on the Attitude Display during instrument approaches. A Lateral Deviation Indicator (LDI) and a Vertical Deviation Indicator (VDI) (Figure 4-6) will automatically appear, depending on the operating mode of the selected navigation sensor and the validity of the associated signal, as described below.

1

Vertical Deviation Indicator (VDI)

2

Lateral Deviation Indicator (LDI)

3

LDI Navigation Source Annunciation

#### Lateral Deviation Indicator

The LDI and corresponding LDI Navigation Source Annunciation automatically display when:

- The active navigation source is a GPS radio, GPS is in the Approach mode, and the signal is valid.

Or

- The active navigation source is a VHF navigation radio and a valid LOC, LOC(BC), or ILS signal is received. .



When the LOC(BC) mode is active, deviation indications (corrected for reverse sensing) are displayed. The deviation shown on the LDI directly corresponds to the deviation indicated on the CDI in the Navigation Display. When the lateral deviation exceeds the displayable range of 2.5 dots, the Course Deviation Diamond becomes dim and hollow, and is parked at the extreme edge of the LDI scale (**Figure 4-7**).

When the LDI navigation source is invalid or is no longer available, the Lateral Deviation Diamond is removed from view, and the Navigation Source Annunciation is slashed by a red horizontal line (**Figure 4-8**).

### Vertical Deviation Indicator

The Vertical Deviation Indicator (VDI) is enabled and is shown on the Attitude Display when the active navigation source is a VHF navigation radio, the ILS mode is active, and a valid localizer signal is being received. The VDI is also displayed for a GPS, supplying valid vertical deviation data, when in the Approach mode.

The VDI will only display with a valid vertical guidance signal. When the vertical deviation exceeds the displayable range, the Glide Slope Deviation Diamond becomes dim and hollow, and is parked at the extreme edge of the VDI scale (**Figure 4-9**).



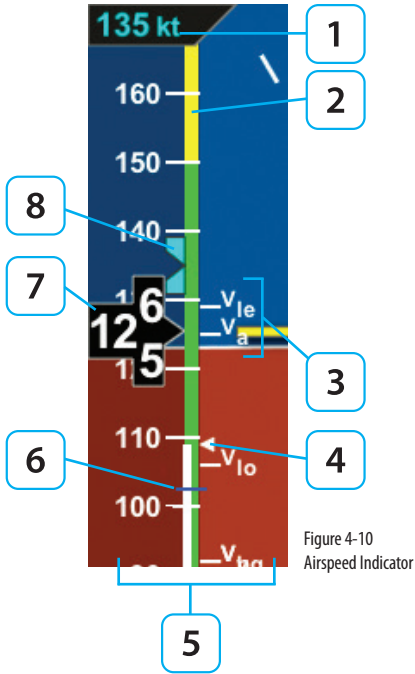
Figure 4-7  
Lateral Deviation Diamond  
Off Scale Indication



Figure 4-8  
LDI Source Invalid



Figure 4-9  
Vertical Deviation Diamond Off Scale Indication



## 4.2 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 4-10**).

- 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. Although the pilot can set the selected airspeed (bug), there is no visual or aural annunciation provided when the actual airspeed deviates from the selected airspeed value.

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  $V_{ne}$  is exceeded or when the airspeed drops below  $V_{so}$  during stalls or landing roll-outs (Figure 4-11).

### 4.2.1 Speed Bands & Textual VSpeeds

Speed Bands and Textual Vspeed markers are shown on the airspeed tape (e.g.,  $V_{ne}$ ,  $V_x$ ,  $V_y$ ,  $V_a$ , etc.). These are typically programmed at installation, or (if left unlocked during installation) may also be adjusted/enabled/disabled by the pilot.

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. The default setting is 0 unless previously set to another value. When the value is 0, the Vspeed is 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. Vspeed are listed in Table 4-1.

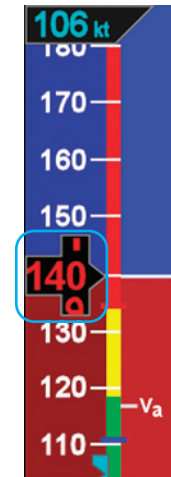


Figure 4-11  
Actual Airspeed Greater Than the  $V_{ne}$

Vspeed	DEFINITION	PRE-SET BANDS	ADJUSTABLE IF UNLOCKED	PRE-SET MARKERS
Vne	Never exceed	•		• (Red Line)
(Red Line)	PRE-SET	•		
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		•	
Vlo	Maximum landing gear operating speed		•	
Vmc	(Multi-engine) Single-engine minimum control airspeed			• (Red Line)
Vyse	(Multi-engine) Best single-engine rate of climb			• (Blue Line)
◀	Maximum initial flap extension speed			•

Table 4-1 Vspeed Definitions

The PFD 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 4-2** and shown in (**Figure 4-12**).

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 PFD installation.

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.

 **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 PFD Airspeed Tape are configured to match the certified mechanical airspeed indicator.*

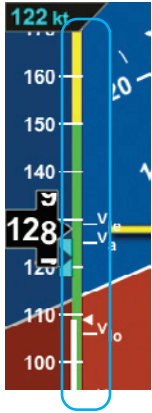


Figure 4-12  
Speed Bands

### Maximum Operating Limit Audio Callout

If the OVERSPEED ALERT is enabled in the installation for your aircraft, if the airspeed exceeds the Maximum Operating Limit ( $V_{mo}$ ) speed, the Overspeed audio alert sounds the voice message "OVERSPEED". The Audio callout will be repeated until the Airspeed is reduced below  $V_{mo}$ .

BAND COLOR	SPEED RANGE	
Red Band (High Speed)	$V_{ne}$ (Top of tape)	Never Exceed
Yellow Band	$V_{no}$ – $V_{ne}$	Caution Range
Green Band	$V_s$ – $V_{no}$	Normal Operating Range
White Band	$V_{so}$ – $V_{fe}$	Flap Operating Range
Red Band (Low Speed)	$V_{so}$ (Bottom of tape)	Disabled on the ground and during takeoff

Table 4-2  
Speed Band Ranges

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

1. Press the MENU Button.
2. Rotate the Right Knob to the VSPEEDS A Menu page (**Figure 4-13**).
3. Press the VSPEEDS Menu Key.  
The Menu label turns magenta, and the EDIT VALUE label displays above the Right Knob
4. Rotate the Right Knob to select ENABLE or DISABLE  
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.

### Set Textual Vspeed Labels

1. Press the MENU Button.
2. Rotate the Right Knob to the appropriate Vspeed Menu page (**Figure 4-13**).
3. Press the appropriate Vspeed Menu Key.  
The Menu label turns magenta, and the EDIT VALUE label displays above the Right Knob. Rotate the Right Knob to the desired value.



Figure 4-13  
VSPEEDS A

### 4.2.2 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. 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 4-14**).
2. New Airspeed Selected. 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 4-15**).



Figure 4-14  
Airspeed Bug Selected to Edit

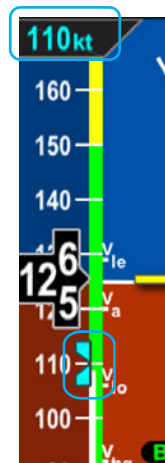


Figure 4-15  
New Airspeed Selected

## 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.



Figure 4-16  
Editing Airspeed Tape Display

## Hide/Display Airspeed Tape

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

1. Press MENU Button.
2. Rotate Right Knob until first Menu Key displays TPS (**Figure 4-16**).
3. Press TPS Menu Key. TPS label and EDIT VALUE label (above Right Knob) appear in magenta.
4. Rotate Right Knob to the desired value: ENABLE or DISABLE (**Figure 4-17**).



Figure 4-17  
Airspeed Tape Disabled



### 4.3 Altimeter

The altimeter consists of Numerical Altitude(drum), Altitude Tape, Altitude Trend Vector, MINIMUMS annunciation, Selected Altitude, Decision Height, Altitude Alerter and BARO setting (Figure 4-18).

- |                                   |  |
|-----------------------------------|--|
| <b>1</b> Altitude Alerter         | <b>6</b> Altimeter Tape                                    |
| <b>2</b> Selected Altitude Field  | <b>7</b> BARO  |
| <b>3</b> Minimums Marker          | <b>8</b> MINIMUMS Annunciation/<br>Selected MINIMUMS Field |
| <b>4</b> Numerical Altitude Value | <b>9</b> Radio Altitude / Decision<br>Height Window        |
| <b>5</b> Altitude Trend Vector    | <b>10</b> Decision Height<br>Annunciation                  |

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.

An adjacent, magenta Altitude Trend Vector predicts the anticipated altitude, in the next six seconds, if the current rate of climb or decent is maintained. Like the VSI, there

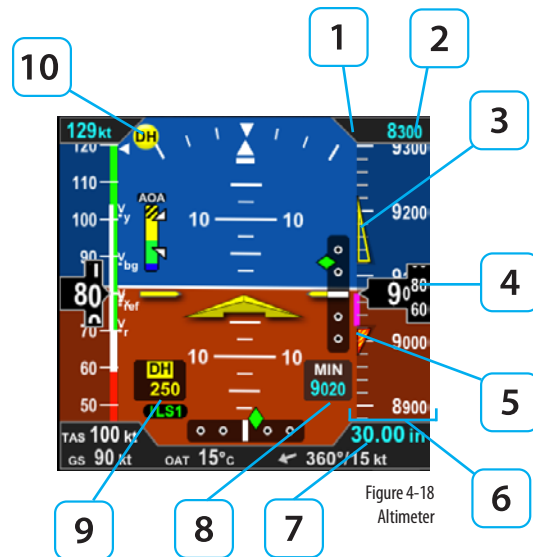


Figure 4-18 Altimeter

## **WARNING**

Always check and set the PFD BARO whenever the mechanical altimeter is adjusted



Figure 4-19  
BARO Field Enabled

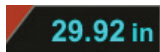


Figure 4-20  
Baro Shown in Inches of Mercury

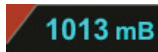


Figure 4-21  
Baro Shown in Millibars

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

### 4.3.1 Barometric Pressure Setting

Barometric units of measure adjustment may be made in either inches of mercury (in) or millibars (mB), as configured by the pilot in the Menu. The adjustment range is 28.10 – 30.99 inches Hg or 946 – 1049 mB.

#### Set the Barometric Pressure

1. Press the BARO Hot Key. The BARO label above the Right Knob and Barometric Pressure Setting Field appear in magenta (**Figure 4-19**).
2. Rotate the Right 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.

### Set Barometric Units of Measure

1. Press the MENU Button.
2. Rotate the Right Knob to select the GENERAL SETTINGS B page.
3. Press the BARO Menu Key. The Menu label turns magenta, and the EDIT VALUE label displays above the Right Knob.
4. Rotate the Right Knob to select either in or mB.
5. Press the MENU Button to exit.

### 4.3.2 Selected Altitude & Alerting

The Selected Altitude is displayed at the top of the Altitude Tape. The Selected Altitude Field range is 100 to 51,000 feet, in 100 foot increments. 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

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. Rotating the knob quickly will change the altitude in larger increments
3. 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.

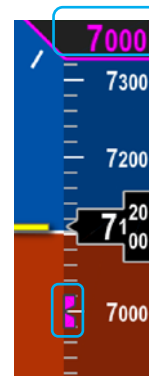


Figure 4-22  
Altitude Bug and Altitude Alerter Enabled

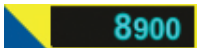


Figure 4-23  
Altitude Alert

### 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.*

### 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.

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.

### Altitude Audio Callout

When the aircraft altitude transitions to within 200 feet or 15 seconds of reaching the selected altitude, the audio alert sounds the voice message "ALTITUDE".

After reaching the Selected Altitude, if the aircraft's current altitude differs from the selected altitude by more than 200 feet, the audio alert sounds the voice message "ALTITUDE".

### 4.3.3 MINIMUMS Annunciation

The Pro PFD provides an adjustable MINIMUMS field to enhance situational awareness during instrument approaches. The Pro PFD provides a MINIMUMS annunciation with a series of markers on the Altitude Tape that provide the pilot with improved awareness when approaching and operating at minimums. There are three different color markers that are shown on the altitude tape that are associated with the MINIMUMS Annunciation, as described in **Table 4-3**.




Marker Color	Description	
Green	The aircraft is 500 feet above selected MINIMUM.	 <p>Figure 4-24 Minimums Green Triangle</p>
Hollow Yellow	<p>The aircraft is 100 feet to 200 feet above the selected MINIMUM.</p> <p>The marker base is at 100 feet above MINIMUM, and the tip is at 200 feet above MINIMUM.</p>	 <p>Figure 4-25 Minimums Hollow Yellow Triangle</p>
Red and Yellow stripes	The aircraft is at the selected MINIMUM.	 <p>Figure 4-26 Minimums Red/ Yellow Striped Triangle</p>

Table 4-3  
Selected MINIMUMS Markers



Figure 4-27  
MIN Hot Key – Selected Minimums

Once the Selected Minimums field value is set to a Decision Altitude, Decision Height, or Minimum Descent Altitude, the Pro PFD provides an alert when the aircraft descends below this altitude. To activate this feature, enable the Selected Minimums (MIN) field and set the value with the Right Knob. The range for the MIN data field is 0 – 15,000 feet, in increments of 10 feet.

### Display/Hide Minimums

1. Press the MIN Hot Key to alternately hide or display the Selected Minimums Field, MINIMUMS Annunciation, and Markers (**Figures 4-27**).

### Set Altitude Minimum

1. Press the MIN Hot key to set the altitude minimum. The Selected Minimums Field (**Figure 4-28**) and the MIN label above the right knob (**Figure 4-29**) are rendered in Magenta.
  2. Rotate the Right Knob to change the value of the Selected MINIMUMS Field.
- OR
1. Press the MIN Hot Key to set the altitude minimum. The Selected MINIMUMS Field and the MIN label above the Right Knob are rendered in magenta.
  2. Press and Hold the Right Knob, the MINIMUMS value will be set to current Altitude.

Once the desired value is selected, and after 10 seconds of inaction, the field is disabled. Whenever the aircraft is at or below the Selected MINIMUMS setting, the MIN legend in the Selected Minimums Field turns inverse amber (Figure 4-30) and when configured with an optional Sonalert, a one-second stuttered tone is generated.

The inverse amber MIN Annunciation is cancelled when the aircraft is 100 feet above the selected minimums setting or when the selected minimums is set to a new altitude. Additionally, the MINIMUMS Markers on the Altitude Tape provide the pilot with additional awareness of aircraft altitude with respect to the set MINIMUMS.

### Minimums Audio Callout

As the aircraft approaches to within 100ft of the minimums altitude, the approaching minimums audio alert sounds the voice message “APPROACHING MINIMUMS”. Once an approaching minimums audio alert has been generated, subsequent ones shall be inhibited until the baro corrected altitude transitions to 200 units above the selected minimum or the selected minimums is adjusted to a new value.

When the aircraft reaches the minimums altitude, the Minimums audio alert sounds the voice message “MINIMUMS”.

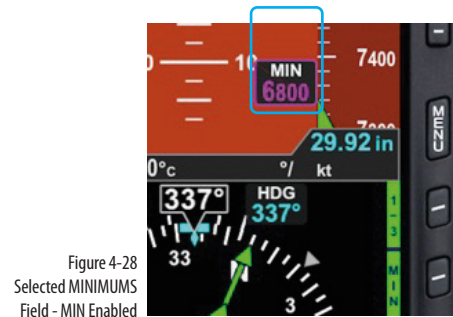


Figure 4-28  
Selected MINIMUMS  
Field - MIN Enabled



Figure 4-29  
MIN above Right Knob  
for Editing

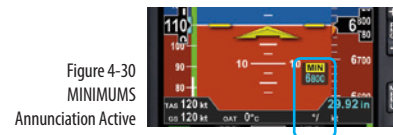


Figure 4-30  
MINIMUMS  
Annunciation Active

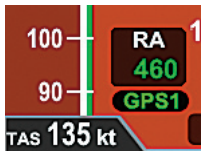


Figure 4-31  
Radio Altitude

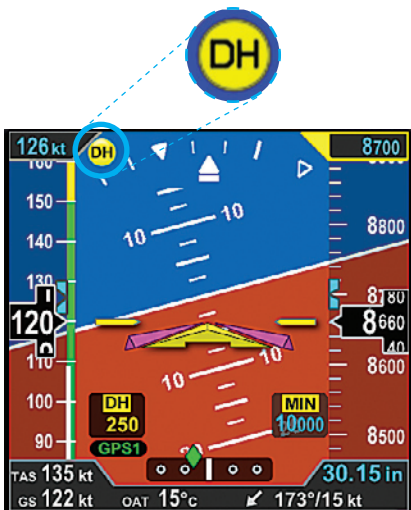


Figure 4-32  
DH Annunciation

### 4.3.4 Radio Altitude Display

When a compatible radio altimeter is connected to the Evolution Display, radio altitude height in feet above ground level (AGL) can be displayed at the bottom left of the Attitude Display (**Figure 4-31**). When the aircraft is above the maximum range of the radio altimeter, the Radio Altimeter display window is removed. The maximum displayed altitude value will depend on the range of the radar altimeter equipment installed in the aircraft.

Radio Altitudes that are greater than or equal to 500 feet AGL are displayed in 100 foot increments (RA 500, RA 600, RA 700...) and altitudes less than 500 feet AGL are displayed in 10 foot increments (RA 490, RA 480, RA 470...)

The digital readout in the Radio Altitude (RA) window is normally displayed in green, however, when the aircraft is at or below the Decision Height (DH) set on the onboard radio altimeter's indicator (if applicable), the RA window on the PFD will show the DH legend as inverse amber and the current RA readout in amber. An amber DH (Decision Height) annunciation is also displayed near the upper left corner of the Attitude Display (**Figure 4-32**).

#### Enable or Disable the Radio Altitude Display

1. Press the MENU Button and rotate the Right Knob to the GENERAL SETTINGS A page.
2. Press the RAD ALT Menu Key and rotate the Right Knob to toggle between ENABLE or DISABLE.
3. Press the MENU Button to exit.



## Hide/Display Altitude Tape

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

1. Press MENU Button.
2. Rotate Right Knob until first Menu Key displays TPS (**Figure 4-33**).
3. Press TPS Menu Key. TPS label and EDIT VALUE label (above Right Knob) appear in magenta.
4. Rotate Right Knob to the desired value: ENABLE or DISABLE (**Figure 4-34**).
5. Press MENU Button to exit.



Figure 4-33  
Editing Airspeed and Altitude Tape Display

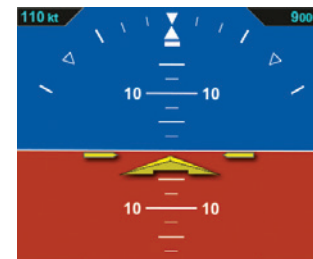


Figure 4-34  
Airspeed Tape Disabled

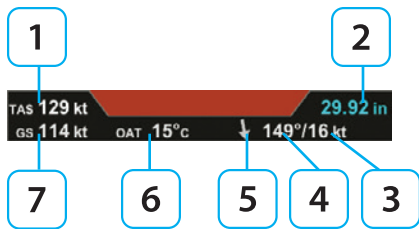


Figure 4-35  
Data Bar

## 4.4 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 4-35)**. 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) or MACH       | <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                    |          |                               |

### **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.*

### 4.4.1. 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.

## 4.4.2 MACH Number Display for Mmo Aircraft

For Mmo aircraft, the PFD can show aircraft Mach number in the Data Bar with a display resolution of 0.01 Mach.

The Mach number (configured during initial installation) can be displayed for either altitude or speed transition.

When configured to ALTITUDE transition, the TAS indication will be replaced by the Mach number whenever the aircraft is above the selected transition altitude.

When configured to SPEED transition, the TAS indication will be replaced by the Mach number whenever the aircraft is above the selected transition Mach number.

### Select the Altitude or Speed Transition setting

1. Press the MENU Button and rotate the Right Knob to the GENERAL SETTINGS C page. (**Figure 4-36**)
2. Press the MACH DSPL Menu Key and rotate the Right Knob to the desired Altitude setting or Speed setting.
3. Press the MENU Button to exit.



Figure 4-36  
Altitude Transition Setting

### NOTE

The installer will configure the PFD to display redline or barber pole airspeed limits that vary with pressure altitude. The colors are configured to correspond with the aircraft's approved markings on the mechanical airspeed indicator.



Figure 4-37  
Select OAT Units of Measure

### 4.4.3 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.

### 4.4.4 Outside Air Temperature (when enabled)

The Outside Air Temperature (OAT) is displayed in the center of the Data Bar (**Figure 4-35**). 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 Right 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 Right Knob (**Figure 4-35**).

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

#### 4.4.5 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 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.

#### 4.4.6 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 4.4.1**. 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.

#### 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 PFD or the data are invalid, the wind direction and speed are dashed and the wind direction arrow is removed.*

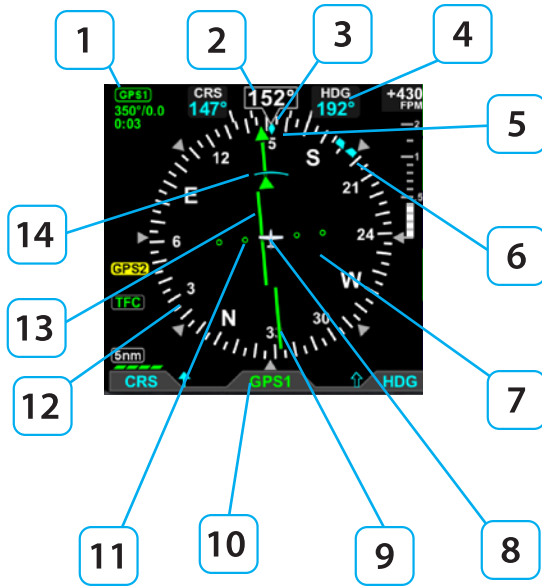


Figure 4-38  
Horizontal Situation Indicator

### NOTE

The size, shape and location of the Course Pointer, Deviation Scale, and Deviation Indicator depend on the Compass Mode selected.

## 4.5 Navigation Display

The Horizontal Situation Indicator (HSI) on the Navigation Display of the PFD, combines a Direction Indicator with a Course Deviation Indicator (CDI) (**Figure 4-38**).

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. The CDI is comprised of a selected course pointer, Deviation Scale and indicator, TO/FROM indicators, and selected navigation source label and information block.

- |          |                        |           |                                |
|----------|------------------------|-----------|--------------------------------|
| <b>1</b> | CDI Source Info Block  | <b>8</b>  | Aircraft Ownship Symbol        |
| <b>2</b> | Magnetic Heading       | <b>9</b>  | Course Pointer                 |
| <b>3</b> | Rate of Turn Indicator | <b>10</b> | Selected CDI Navigation Source |
| <b>4</b> | Selected Heading Field | <b>11</b> | Course Deviation Scale         |
| <b>5</b> | Ground Track Marker    | <b>12</b> | Compass Scale                  |
| <b>6</b> | Heading Bug            | <b>13</b> | Course Deviation Indicator     |
| <b>7</b> | TO/FROM Indicator      | <b>14</b> | Altitude Intercept Arc         |

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°.

The PFD offers three Compass Modes: 360°, ARC HSI, and ARC CDI. The default Compass Mode is 360. The aircraft's heading is always expressed degrees magnetic.

### 4.5.1 360° 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 4-39**).

### 4.5.2 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. The default ARC Compass Mode is ARC HSI.

The ARC HSI Compass Mode presents a rotating CDI, similar to that used in the 360° Compass Mode (**Figure 4-40**).

The ARC CDI Compass Mode uses a fixed CDI, resembling a contemporary GPS navigation deviation display. The ARC CDI Compass Mode is intended to maximize the lower display area for map and flight plan data (**Figure 4-41**).



Figure 4-39  
360° Compass Mode



Figure 4-40  
ARC HSI Compass Mode



Figure 4-41  
ARC CDI Compass Mode



Figure 4-42  
GENERAL SETTINGS A

### Select ARC CDI/HSI Compass Mode

1. Press the MENU Button.
2. Rotate the Right Knob to the GENERAL SETTINGS A Menu page (**Figure 4-42**).
3. Press the ARC MODE Menu Key. The Menu label turns magenta, and the EDIT VALUE label displays above the Right Knob (**Figure 4-43**).
4. Rotate the Right Knob to select either HSI or CDI (**Figure 4-44**).
5. Press the MENU Button to exit.



Figure 4-43  
Changing the ARC Compass MODE



Figure 4-44  
ARC CDI Compass MODE Selected



## Select Compass Type

1. Press the 360/ARC Hot Key (**Figure 4-45**) to alternately select either the 360° or ARC Compass Mode.



Figure 4-45  
360/ARC Hot Key



Figure 4-46  
Reduced Length Course Pointer,  
ARC HSI Compass Mode



Figure 4-47  
Stub Course Arrowhead, ARC CDI  
Compass Mode



Figure 4-48  
Stub Course Tail,  
ARC CDI Compass Mode

### 4.5.3 Course Pointer

For all Compass Modes, the arrowhead of the Course Pointer aligns with the corresponding value on the compass scale regardless of the aircraft heading. The ARC Compass HSI and CDI Course Pointers are different and are described in **Table 4-4**.

COMPASS	DESCRIPTION
ARC HSI	The Course Pointer length shortens as necessary when rotated to remain within the display area ( <b>Figure 4-46</b> ).
ARC CDI	The Course Pointer is shown as a stub arrow or tail whenever the CRS value or its reciprocal falls within the displayable range of the compass scale arc ( <b>Figure 4-47</b> and <b>4-48</b> ).

Table 4-4  
ARC Compass Mode Course Pointer Display

### 4.5.4 TO/FROM Indicator

Each of the Compass Modes has a TO/FROM indicator. The TO/FROM indicator shows whether the aircraft is heading toward a waypoint or radio navaid, or from a waypoint or radio navaid. For each Compass Mode, the TO/FROM indication is slightly different, as described in **Table 4-5**.

COMPASS	DESCRIPTION
360°	The TO indicator is an arrowhead on the top half of the Course Pointer, oriented in the same direction as the course arrowhead ( <b>Figure 4-49</b> ). The FROM indicator is an arrowhead on the bottom half of the Course Pointer, oriented in the direction opposite to the course arrowhead ( <b>Figure 4-50</b> ).
ARC HSI	The TO indicator is shown as two arrowheads, one on each half of the Course Pointer, oriented in the same direction as the course arrowhead ( <b>Figure 4-51</b> ). The FROM indicator is shown as two arrowheads, one on each half of the Course Pointer, oriented opposite to the direction of the course arrowhead ( <b>Figure 4-52</b> ).
ARC CDI	The TO indication is shown as TO on the left side of the Deviation Scale ( <b>Figure 4-53</b> ). The FROM indication is shown as FROM on the right of the Deviation Scale ( <b>Figure 4-54</b> ).

Table 4-5  
TO/FROM Indicator Description

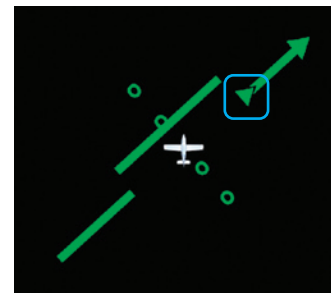


Figure 4-49  
360° TO Indication

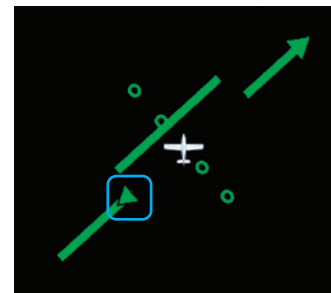


Figure 4-50  
360° FROM Indication



Figure 4-51  
HSI TO Indication



Figure 4-52  
HSI FROM Indication



Figure 4-53  
CDI TO Indication



Figure 4-54  
CDI FROM Indication

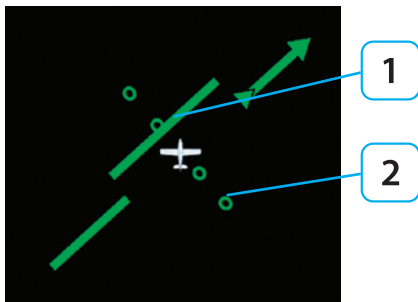


Figure 4-55  
Deviation Indicator, 360° and ARC HSI Compass Modes

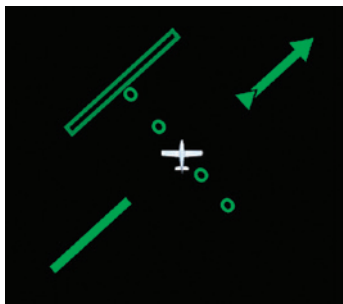


Figure 4-56  
Exceeded Deviation, 360° and ARC HSI Compass Modes

## 4.5.5 Course Deviation Indicator and Scale

Selected course deviation is depicted by a Course Deviation Indicator and Scale. Deviation is indicated by positioning the Course Deviation Indicator on the Scale corresponding to the lateral deviation value.

The 360° and ARC HSI Compass Modes show the CDI as a green line centered on the display and parallel with the Course Pointer. The scale is a set of four hollow, green dots that are perpendicular to the Course Pointer (**Figure 4-55**).

- 1 Course Deviation Indicator
- 2 Course Deviation Scale

The ARC CDI Compass Mode's CDI and Scale are located at the bottom of the lower display. The indicator is a green diamond, and the Scale is a set of four hollow, white dots with a white index mark at the center (**Figure 4-57**). When in the ARC CDI Compass Mode, on a Localizer Back Course approach, a BC label is presented to the left of the scale, and the Indicator corrects for reverse sensing (**Figure 4-58**).

When the lateral deviation exceeds the maximum displayable range of 2.5 dots, the Deviation Indicator bar or diamond, as applicable, becomes hollow and darker (**Figure 4-56** and **4-59**).



Figure 4-57  
Course Deviation Indicator, ARC CDI  
Compass Mode



Figure 4-58  
Course Deviation Indicator, ARC CDI  
Compass Mode with Back Course



Figure 4-59  
Deviation Exceeded, ARC CDI

### Localizer Back Course (BC) Operation

When flying a Back Course final approach (the aircraft heading is opposite to the localizer front course), set the CRS value to the front course localizer or ILS approach value. The tail of the CDI will match the back-course runway's magnetic orientation.

When the LOC(BC) mode is active, two "BC" annunciations are shown; on the Attitude

Display left of the Lateral Deviation Indicator (LDI) and on the ARC Compass left of the Course Deviation Scale (**Figure 4-60**). The left/right deviation indications are corrected for reverse sensing and will behave intuitively, the same as with a front course localizer.

### 4.5.6 CDI Navigation Source

When the PFD powers up, the default Selected CDI Navigation Source is the last source selected. The pilot can select from any of the installed navigation sources using the Middle Button. The PFD supports navigation information display from VHF Omnidirectional Radio Range (VOR) Nav aids, Localizers (LOC), Glide Slope receivers (GS), and Global Positioning Systems (GPS). There can be up to four dedicated, two integrated, or a combination of one integrated and two dedicated navigation systems installed.

When individual GPS and VLOC devices are installed, the GPSS signal source, GPS position, flight plan, and information for VLOC1, VLOC2, and GPS1 are provided by the GPS1 navigation source whenever GPS1 is selected as the CDI navigation source and by GPS2 whenever GPS2 is selected as the Selected CDI navigation source.



Figure 4-60  
Back Course (BC) Annunciation Locations

## NOTE

There are many radio configurations available. Your authorized Aspen Avionics Dealer can explain the configuration used on your aircraft.

### Select the CDI Navigation Source

- Press the CDI Navigation Source Select button until the desired navigation source is displayed above the button (e.g., GPS1, GPS2, VLOC1, VLOC2) (**Figure 4-61**).

1

CDI Navigation Source Select Button

2

Selected CDI Source Label

3

CDI Source Information Block



Figure 4-61  
CDI Source selection and Information

Whenever the CDI Navigation Source's data is valid, a CDI Source Information Block for the selected source is shown in the upper left corner of the Navigation Display, as shown in (**Figure 4-65**) and described in **Table 4-6**.

Radio Mode	Information Block Label	
GPS		GPS1 or GPS2
VHF	VOR	VOR1 or VOR2
	Localizer	LOC1 or LOC2
	Localizer Back	LOC1(BC) or LOC2 (BC)
	ILS	ILS1 or ILS2

Table 4-6  
VHF NAV Radio Modes

- 1 Selected CDI Navigation Source
- 2 Waypoint identifier or tuned frequency (when available)
- 3 Bearing (in degrees)/Distance (in Nautical Miles) to waypoint or navaid (when available)
- 4 Estimated Time Enroute (Hours:Minutes)

If both the station identifier and the tuned frequency of the associated VHF NAV radio are available, only the station identifier is displayed on the second line of the information block. In most cases, however, only the tuned frequency is available for display from integrated GPS/VLOC devices.



Figure 4-62  
CDI Source Information Block



Figure 4-63  
No Course Deviation Bar or TO/FROM Indicator



Figure 4-64  
Invalid CDI Navigation Source Label



Figure 4-65  
CDI Source Information Blank



Figure 4-66  
Menu, GENERAL SETTINGS

When available, the bearing and distance to station is displayed on the third line of the information block in the format  $ddd^\circ/nnnn$  or  $ddd^\circ/nn.n$ , where  $ddd$  is the bearing in degrees and  $nnnn$  or  $nn.n$  is the distance in nautical miles (e.g.,  $360^\circ/1103$  or  $322^\circ/3.2$ , shown in **Figure 4-62**).

When available, the estimated time enroute information is displayed on the fourth line of the information block in the format  $h:mm$  (where  $h$  is hours and  $mm$  is minutes).

When CDI Navigation Source data is invalid or unavailable from a configured navigation source, the HSI course deviation bar and the TO/FROM indicator are removed from the display (**Figure 4-63**). Additionally, the selected CDI Navigation Source label in the CDI Source Information Block is slashed with a red line (**Figure 4-64**).

- When information for a configured and selected navigation source is CDI Source Information Block is blank (**Figure 4-65**)



## 4.5.7 Auto Course

The pilot can either use the Auto Course (AUTOCRS) or manually set a CRS value. By default, AUTOCRS is enabled. When the selected CDI Navigation Source is a connected GPS receiver and AUTOCRS is enabled, CRS is not adjustable (current course value is automatically slewed and controlled by the desired track from the GPS). When AUTOCRS is enabled, the CDI navigation source is a GPS, and that system is configured for automatic waypoint sequencing (i.e., not OBS or HOLD modes) then Auto Course Select is active.

### Enable Auto Course

1. Press the MENU Button.
2. Rotate the Right Knob to the GENERAL SETTINGS A page (**Figure 4-66**).
3. Press the AUTOCRS Menu Key.

The Menu label turns magenta, and the EDIT VALUE label displays above the Right Knob (**Figure 4-67**).

4. Rotate the Right Knob to select ENABLE (**Figure 4-68**).
5. Press the MENU Button to exit.

When AUTOCRS is enabled, the CRS value is set to the desired track output from the CDI Navigation Source. The CRS value is shown in the upper left of the lower display area in green under the CRS label. Additionally, an inverse green A is shown beside the CRS label in the upper left of the lower display area and in the legend above the Left Knob. This indicates that the course is being automatically adjusted (**Figure 4-69**).



Figure 4-67  
Editing AUTOCRS



Figure 4-68  
AUTOCRS Enabled

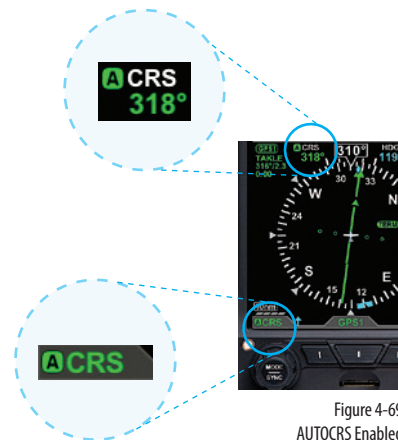


Figure 4-69  
AUTOCRS Enabled



Figure 4-70  
Menu, GENERAL SETTINGS



Figure 4-71  
Editing AUTOCRS



Figure 4-72  
AUTOCRS Disabled



Figure 4-73  
CRS Field Enabled for Editing

### Disable Auto Course

1. Press the MENU Button.
2. Rotate the Right Knob to the GENERAL SETTINGS A page (**Figure 4-70**).
3. Press the AUTOCRS Menu Key.

The Menu label turns magenta, and the EDIT VALUE label displays above the Right Knob (**Figure 4-71**).

4. Rotate the Right Knob to select DISABLE (**Figure 4-72**).
5. Press the MENU Button to exit.

### 4.5.8 CDI Selected Course

When the CDI source changes from a GPS source with AUTOCRS to another CDI source, the CRS value reverts to the last set value. When the CDI source is set to a VHF receiver operating in the VOR or Localizer modes, editing the CRS value adjusts the current selected CRS value. When the CDI source is set to a GPS receiver, and AUTOCRS is disabled, the CRS value may be adjusted. When transitioning from GPS guidance to VOR or localizer guidance, the course pointer should manually be set to the appropriate course.

#### Select CDI Course

1. Press the Left Knob. The CRS label above the Left Knob and the Course field are enabled for editing, both rendered in magenta (**Figure 4-73**).
2. Rotate the Left Knob to change the value of the Course field.

Once the CRS value is set, and after 10 seconds of inaction, the CRS field is disabled, and both the label and field are rendered in cyan.

## 4.5.9 Bearing Pointer Source Selection

When the 360° Compass mode is selected, single- and double-line bearing pointers are available (**Figure 4-74**). The bearing pointers are independent of the CDI and provide supplemental navigation information by pointing to active GPS waypoints or nav aids. By default, the bearing pointers are off and not displayed.

1	Single-Line Bearing Pointer
2	Single-Line Bearing Pointer Source Information <ul style="list-style-type: none"> <li>Distance (NM) to active GPS waypoint</li> <li>Waypoint identifier, station identifier (when available, or the tuned frequency of the associated VHF NAV radio (when available)</li> </ul>
3	Single-Line Bearing Pointer Icon
4	Double-Line Bearing Pointer
5	Double-Line Bearing Pointer Source Information <ul style="list-style-type: none"> <li>Distance (NM) to active GPS waypoint</li> <li>Waypoint identifier, station identifier (when available, or the tuned frequency of the associated VHF NAV radio (when available)</li> </ul>
6	Double-Line Bearing Pointer Source



Figure 4-74  
Bearing Pointer Description



Figure 4-75  
Bearing Pointers OFF



Figure 4-76  
Invalid Bearing Pointer Source



Figure 4-77  
Icons when Bearing Pointers are OFF

The Bearing Pointers indicate only the bearing information provided by their selected navigation sources. They resemble and perform like traditional Radio Magnetic Indicator (RMI) needles. Each Bearing Pointer's head and tail is aligned with the corresponding bearing/radial value on the compass. The pilot can select a navigation source for each of the Bearing Pointers from the same VOR and GPS sources available to the CDI or simply turn off the Bearing Pointer and Source Information.

Each Bearing Pointer is associated with a Left Button or a Right Button, its source, and Information Block. The Left Button, immediately adjacent to the CDI Navigation Source Selection Button (Middle Button), is associated with and controls the Single-Line Bearing Pointer. Likewise, the Right Button controls the Double-Line Bearing Pointer. The Bearing Pointers' Source Information is shown directly above their respective Buttons.

Unlike the CDI's Course Pointer, which can be adjusted by the pilot, no adjustments can be made to the Bearing Pointers. When a VOR is selected as the source, the arrow of the needle points to the VOR navaid to which the receiver is tuned. The position of the Bearing Pointer tail, with respect to the compass, indicates the aircraft's current position on the VOR radial. When a GPS source is selected, the Bearing Pointer indicates the bearing to the active waypoint.

When the Bearing Pointer Source Information is unavailable or invalid, the Bearing Pointer and its Source Information are removed (**Figure 4-75**). The Bearing Pointer's Source is also source legend slashed with a red line (**Figure 4-76**).

When a Bearing Pointer is turned OFF, only the Bearing Pointer's icon is shown. The Selected Source, the Source Information, and the Bearing Pointer are removed (**Figure 4-77**).

### Select the Single-Line Bearing Pointer Source

1. Press the Single-Line Bearing Pointer Button (Left Button, **Figure 4-78**) until the desired navigation source is shown above the Button.

### Select the Double-Line Bearing Pointer Source

1. Press the Double-Line Bearing Pointer Button (Right Button, **Figure 4-79**) until the desired navigation source is shown above the Button.

## NOTE

A VOR that is tuned to a localizer frequency is considered an invalid Bearing Pointer source since Localizer signals provide no bearing information.



Figure 4-78  
Single-Line Bearing Pointer and Button



Figure 4-79  
Double-Line Bearing Pointer and Button

Figure 4-80  
Direction of Flight  
Numerical Display





Figure 4-81  
Heading Bug and Selected  
Heading Field



Figure 4-82  
Selected Heading Bug Outside of  
the ARC Compass Scale Range



Figure 4-83  
Heading Selected to Edit

## 4.5.10 Aircraft Heading Display

The aircraft heading is displayed in degrees magnetic (**Figure 4-80**). The PFD 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 4-81**).

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 4-82**).

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 Right Knob.

The HDG label above the Right Knob and the Selected Heading Field are enabled for editing, both rendered in magenta (**Figure 4-83**).

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

Or

1. Press and hold the Right Knob until the HDG becomes set to the current aircraft heading.

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

### 4.5.11 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 (**Figure 4-84**). The turn rate indication is provided for every compass mode, 360° and ARC.

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.

### 4.5.12 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 4-85** and **4-86**). The Ground Track Marker is removed from the display when ground track data is not available or invalid.



Figure 4-84  
Rate of Turn Indicator (360° Compass Mode)



Figure 4-85  
ARC Compass Mode, Ground Track Marker



Figure 4-86  
360° Compass Mode, Ground Track Marker



Figure 4-87  
VSI



Figure 4-88  
VSI Tape Off-Scale

### 4.5.13 Altitude Intercept Arc

When climbing or descending toward the selected altitude on the PFD's altitude tape, the Nav Display/Basemap (not available on SV1) will display a cyan altitude intercept arc that shows the location the aircraft will reach the selected altitude at the current vertical speed. The size of the selected altitude intercept arc decreases as the aircraft gets closer to the selected altitude. Selected altitude is set on the PFD's altitude tape using the altitude bug, see **Section 4.3.2**.

The altitude intercept arc feature can be enabled/disabled in the main menu (see **Table 2-5**).

## 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 4-87**). 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 4-88**).

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.



## 4.7 Navigational Map

The Navigational Map provides for the depiction of Flight Plan, Basemap data,, Weather and Traffic information on the Navigation Display, providing situational awareness of these elements in context of the aircraft location, heading and track on the Navigation Display. If Evolution Synthetic Vision is enabled, the Nav Map can also show terrain, obstacles, landmarks. The map is always oriented with magnetic heading up and centered so that the current aircraft position coincides with the aircraft's Ownship Symbol. The current 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** Declutter Level
- 4** Range



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



Figure 4-90  
Basemap Range Buttons



Figure 4-91  
New Basemap Range

## 4.7.1 Range

All of the features on the Nav Map are scaled to the selected range set by the pilot. The MAP range is the distance from the Ownship to outside radius of the compass scale on the Navigation Display. The Range can be set to 2,3,5,10,15,20,30,40,60,80,100, or 200 nm.

### Change Map Range

1. Press the Range Up (RNG +) or the Range Down (RNG -) Button (**Figure 4-90**), until the desired range is displayed (**Figure 4-91**).
2. Press and Hold the RNG Button to continuously increase/decrease the range

## 4.7.2 Auto Range

The PFD 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 4-92**).

### 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 4-93**).
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



Figure 4-92  
Auto Range Mode



Figure 4-93  
GENERAL SETTINGS B Page Editing  
Auto Range Setting

## NOTE

All basemap and flight plan elements are received from the GPS and are only available from compatible GPS navigators

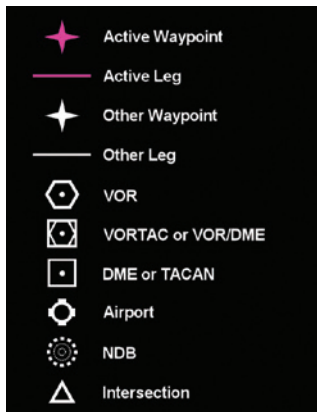


Figure 4-94  
Basemap Symbol Set

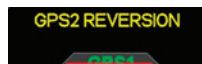


Figure 4-95  
GPS1 Failure, Reversionary Navigation



Figure 4-96  
RSM GPS Reversionary Navigation

## 4.7.3 Basemap and Flight Plan Data

When configured with a compatible GPS, the Nav Map displays basemap symbols on the Nav Map as well as the flight plan waypoints and legs from the configured GPS. 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. **(Figure 4-94)** depicts the Flight Plan and basemap symbols which can be displayed.

### Map Data Source and Reversion

If more than one GPS navigator source is available, the GPS selected by the CDI Navigation Source is used for the source of Basemap and flight plan information.

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. Another configured GPS source if providing valid position data. In this case, a GPS# REVERSION annunciation is shown above the Selected CDI Navigation Source **(Figure 4-95)** (# indicates the configured GPS source that is now providing the aircraft's position, either 1 or 2).
  2. 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 4-96)**.

## 4.7.4 Lightning

The LTNG Hot Key permits display of lightning information on the Nav Map. When configured, Stormscope lightning and/or XM/FIS-B Weather Lightning is displayed. The Hot Key label, LTNG/CELL/STRK, is green when enabled or blue when disabled. The default setting following a power cycle of the unit is disabled.

When enabled, the lightning displays as described in **Table 4-7**. The Hot Key label is inverse green (green label and dark blue letters) when enabled or a blue label and green letters when disabled. If neither XM nor Stormscope is configured in the installation, the Hot Key is blank.











Hot Key Label	Display Symbol	Annunciation	Description
	 XM Lightning Symbol	 Shows the age of received data.	Symbols are positioned on the display relative to the Ownship Symbol.  Data Link Lightning Symbols display as cyan lightning symbols at full intensity for 5 minutes after information is received.  After 5 minutes, the symbols will fade over the next 15 minutes.
	 WX-500 Strike Symbol	 Shows the current strike rate	Symbols are positioned on the display relative to the Ownship Symbol.
	 WX-500 Cell Symbol	 Shows the current cell rate.	Symbols are positioned on the display relative to the Ownship Symbol.
			Disabled

Table 4-7 Lighting Display

When Strike or Cell mode is displayed, pressing and holding the CELL or STRK Hot Key will remove all Stormscope symbols from the display and the RATE will become zero. Resetting the Stormscope data can also be done via the MENU.



Figure 4-97  
Data Link Weather Enabled

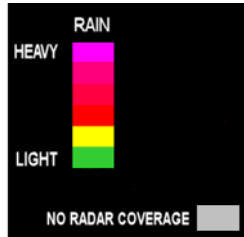


Figure 4-98  
FIS-B NEXRAD Legend



Figure 4-99  
XM NEXRAD Legend

## 4.7.5 NEXRAD Weather

NEXRAD (Next-Generation Radar) is a network of 159 high-resolution Doppler radars operated by the National Weather Service (NWS) to detect meteorological data for the United States. The data can be processed and displayed in a mosaic map showing patterns of precipitation and its movement. Each NEXRAD radar site has a maximum range of 250 nm. Since NEXRAD data is not real-time, data is updated about every 10 minutes not including processing and dissemination time, it should be used for long range planning only. Do not use NEXRAD to penetrate severe weather.

Coverage is generally limited to the Continental United States, its coastal regions, portions of Alaska, Hawaii, Puerto Rico and Guam. The Hot Key label is green when enabled and blue when disabled. When enabled the NXRD annunciation displays above the current Range. The Weather default setting is OFF.

### Display NEXRAD Weather (Figure 4-97)

1. Select the 2/X Hot Key Menu.
2. Press the NXRD Hot Key to enable Data Link Weather

The NEXRAD Radar information is displayed using a color scale to represent the strength of the radar return, as represented in the legend when displayed. FIS-B and XM have similar but slightly different colors available, as shown respectively in (Figure 4-98 and Figure 4-99).

### Display Data Link Weather Legend

1. Press the MENU Button.
2. Rotate the Right Knob to the UAT or XM RECEIVER C Menu page.
3. Press and hold the HOLD FOR LGND Menu Key. The NEXRAD Weather Legend displays until the Menu Key is released .
4. Press the MENU Button to exit.

When the Weather is enabled, an age annunciation is shown in the lower left corner of the Navigation Display. The age annunciation indicates the elapsed time in minutes since the information was generated. Each weather product has an age limit and is usually updated at the update frequency indicated in **Table 4-8**.






Age Annunciation	Conditions
	Weather data is being receive. “##” indicates the age of the last valid data in minutes being displayed
	Weather data is not being received but has not yet expired. “##” indicates the age of the last valid data in minutes being displayed. Check local weather conditions.
 	Weather data is not being received and the last valid data is expired or invalid. Data is removed from the display.
	Valid data has not yet been received from the NEXRAD receiver after the PFD is turned on.

Table 4-8  
Weather Age Annunciations



Figure 4-100  
Traffic Overlay Enabled

## 4.7.6 Traffic

When the EFD1000 PRO MAX PFD is configured with a traffic sensor, the traffic display can be enabled on the Navigation Display

Pressing the TFC Hot Key enables Traffic and the selection of a Traffic Altitude Filter. The Hot Key Label is inverse green (green label with dark blue letters) when enabled (**Figure 4-100**) or a blue label with green letters when disabled.

When Traffic is enabled, a TFC annunciation is presented on the lower left of the Navigation Display. The traffic setting that was previously reset over a power cycle is retained as last configured by the pilot.

### 4.7.6.1 Display of Traffic Symbols

The EFD1000 PRO MAX PFD displays three threat levels using TCAS symbology; traffic advisory (amber), proximity advisory (solid cyan), and other traffic (hollow cyan). If supported by the Traffic Sensor, Directional and Ground traffic symbols may also be shown. **Table 4-9** lists the various types of traffic symbols that can be shown.

The EFD1000 PRO MAX PFD displays intruder information from the Traffic Sensor with the threat level assigned by the Traffic Sensor. Each traffic symbol is positioned at a location representing the relative range and bearing to the ownship symbol. All intruders within the current display range and the selected altitude filter are shown (up to a limit of 32 intruders, prioritized in the order received from the traffic sensor).

















Symbol Type	Non-Directional	Directional
Traffic Advisory		
Proximity Advisory		
Other Traffic		
Proximity Ground Traffic		
Other Ground Traffic		
Proximity Ground Vehicle		
Other Ground Vehicle		

Table 4-9 Traffic Symbols

A data block is given for each reported intruder displaying the type, relative altitude, and intruder vertical direction as supplied by Traffic Sensor. The data block text color is the same as the traffic symbol, amber for Traffic Advisory and cyan for proximity and other traffic (**Figure 4-101**).

When an intruder’s altitude and vertical speed are available, they are displayed as part of the on-screen data block. The relative altitude is shown as two digits indicating the relative altitude difference, in hundreds of feet, from the ownship. The altitude value for traffic above the ownship is preceded by a plus symbol (+) and is on top of the symbol.

**NOTE**

Traffic that is within 100 feet of the ownship displays an altitude value of 00, above or below the traffic symbol as appropriate.

**NOTE**

If an intruder is flying level no arrow is shown. If the intruder is not reporting altitude, neither the arrow or the altitude indication are shown.



Figure 4-101  
Intruder Data Block

 **NOTE**

The altitude filters listed in Table 4-8 are referenced to your aircraft and the PFD altitudes. The traffic sensor configured with the PFD may have different (i.e., lower) altitude thresholds. Check your traffic sensor pilot's manual for specifics.

The altitude value for traffic below the ownship is preceded by a minus symbol (-) and is on the bottom of the symbol.

An arrow next to the traffic symbol gives the direction of vertical movement in relation to the ownship. Intruders climbing or descending at a rate greater than 500 fpm display an up-arrow (climbing), or down-arrow (descending) to the right of the traffic symbol. Traffic that is at co-altitude with the aircraft and has no vertical trend is indicated by an altitude value of 00 below the traffic symbol.

 **WARNING**

*Do not rely on the PFD as the sole source of data for collision avoidance. It is the pilot's responsibility to visually acquire other aircraft for safe flight. Maneuver your aircraft based only on ATC guidance or positive acquisition of conflicting traffic. Traffic information is:*

- *Provided as a proximity warning only*
- *Intended to assist the pilot in the visual acquisition of other aircraft*
- *Not intended to provide recommended avoidance maneuvers*
- *Not provided for aircraft that are not transponder equipped, experiencing a transponder failure, or out of radar coverage*

### 4.7.6.2 Traffic Altitude Filter

There are five Altitude Filters available: Off, Normal, Unrestricted, Above, and Below (**Table 4-10**). Only traffic within the selected altitude filter value will display.

Hot Key Label	Altitude Filter Level	Traffic Display Volume
TRFC	Off	None
TFCN	Normal	±2,700 ft
TFCU	Unrestricted	±9,900 ft
TFCA	Above	+9,900 ft to -2,700 ft
TFCB	Below	+2,700 ft to -9,000 ft

Table 4-10 Traffic Filter Parameters

The pilot adjusts the altitude filter value by continuously pressing the TFC Hot Key, which cycles through each of the filter levels. The TFC annunciation displays in the lower left of the display (**Figure 4-102**).

### 4.7.6.3 Traffic Velocity vector

If the Traffic Sensor is “ADS-B IN”, then the velocity vector of the traffic can be display as part of the data block (**Figure 4-103**). The length of the velocity is defined by the distance the intruder will travel at current ground speed in a specified number of seconds. The number of seconds to display is selectable in the Main Menu page “UAT”, item “HORZ VERT SCALE” and can be set to 0, 10, 20, 30, 40, 50 or 60 seconds. If selected to 0 seconds, then the vector is not shown.



Figure 4-102  
Traffic Altitude Filter



Figure 4-103  
Traffic with Velocity Vector

TA 3.1 +03  
TA 5.2 -06

Figure 4-104  
Text-format Traffic Advisories

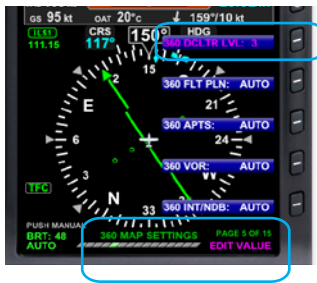


Figure 4-105  
MAP Hot Key






#### 4.7.6.4 Non-Bearing Advisories

If the traffic sensor reports Traffic Advisories without bearing information, the advisory is displayed as a text only data block centered on the display below the ownship symbol (**Figure 4-104**). The EFD1000 PRO MAX PFD displays up to two Traffic Advisories at a time, with the most urgent listed first. Non-bearing Traffic Advisories outside the displayable range are displayed based on priority. Intruders generating a Proximity Advisory or Other Traffic Advisory without bearing data or outside the displayable region are not displayed.

### 4.7.7 Map Layering and Declutter

The features on the Navigation Map are displayed and layered as detailed in **Table 4-11**. The level of detail of Flight Plan and basemap Symbols can be controlled via the Declutter Setting. Other are controlled by dedicated Hot Keys.

To select the desired level of basemap detail on the map, the pilot selects one of the declutter levels as described in **Table 4-11**. 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.

Feature Group and Layer Order (from Top to Bottom)		Max Range feature is displayed	Declutter Setting				
			 Level 4	 Level 3	 Level 2	 Level 1	 Level 0 (Off)
Traffic Overlay Symbols	1		Enabled/Disabled via Hot Key Only				
Owship Symbol	2		Always ON				
Instruments <sup>1</sup> and Annunciations <sup>2</sup>	3		Always ON				
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	●				
WX-500 or Data Link Lightning <sup>4</sup>	9		Enabled/Disabled via Hot Key Only				
NEXRAD Weather	10		Enabled/Disabled via Hot Key Only				

**Table 4-11**  
Map Feature Group Layering, Range, and Declutter Levels

### Select Map Declutter Level

1. Press the MENU Button and rotate the Right Knob to MAP SETTINGS page.
2. Press the DCLTR LVL Menu Key (**Figure 4-105**) and rotate the Right Knob to select the desired map declutter level.
3. Press the MENU Button to exit.

1. e.g., VSI, Direction Indicator, CDI, 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.

## 4.8 Autopilot Integration

The Pro PFD can connect with many different legacy autopilot systems that are typically found in general aviation aircraft. Generally, the PFD can display the Flight Director (FD) bars on the Attitude Indicator, providing pitch and roll guidance commands to the pilot. For certain autopilots, the PFD can display the Autopilot Mode Annunciations, and provide selected Altitude, Selected Airspeed and Selected Vertical Speed inputs to the autopilot.

When connected to an autopilot system that includes Nav or Approach couplers, the PFD also acts as the navigation source selector switch to the autopilot. This assures that the navigation information selected for the PFD is the same as that being provided to the autopilot. This arrangement also eliminates the need for external autopilot navigation source selector switches and relays that were previously used to select which navigation radio would be connected to the autopilot. Selection of autopilot modes and mode control is unaffected by the installation of the PFD.

### 4.8.1 GPS Steering (GPSS)

GPS Steering represents a modern approach to flying between flight plan waypoints, and offers many advantages of over traditional methods of flying direct course lines between waypoints.

With traditional point-to-point navigation, the autopilot is provided with desired course and cross-track deviation information associated with the current flight leg. From there, it will maneuver the aircraft to center the needle and track the desired course. The autopilot does not anticipate upcoming course changes, nor can it fly curved flight paths without pilot assistance, and it has to recompute wind corrections following each

course change. Upon reaching a waypoint, the pilot must set the course for the next leg (unless AUTO CRS is enabled) and the autopilot will then intercept and track that leg. In this type of operation, the CDI must always be set to the desired course.

With GPSS the PFD can unlock the GPS Steering capability already available in many models of general aviation GPS navigators. With GPSS the navigator continuously computes the desired bank angle to track the GPS flight plan and outputs that information over a digital data bus. The GPS Steering command anticipates upcoming turns; this includes the turn rate and turn initiation point required to roll out centered on the next leg.

Some GPS navigators even provide GPS Steering commands for complex procedures, such as DME arcs, holding patterns, and procedure turns allowing the autopilot to fly these maneuvers without pilot intervention. Check with your GPS manufacturer to see if your GPS supports these capabilities.

The PFD translates GPS Steering commands received over a digital data bus into a signal that is compatible with the autopilot Heading channel. Thus, by selecting GPSS on the PFD and the Heading mode of the autopilot, the autopilot is able to fly GPSS commands.

 **WARNING**

*GPS Steering is a powerful automation tool that can substantially reduce pilot workload. However, using GPSS safely and effectively requires a thorough understanding of your specific aircraft installation and the interaction between the PFD, your GPS navigator, and your autopilot. Pilot actions required to use GPSS safely can vary significantly depending on the autopilot and GPS navigator installed, especially when used on instrument approaches, especially those with vertical guidance.*

*It is imperative that pilots new to GPSS gain experience with it in VFR conditions and, ideally, get dual instruction from a CFII who thoroughly understands GPSS and the autopilot and GPS navigator in your airplane before using GPSS on instrument procedures in IMC.*

 **NOTE**

*When GPSS is disabled, the autopilot will follow the Heading Bug.*



Figure 4-106  
GPSS Hot Key

## NOTE

When GPSS is selected on the PFD, the autopilot must be in Heading mode to follow the GPSS commands.

If the connected GPS does not provide the required steering commands, the GPSS legend adjacent to the GPSS Hot Key will be rendered in gray, and it will not be possible to enable GPSS with the Hot Key.

### Enable/Disable GPSS

1. Press the GPSS Hot Key to alternately enable or disable GPS Steering (Figure 4-106).

When GPSS is enabled, and the autopilot is in HDG mode, the autopilot will follow the steering commands from the GPS. A GPSS enabled state will be indicated on the PFD in two locations: 1) the GPSS legend adjacent to the GPSS Hot Key will be shown in inverse green; and 2) the annunciation GPSS1 (or GPSS2, depending on the selected source), along with an inverse A, will be shown next to the HDG reference at the top of the Navigation Display, to the right of the Magnetic heading indication (Figure 4-107).

When GPSS is disabled, and the autopilot is in HDG mode, the autopilot will follow the PFD Heading Bug. A GPSS disabled state will be indicated on the PFD in two locations: 1) the GPSS legend adjacent to the GPSS Hot Key will be shown in gray; and 2) the Selected Heading Field will return. (Figure 4-108).

When the PFD navigation source is GPS1, enabling GPSS with the autopilot in HDG mode will cause the autopilot to track the flight plan in GPS1, and GPSS1 will be annunciated by the HDG reference at the top of the Navigation Display. Similarly, when GPS2 is the navigation source on the PFD, and GPSS is enabled, the autopilot in HDG mode will track the GPS2 flight plan, and GPSS2 will be annunciated at the top of the navigation display.



When using GPSS with a stand-alone VLOC receiver, or with a combined GPS/VLOC navigator, GPSS will continue to follow the GPS output of that combined navigator, even when VLOC is selected as the PFD Selected CDI Navigation Source. With combined GPS/VLOC receivers, the transition from GPS to VLOC may occur automatically, depending on how that system has been configured by the pilot.

For example, suppose you use a GPS to fly a GPS flight plan and have an ILS instrument approach loaded and active, and the GPS is set for Auto ILS CDI changeover once you are established inbound on the final approach course. With GPSS enabled on the PFD and the autopilot in HDG mode, the GPSS will steer the autopilot laterally through the flight plan using GPS, even after the GPS CDI automatically switches to VLOC, and the PFD navigation source similarly switches to VLOC. However, until you switch the autopilot into the Approach mode, it will not arm or capture the glideslope to fly the ILS approach. This feature is particularly useful for autopilots that do not automatically transition from Heading mode to Nav mode when the selected course is intercepted.

## NOTE

Refer to the Aircraft Flight Manual Supplement for your GPS for information about GPSS commands that may be output by that system.



Figure 4-107  
GPSS Enabled with Autopilot in  
HDG Mode



Figure 4-108  
GPSS Disabled and Autopilot in  
HDG Mode

 **WARNING**

*It is your responsibility as Pilot in Command to ensure that you are familiar with the operation of all installed equipment. Operation of the PFD in IMC conditions should not be attempted unless you are proficient in its use and operation, as described herein.*

 **NOTE**

*Refer to the autopilot systems Aircraft Flight Manual Supplement and/or POH for details regarding use and operation of the autopilot system.*

*Examples here are provided for reference only, based on operation of the Bendix/King KFC-200 autopilot, and actual operation may vary depending on the autopilot system installed in your aircraft.*

When flying an ILS on a WAAS GPS, the autopilot in HDG mode can use the GPSS to fly the full course reversal automatically, and the GPS will automatically switch to VLOC once established inbound to the Final Approach Fix. But the pilot must then engage the Approach mode on the autopilot to track the localizer and couple to the glideslope.

Several conditions can cause GPSS to be disabled automatically (switching to a different GPS steering source on the PFD, losing the GPS navigator source, canceling the flight plan, etc.). If this happens, the PFD will send a Wings Level command to the autopilot when in HDG mode, the GPSS Hot Key will annunciate the condition by showing GPSS in inverse amber, and the GPSS# and inverse A annunciation at the top of the

Navigation Display will be shown with a red slash. (See **Figure 4-109**). To re-engage GPSS, select a valid GPS navigation source (with valid flight plan or direct-to selection on the GPS navigator), and then press the GPSS Hot Key. If a valid GPSS signal cannot be restored, pressing the GPSS Hot Key will cancel GPSS mode and restore the Heading Bug's output to the autopilot.

## 4.8.2 Flight Director

When connected to a compatible autopilot system, the PFD will display a single-cue Flight Director (FD). The FD's command bars visually represent the lateral and vertical steering cues transmitted to the PFD by the autopilot (**Figure 4-110**). When the FD output from the autopilot is unavailable or invalid, the FD command bars are removed from the display. To hand fly using the FD, maneuver the airplane to tuck the Aircraft Reference Symbol into the FD's command bars.

## 4.8.3 Typical Autopilot Operations

Whenever the PFD's installed configuration includes connections to GPS, VLOC, and autopilot systems, it acts as a data conduit between the navigators and the autopilot.

This enables any compatible navigator to be coupled to the autopilot.

### NOTE

*With the autopilot in HDG mode, if GPSS is automatically disabled, the autopilot will roll wings level; it will not follow the Heading Bug.*

### HDG Mode Operation – Heading Bug Steering

1. Set the PFD Heading Bug to the desired heading.
2. Verify that GPSS is not selected.
3. Select the autopilot's Heading (HDG) mode.
4. Engage the autopilot and verify that the autopilot turns the aircraft to the selected heading.



Figure 4-109  
GPSS Automatically  
Disabled — Wings Level Mode

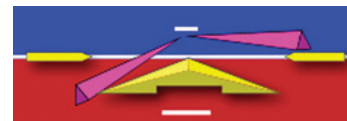


Figure 4-110  
Flight Director

 **NOTE**

*When GPSS is enabled, the HSI Heading Bug is not coupled to the autopilot. To connect the Heading Bug to the autopilot, disable GPSS with the GPSS Hot Key.*

 **NOTE**

*The autopilot must be in Heading (HDG) Mode to receive GPSS signals from the PFD.*

 **NOTE**

*When using an integrated GPS/VLOC navigator, select VLOC or GPS with the CDI source button on the GPS select until the desired CDI Navigation Source is shown on the PFD.*

**HDG Mode Operation – GPS Steering (GPSS)**

1. Couple the PFD CDI to a GPS navigation source with an active flight plan.
2. Enable GPSS by pressing the GPSS Hot Key.
3. Select the autopilot's Heading (HDG) mode.
4. Engage the autopilot and verify that the autopilot turns the aircraft to follow the GPS flight plan.

**NAV Mode Operation – VLOC Navigation**

1. Using the CDI Source Select button, couple a tuned/valid VLOC radio to the PFD CDI and adjust the Course Pointer (CRS) to a value that will intercept the course.
2. Set the PFD Heading Bug
3. Engage the autopilot in Heading (HDG) mode and verify that the aircraft turns to the desired heading.
4. If your autopilot supports automatic Heading to Navigation mode transitions, arm Navigation capture on the autopilot by selecting its Navigation (NAV) mode. Otherwise, select the autopilot's Navigation (NAV) mode when the autopilot's navigation signal capture criteria are satisfied (see your autopilot AFMS for more information).
5. Monitor the PFD CDI deflection and verify that, upon intercepting the desired course, the autopilot modes transition appropriately and the autopilot tracks the desired course.

### NAV Mode Operation – GPS Navigation

1. With a valid flight plan programmed and active in the GPS, use the CDI Source Select button to couple the GPS to the PFD
2. If AUTO CRS is disabled, set the Course Pointer to the desired course (CRS), or enable AUTO CRS
3. With GPSS disabled, set the PFD Heading Bug to a value that will intercept the active leg of the flight plan, or enable GPSS via the GPSS Hot Key.
4. Engage the autopilot in Heading (HDG) mode and verify that the aircraft turns to a heading to intercept the active leg of the flight plan.
5. If your autopilot supports automatic heading to nav mode transitions, arm the navigation capture on the autopilot by selecting its Navigation (NAV) mode. Otherwise, select the autopilot Navigation (NAV) mode when the autopilot navigation signal capture criteria are satisfied (see your autopilot AFMS for more information).
6. Monitor the PFD CDI deflection and verify that, upon intercepting the flight plan leg, the autopilot modes transition appropriately and the autopilot tracks the desired course.

### APPR Mode Operation – ILS Approach with Vectors to Final

1. Using the CDI Source Select button, couple a tuned/valid ILS radio frequency to the PFD CDI, and adjust the course (CRS) (Section 4.4.7).
2. Set the PFD Heading Bug to a value that will intercept the desired course, or as instructed by ATC (Section 4.4.9).
3. Engage the autopilot in Heading (HDG) and Altitude (ALT) Hold modes and verify that the aircraft turns to the desired heading.
4. Once cleared for the ILS approach, arm the autopilot's Approach (APPR) mode, or continue to fly Heading (HDG) mode until the CDI centers.

#### **NOTE**

*Not all autopilots operate in the manner described here for intercepting courses. See the AFMS for your autopilot installation to understand how to adapt these example procedures to your particular autopilot.*

#### **NOTE**

*In order for the autopilot to couple to vertical guidance on GPS WAAS approaches, most autopilots must first be established on the final approach course and in the Altitude (ALT) Hold mode at least two miles outside the Final Approach Fix (FAF). The Approach (APPR) mode must be annunciated on both the PFD and the GPS.*

#### **NOTE**

*A PFD and a mechanical standby Nav indicator can both be connected to an integrated VOR/Localizer/GPS Navigation system. When the GPS OBS mode is selected, the PFD Selected Course (CRS) control commands the GPS OBS course and the mechanical standby nav indicator's OBS course selector is ignored. When the PFD is turned off, the course selector on the mechanical standby Nav indicator commands the GPS OBS value.*

5. Monitor the CDI's deflection and verify (if supported by your autopilot) that, upon intercepting the localizer, the autopilot switches to Approach (APPR) capture, and tracks the localizer course. Otherwise, engage the autopilot Navigation or Approach mode per the procedures in your autopilot's AFMS.
6. Monitor the autopilot localizer tracking performance. Upon intercepting the glide slope, verify that the autopilot captures the Glide Slope (GS) and initiates a descent to track the glide slope.

#### **APPR Mode Operation – GPS or GPS/RNAV APV WAAS Approach**

1. With a valid GPS approach programmed in the GPS, use the CDI Source Select Button to couple the GPS to the PFD
2. If AUTO CRS is disabled, set the Course Pointer to the desired course, or enable AUTO CRS
3. With GPSS disabled, set the PFD Heading Bug to a value that will intercept the active leg of the flight plan or enable GPSS via GPSS Hot Key.
4. Engage the autopilot in Heading (HDG) mode and verify that the aircraft turns to a heading to intercept the active leg of the approach.
5. For autopilots that do not support automatic heading mode to Navigation (NAV) or Approach (APPR) mode transitions, use the Heading Bug to establish the aircraft inbound to the Final Approach Fix (FAF) and then engage the autopilot's Approach (APPR) mode.
6. For autopilots that support automatic Heading (HDG) to Approach (APPR) mode transitions, monitor the PFD CDI and verify that, upon intercepting the active leg of the approach, the autopilot turns to track the GPS approach course guidance.

#### **THE FOLLOWING APPLY FOR WAAS GPS/RNAV APV APPROACHES ONLY**

7. Once cleared for the GPS/RNAV approach, select the autopilot's Approach (APPR) mode.

8. Monitor the PFD CDI and verify that the autopilot intercepts and tracks the final approach course and the GPS switches to its Approach mode.
9. Most WAAS GPS navigators will not arm or activate vertical guidance until the aircraft is within two miles of the FAF (unlike an ILS where the VDI will display as soon as the aircraft is established on the final approach course and a valid localizer signal with glide slope signal is received). As you approach the FAF, watch for the VDI to appear on the PFD Attitude Display. This indicates that the autopilot is ready to capture the glide slope.
10. Monitor the autopilot lateral approach course tracking with the PFD CDI and LDI. Upon intercepting the WAAS GPS glide slope, verify that the autopilot switches captures the glide slope and starts a descent.

#### **GPS APPR Mode Operation – WAAS GPS Underlay to ILS Approach Using Pilot Navigation and GPSS**

1. With a valid ILS approach loaded and activated in the GPS, use the CDI Source Select button to couple the GPS to the PFD CDI
2. Verify that the correct ILS frequency is tuned.
3. When the active flight plan leg is the course to the Initial Approach Fix (IAF), enable.
4. Engage the autopilot in Heading (HDG) and Altitude (ALT) Hold modes and verify that the aircraft continues to fly the course to the IAF.
5. Monitor the PFD CDI and aircraft track to ensure the aircraft flies to the IAF and then turns outbound for the course reversal.
6. A WAAS GPS navigator provides guidance along curved flight paths, and will guide the aircraft through the course reversal and establish it inbound to the FAF without pilot intervention.
7. Once established on the final approach course to the FAF, engage the autopilot's Approach (APPR) mode.
8. Use the PFD CDI Source Select button to change to the VLOC for the approach (if not done automatically by the GPS/nav receiver).

#### **NOTE**

*WAAS GPS navigators can provide vertical guidance on several types of GPS/RNAV instrument approaches. RNAV (GPS) APV (Approaches with Vertical Guidance), such as LPV and LNAV/VNAV approaches, often have lower approach minima shown on the approach plate. Aircraft equipped with appropriate WAAS GPS equipment may use these lower minima.*

*Even with more traditional lateral guidance-only GPS/RNAV approaches (e.g. (LNAV) with step-down altitudes) WAAS GPS may still provide a pseudo-glide slope that enables a continuous descent to the MDA (Minimum Descent Altitude). The autopilot may consider this a glide slope and attempt to fly it. For this type of instrument approach, the vertical guidance is advisory only and the MDA is the appropriate approach minimum.*

*These types of approaches are set up and flown the same way, much like an ILS approach. The pilot must be aware of the differences and which minima to use.*

 **NOTE**

The PFD supports GPS LPV approaches (Approaches with Vertical Guidance) by providing the autopilot with GPS lateral and vertical deviation signals that are identical to those typically provided by an ILS radio. To fly GPS LPV approaches, configure and operate the autopilot as you would for an ILS approach.

 **NOTE**

Some IFR GPS navigators include ILS approaches in their procedures database. GPS may be used to navigate the initial segments of the ILS approach, but the pilot must switch to VLOC navigation outside the FAF and before glide slope intercept.

Some integrated GPS/NAV receivers can be configured to switch automatically, and the PFD Selected CDI Navigation Source will follow automatically. It is the pilot's responsibility to verify that the PFD CDI source is correctly set to VLOC# before reaching either glide slope intercept or the FAF.

9. Monitor the PFD CDI localizer deflection and verify that, upon intercepting the localizer, the autopilot captures the final approach course and switches to the Approach (APPR) mode.
10. Monitor the autopilot localizer tracking performance. Upon intercepting the glide slope, verify that the autopilot captures glide slope and initiates a descent.

### **GPS APPR Mode Operation – WAAS GPS Underlay to ILS Approach With ATC Vectors to Final**

1. With a valid ILS approach loaded and activated in the GPS, use the CDI Source Select Button to couple the PFD GPS to the CDI
2. Verify that the correct ILS frequency is tuned.
3. Set the Heading Bug to the heading assigned by ATC
4. Disable GPSS via the GPSS Hot Key.
5. Engage the autopilot in Heading (HDG) mode and verify that the aircraft turns to the Selected Heading.
6. When cleared for the approach and given the final heading to intercept the final approach course by ATC, arm the autopilot's Approach (APPR) and Altitude (ALT) Hold modes.
7. Monitor the CDI and aircraft track to verify that the autopilot intercepts the final approach course and begins to track inbound to the FAF.
8. Use the PFD CDI Navigation Source Select Button to change to the VLOC source for the approach (if not done automatically by the GPS/nav receiver).
9. Monitor the PFD CDI localizer deflection and verify that, upon intercepting the localizer, the autopilot captures the final approach course and switches to the Approach (APPR) mode.
10. Monitor the autopilot localizer tracking performance. Upon intercepting the glide slope, verify that the autopilot captures the glide slope and initiates a descent to.



## 4.8.4 Advanced Autopilot Integration

When integrated with Autopilots which support it, the EFD1000 PRO MAX PFD can display the Autopilot Mode Annunciations and control the Selected Altitude, Airspeed and Vertical Speed targets in the PFD (**Figure 4-111**). The Annunciation information displayed includes:

- 1 AP/FD Mode
- 2 Armed Lateral Mode
- 3 Active Lateral Mode
- 4 Active Vertical Mode
- 5 Armed Vertical Mode
- 6 Alert Annunciations



Figure 4-111  
Autopilot Intergration Display

The specific modes that are display are dependent upon the specific autopilot installed. Refer to the appropriate Autopilot Pilot guild for details.



Figure 4-112  
VSI Hot Key

When integrated with Autopilots which support it, the EFD1000 PRO MAX PFD can also display and edit the Autopilot targets, including Airspeed, Altitude and Vertical Speed. The PFD selected values can also be modified via the Autopilot Control Panel where supported.

Selecting Altitude and Airspeed are done normally as previous discussed. For Autopilots that support a PFD supplied Selected Vertical Speed, the GPSS Hot Key is replaced with a VSI Hot Key that enables editing of the Selected Vertical Speed (**Figure 4-112**).

### **Edit Selected Vertical Speed**

1. Press the VSI Hot Key, VSI in Magenta is displayed over the Right Knob and the Selected VS is shown next to the VS Bug, both in Magenta.
2. Turn the Right Knob to select the desired Vertical speed. The Bug and Speed will move up/down the VSI as the value is changed
3. Press the VSI again to exit edit mode. The VS Bug will change to Cyan and indicates the Selected Vertical Speed, the Numeric VS value is removed.

## 4.9 Angle of Attack (AoA)

The Aspen Evolution Angle of Attack indicator, if enabled, calculates and displays AOA from flight envelope data collected from the AHRS, Air Data Computer and a certified GPS (**Figure 4-113**). When calibrated properly it calculates the aircraft AOA and displays the Flaps UP and Flaps DOWN AOA on the color coded AOA bar display.

The Evolution Angle of Attack provides the pilot a visual display of the AOA trend and the trend towards stall simultaneously in both the Flaps UP and Flaps DOWN configuration.



Figure 4-113  
Angle of Attack (AOA) Display



### WARNING

*It's vital you refer to the pointer that corresponds to the current aircraft Flaps configuration for an accurate AOA indication. Failing to do so may result in inadvertently entering into a dangerous AOA condition.*



Figure 4-114  
AOA Indicator

## 4.9.1 Display

The Aspen AOA indicator is comprised of a fixed colored tape with Blue, Green, Yellow and Yellow - Black Cross Hatch bands (**Figure 4-114**). Two pointers point to the AOA colored tape indicator. The top Flaps UP pointer and the bottom Flaps DOWN pointer. Due to the difference in the Flaps DOWN or Flaps UP aircraft performance it is possible for the two AOA pointers to simultaneously indicate two different AOA performance regions.





Color	AOA Condition
	Warning AOA
	Caution/High AOA
	Normal Approach AOA
	Low AOA, Cruise flight

Table 4-12 AOA Color Band Key

### AOA Indicator Color Bands

Each colored band on the AOA indicator corresponds to a different position on an aircraft coefficient of lift curve. Each region depicts a different AOA or lift availability level (“**Table 4-12** and **Figure 4-115**). When flaps are deployed the shape of the wing is changed, lift increases, and the coefficient of lift curve is shifted up. But even though the coefficient of lift curve has shifted the relative angle of attack performance points have not.

### Low AOA (Blue)

When the pointer is in the Blue color band the aircraft is at a low angle of attack. This would most frequently be seen during normal or cruise flight.

### Normal Approach AOA (Green)

When the pointer is in the Green color band, the AOA is indicating a normal approach stall margin. With the Flaps DOWN (**Figure 4-114**) this occurs when the aircraft is at an AOA lower or equal to the minimum approach stall margin, which is typically near  $1.3 V_{SO}$ . The stall margin is greater than the short field approach stall margin<sup>1</sup>.

### Green / Yellow transition

Approximately the short field approach AOA<sup>1</sup>

### Caution AOA (Yellow)

When the pointer is in the Yellow color band, the AOA is indicating a reduced stall margin. Cautioning you the current AOA is greater than normal and that should the AOA trend continue to increase it could result in entering the Yellow - Black Cross Hatch or Warning AOA region.

The stall margin is less than the short field approach stall margin<sup>1</sup>

### Yellow / Yellow -Black Cross Hatch transition

Correlates approximately to the stall warning horn

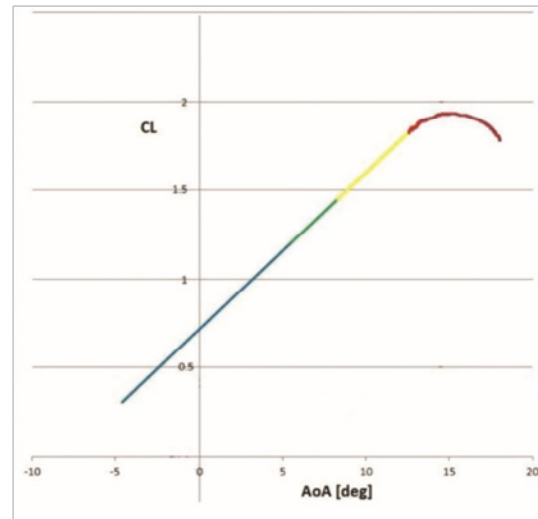


Figure 4-115  
Display Color Bands VS Coefficient of Lift

1. Stall margin at one g, maximum gross weight, zero bank angle, no acceleration. An approximate value due to calibration, weight, and calibrated vs indicated airspeed errors. If the short field approach speed is not presented in the Airplane Flight Manual the normal approach speed is used. The instruction for Continued Airworthiness contain the calibration information for the airplane.

 **NOTE**

*Reducing flaps while in a Caution or borderline Warning “Flaps DOWN” AOA state may result in a dangerous AOA condition.*

 **NOTE**

*The AOA system is non-required and is to be used only as supplemental information to the pilot. The AOA system may not be used as a substitution for the certified aircraft stall warning system.*

**Warning AOA (Yellow Black Cross Hatch)**

When the pointer is in the Yellow color band, the AOA is at a high / critical AOA and the aircraft could stall if the AOA increases further. Under this condition a stall is imminent, and the pilot should maneuver to lower the AOA (pitch DOWN or speed up). The stall margin is much less than the short field approach stall margin<sup>1</sup>.

**Top of Yellow - Black Cross Hatch**

Margin to actual stall is extremely small

## 4.9.2 ON/OFF/Auto Mode


The display of the AOA indicator on the PFD and be turned On or Off via the Menu (Figure 4-116). In addition, the AOA can be set to automatic mode which removes the display of the AOA indicator during normal flight conditions to declutter the PFD (Table 4-13).

### Setting the AOA Mode

1. Press the MENU key to bring up the menu pages and Turn the Right Knob until GENERAL SETTINGS C is shown
2. Press the Hot Key labels AOA DISP and the edit the value with the Right Knob.
3. Press Menu to exit



Figure 4-116  
Angle of Attack Mode Settings Display

AOA Mode	AOA Display	AOA Operation
OFF		The AOA feature is off and the PFD does not display the AOA indicator.




AOA Mode	AOA Display	AOA Operation
ON	 <p>The image shows the AOA display in ON mode. The airspeed indicator is at 70 kt. The AOA indicator is a vertical scale with a green band from 0 to 100, a yellow band from 100 to 110, and a red band from 110 to 120. The AOA pointer is positioned in the green band, approximately 25% into it. The text 'AOA' is displayed above the pointer. The airspeed indicator shows 78 kt at the bottom.</p>	<p>The AOA feature is on and the PFD constantly displays the AOA indicator.</p>
AUTO	 <p>The image shows the AOA display in AUTO mode. The airspeed indicator is at 20 mph. The AOA indicator is a vertical scale with a blue band from 0 to 50, a green band from 50 to 100, a yellow band from 100 to 110, and a red band from 110 to 120. The AOA pointer is positioned at the bottom of the blue band. The text 'AOA AUTO' is displayed above the pointer. The airspeed indicator shows 10 mph at the bottom.</p>	<p>AOA is in AOA Auto mode, "AOA Auto" is displayed when both AOA pointers are at the bottom of "Blue" Low AOA color band or the aircraft is on the ground.</p>
	 <p>The image shows the AOA display in ON mode. The airspeed indicator is at 70 kt. The AOA indicator is a vertical scale with a green band from 0 to 100, a yellow band from 100 to 110, and a red band from 110 to 120. The AOA pointer is positioned in the green band, approximately 25% into it. The text 'AOA' is displayed above the pointer. The airspeed indicator shows 78 kt at the bottom.</p>	<p>The AOA indicator appears when when the upper pointer is approximately 25% into the "Green" color band.</p>

Table 4-13  
AOA Display Operations



## 4.10 Evolution Synthetic Vision

The Evolution Synthetic Vision option, when selected on your flight display, replaces the traditional blue-over-brown background of the legacy attitude indicator with a real-time, computer-generated 3D view of terrain, obstacles, and traffic for the utmost in pilot situational awareness. ESV uses 9 arc-second and 3 arc-second resolution terrain data to render the Synthetic Vision VIEW.

You will find that Aspen's ESV is intuitive and easy to use. Aspen's exclusive display layouts permit you to personalize a configuration that works best for you – on the Primary Flight Display, the Multi-Function Flight Display, or both. ESV may be presented on any of the window configurations – Full Screen, Split Screen, or Thumbnail LAYOUT.

ESV also has a field of view option, narrow or wide, which allows you to toggle to the view that best suits the phase of flight. The wide field of view is suited for enroute, while the narrow field of view is best for zooming in on the approach environment.

ESV's easy-to-read display features include: Flight Path Marker symbology that graphically depicts the lateral GPS track and vertical speed of the aircraft, a Distance Marker to assist in estimating the distance to a point ahead of the aircraft, and a Terrain Warning System (TWS) that provides visual, audio, and text warning annunciations when the system predicts a collision with terrain or an obstacle.



### **WARNING**

*The Terrain and Obstruction information is based on terrain and obstacle elevation information contained in a third party database. This data may contain inaccuracies and/or omissions and must only be used as an aid to situational awareness. The information provided should never be used for primary terrain avoidance or navigation.*



Figure 4-117  
Zero Pitch Line (ZPL)



Figure 4-118  
Flight Path Marker

## 4.10.1 SV Display Elements

### 4.10.1.1 Zero Pitch Line - ZPL

The Zero Pitch Line (ZPL) is a white line on the Attitude Display that represents the horizon, similar to the horizon line on an attitude indicator. The center of the ZPL is removed to present a clear view of the center of the Synthetic Vision display (**Figure 4-117**). Terrain above the aircraft's altitude is presented above the ZPL while terrain below the aircraft's altitude is presented below the ZPL.

### 4.10.1.2 Flight Path Marker - FPM

The Flight Path Marker (FPM) displays the aircraft's lateral and vertical flight path (**Figure 4-118**). The FPM position is derived from the GPS ground track and vertical speed. When the FPM intercepts terrain, an obstacle, or a runway, this indicates that the aircraft is tracking in three dimensions toward that feature. When the FPM is above the Synthetic Vision terrain, this indicates the aircraft will clear that terrain. When the FPM is held on the ZPL, the aircraft is maintaining its current altitude. The Flight Path Marker can be removed from view to reduce display clutter. The Flight Path Marker can be Enabled/Disabled in the Menu.

#### **To display or remove the Aircraft Reference Symbol on the MFD**

1. Press the MENU button and rotate the Right Knob to the SV SETTINGS page.
2. Press the FLIGHT PATH MARKER Menu Key and rotate the Right Knob to the desired setting (ENABLE or DISABLE).

### 4.10.1.3 SV Distance Marker

The DIST Hot Key presents a cyan dashed line (Distance Line) representing the ground distance ahead of the aircraft (**Figure 4-119**). The Distance Marker is used to estimate the ground distance from the aircraft to a feature on the display. The selectable distance options are OFF, 1nm thru 20nm (in 1nm increments), 20nm, 25nm, 30nm, and 40nm. The maximum distance ESV presents the virtual horizon is 40nm.

#### To edit the Distance Line and SV Distance Marker

1. Press the DIST Hot Key (The Right Knob label turns magenta and displays “SV DIST MARKER” with the distance selected).
2. Rotate the Right Knob to the desired distance setting or press and hold the Right Knob to automatically SYNC the Distance Line to the 5nm range



Figure 4-119  
SV Distance Marker



Figure 4-120  
Load Airport Flag  
Display



Figure 4-121  
Other Airport Flag  
Display

#### 4.10.1.4 Airport Flags

An Airport Flag displays the airport's identifier and its location. A flag is presented when the aircraft is approximately 20nm away from an airport. When the aircraft is approximately 2nm away from the airport, the flag is removed from view.

The destination airport that has been loaded into the aircraft's GPS flight plan is identified with a magenta flag (**Figure 4-120**). Other airports are identified with a white flag (**Figure 4-121**).

The Airport Flag can be decluttered according to several parameters: Flight Plan Airports only, no flags shown, all hard surface runways, or only airports with runway lengths greater than 4500, 4000, 3500, 3000, 2500 feet.

The Airport Flag display option is found in the MENU of the PFD and MFD. The settings for the Airport Flags are; Flight Plan Airports Only, None, ON>4500, ON>4000, ON>3500, ON>3000, ON>2500, All Hard Surface, and ALL ON.

### 4.10.1.5 Runways

Hard-surfaced runways are gray in color with white runway markings. Runway markings include the runway centerline, runway numbers, letters for parallel runways, runway threshold markings, and displaced thresholds (**Figure 4-122**).

Other than hard-surfaced runways, often referred to as a grass runway or a gravel runway, are colored differently depending on the airport field elevation. Runways at field elevations 2000 feet and greater are colored tan with gray. Runways at field elevations less than 2000 feet are colored green with gray (**Figure 4-123**).



Figure 4-122  
Hard-surfaced Runway Display



Figure 4-123  
SV Distance Marker



Figure 4-124  
NAV Display SV3



Figure 4-125  
Synthetic Vision VIEW

#### 4.10.1.6 Obstacle Symbols - Towers

Three-dimensional obstacle symbols **Table 4-14** are presented in perspective on all Synthetic Vision VIEWS and also in a top-down two-dimensional view on the Nav Display of SV3 (**Figure 4-124**). ESV presents obstacles taller than 200 feet AGL that are within 2500 feet vertically of the aircraft altitude.

The obstacles presented in the Synthetic Vision VIEW appear small at first and grow larger as they get closer to the aircraft.

- Obstacles that are between 500 feet and 2500 feet below the aircraft's altitude are blue.
- Obstacles that are between 100 feet and 500 feet below the aircraft's altitude are amber.
- Obstacles that are above the aircraft's altitude or within 100 feet below the aircraft's altitude are red.

Obstacle Height < 1000' AGL		Obstacle Height > 1000' AGL		Obstacle Symbol Color Meaning
				Obstacle is between 500' and 900' below aircraft's altitude
				Obstacle is between 100' and 500' below aircraft's altitude
				Obstacle is above aircraft's altitude or within 100' below aircraft's altitude

Table 4-14 Obstacle Symbols and Meanings

#### 4.10.1.7 Traffic Symbols & Advisories

For aircraft equipped with a compatible traffic detection system, ESV 3D Traffic Symbols **Table 4-15** are presented on the Synthetic Vision VIEWS. The traffic symbols are oriented in three dimensions. A traffic symbol will appear larger as the traffic approaches and smaller as the traffic recedes.




Traffic Advisory	Proximity Advisory	Other Traffic
		

Table 4-15 ESV 3D Traffic Symbols

When a traffic advisory occurs on the Synthetic Vision VIEW, an amber TRAFFIC annunciation is automatically presented in the Data Bar. Additionally, TRFC appears in amber above the Lower Middle button (**Figure 4-125**).

Pressing the Lower Middle button when the amber TRFC appears, switches the display to SV2 and presents the traffic on the Nav Display for situational awareness on the Nav Display. After selection, the Lower Middle button label changes to BACK to enable the pilot to quickly return to the previous display.

All traffic shown on the Nav Display of SV2 and SV3 are presented in 2D plan view (top-down view) and represent the relative range and bearing to the aircraft. The range shown on the lower left of the view represents the range from the center of the compass rose to the edge of the compass rose.

### **WARNING**

*Do not rely on the PFD/MFD as the sole source of data for traffic avoidance. It is the pilot's responsibility to visually acquire other aircraft for safe flight. Maneuver your aircraft based only on ATC guidance or positive acquisition of conflicting traffic. Traffic information is:*

*Provided as a proximity warning only.*

*Intended to assist the pilot in the visual acquisition of other aircraft.*

*Not intended to provide recommended avoidance maneuvers.*

*Not provided for aircraft that are not transponder equipped, experiencing a transponder failure, or (in the case of TIS) out of radar coverage.*



Figure 4-126  
SV1 Hot Key



Figure 4-127  
Synthetic Vision VIEW

#### 4.10.2 SV1 Full Screen

Pressing the SV Hot Key enables the ESV function and changes the SV Hot Key label to SV1 (**Figure 4-126**). SV1 (Synthetic Vision 1) Full Screen presents Synthetic Vision under the entire primary flight data area of the PFD (**Figure 4-127**).

The CRS and HDG Fields are presented on SV1 whenever the Left or Right Knob is rotated to set the desired course/heading value (**Figure 4-127**). After 10 seconds of inactivity, the CRS/HDG Field is removed from view.

The Selected Heading Field with GPSS is presented on SV1 until the GPSS is disabled by the pilot OAT and Map features on the HSI are not shown. Winds are shown in an abbreviated style to maximize the screen area.

#### 4.10.3 SV2 Split Screen

SV2 present Synthetic Vision on the Attitude Display portion of the PFD. The lower half of the display presents the standard Nav Display, The Nav Display operated the same as when SV is OFF and supports display of basemap items, Flight Plan, Traffic, NXR, etc (**Figure 4-128**).

#### 4.10.4 SV3 Split Screen

SV3 present Synthetic Vision on the Attitude Display portion of the PFD. The lower Navigation Display shows a high resolution terrain map overlaid with Terrain Coloring, Obstacle Symbols and Traffic (**Figure 4-129**).



### 4.10.5 Field of View

ESV can be presented in a Narrow Field of View or in a Wide Field of View by pressing the FOV1 (Narrow Field of View) or FOV2 (Wide Field of View) Hot Key. A quick glance at the FOV Icon (**Figure 4-130** and **Figure 4-131**) presented at the bottom right corner of all Synthetic Vision VIEWS indicates which field of view is currently displayed.

The FOV Icon correlates with the two-dashed lines radiating from the center of the ownship symbol on the Nav Display, indicating if a narrow horizontal field of view (**Figure 4-132**) or a wide horizontal field of view has been selected (**Figure 4-133**).



Figure 4-128  
Narrow Field of View (FOV1)



Figure 4-129  
Narrow Field of View (FOV2)

#### NOTE

*The ends of the dashed lines do not imply a Synthetic Vision range limit. The range limit presented for the Synthetic Vision horizon is always 40 nautical miles.*



Figure 4-130  
Narrow FOV Icon

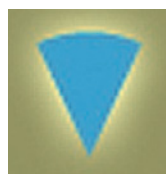


Figure 4-131  
Wide FOV Icon



Figure 4-132  
Narrow Horizon FOV



Figure 4-133  
Wide Horizon FOV



Figure 4-134  
FOV1 Narrow Field of View



Figure 4-135  
FOV1 Narrow Field of View

#### 4.10.5.1 FOV1 - Narrow Field of View

FOV1 (**Figure 4-134** and **Figure 4-135**) presents an approximate 20° horizontal view (10° either side of the nose) and a visible pitch ladder range between 5° to -20° for SV1.

FOV1 (Narrow Field of View) is the most accurate representation of the outside view.

#### 4.10.5.2 FOV2 - Wide Field of View

FOV2 (**Figure 4-136** and **Figure 4-137**) presents an approximate 50° horizontal view (25° either side of the nose) and a visible pitch ladder range between 20° to -50° for SV1. The pitch ladder scale on FOV2 is equal to that on the standard display.

FOV2 is a wider field of view and objects on the display are closer than they appear. FOV2 is best used for enroute.

(**Figure 4-138**) shows the portion of FOV1 display that is depicted in FOV2.

### NOTE

The vertical Field of View is also narrow.  
See **Figure 4-138**.



Figure 4-136  
FOV2 Wide Field of View



Figure 4-137  
FOV 2 Wide Field of View



Figure 4-138  
FOV1 Narrow Field of View



Figure 4-139  
Terrain Warning System VIEW



Figure 4-140  
Terrain Coloring VIEW

## 4.10.6 Terrain Warning System – TWS

The Aspen Terrain Warning System (TWS) is included with the Evolution Synthetic Vision System to provide simple and effective terrain and obstacle alerting. To enhance the pilot's situational awareness of a potential terrain/obstacle collision, the Terrain Warning System employs the following TWS Alerts (**Figure 4-139**):

- Terrain Coloring
- FPM Coloring
- Caution/Warning Text Annunciations, and
- Aural/Audio Alerts

### 4.10.6.1 Terrain Coloring

When the aircraft is close to the ground, the terrain and obstacles displayed in Synthetic Vision and on the SV3 moving map change color. The terrain and tops of obstacles ahead show yellow when within 500 feet vertically of the aircraft and red when within 100 feet vertically.

Red and yellow coloring are used for visual terrain awareness and alerting. This terrain coloring represents the relative terrain elevation compared to the aircraft's altitude.

Enroute terrain that is between 100 and 500 feet below the aircraft is shown as yellow. The terrain that is less than 100 feet below the aircraft and above is shown as red (**Figure 4-140**).

#### 4.10.6.2 Predictive Terrain/Obstacle Conflict

The TWS uses the Flight Path Marker to predict a collision with terrain or an obstacle.

When the Flight Path Marker is positioned over terrain or an obstacle and the Terrain Warning System predicts that a potential collision will occur within 45 seconds (if the current flight path is maintained) the audible alert is sounded and the green Flight Path Marker changes its shape and turns to an amber color (**Figure 4-141**).

An amber text alert is announced on the Data Bar announcing the type of threat, e.g.

**“CAUTION - TERRAIN, TERRAIN”** or

**“CAUTION - OBSTACLE, OBSTACLE”**

Similarly, when TWS predicts that a potential collision will occur within 30 seconds (if the current flight path is maintained) the audible alert is sounded and the Flight Path Marker changes its shape and turns to a red color (**Figure 4-142**).

A red text alert is announced on the Data Bar announcing the type of threat, e.g.

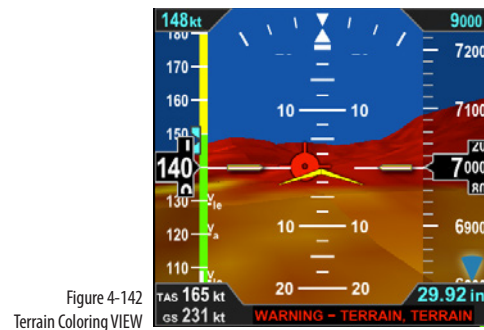
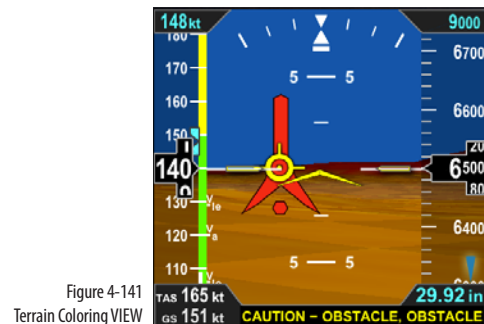
**“WARNING - TERRAIN, TERRAIN”** or

**“WARNING - OBSTACLE, OBSTACLE”**



**WARNING**

*Changes in heading can cause an immediate conflict that is much less than the 45 or 30 seconds explained here.*



 **NOTE**

*In aircraft certified with a Terrain Avoidance Warning System (TAWS), the Aspen TWS system does not provide audible alert or text alert information. Only the FPM Coloring and the Terrain Coloring is displayed.*

**Aural/Audio Alert**

When a terrain alert occurs, an Aural Alert (an audible alarm from an external tone generator) provides a distinct stuttered, 3-second aural tone when a terrain/obstacle alert occurs. After the initial alert tone has sounded, the aural alert will sound again whenever a higher priority alert occurs.

When a terrain alert occurs, the audio alert sounds the appropriate voice message

**“CAUTION - TERRAIN, TERRAIN”**

**“CAUTION - OBSTACLE, OBSTACLE”**

**“WARNING - TERRAIN, TERRAIN”**

**“WARNING - OBSTACLE, OBSTACLE”**

### 4.10.6.3 Flight Path Marker Coloring

The Flight Path Marker (FPM) has a terrain warning function when a collision with terrain or an obstacle is predicted. The FPM will change shape and color, depending on the predicted time to collision. The FPM colors are green, white, amber, and red.

- A green FPM indicates normal enroute operation (**Figure 4-143**).
- A white FPM indicates operation with the Airport Area with reduced terrain coloring and alerts (**Figure 4-144**).
- An amber FPM is a Caution alert predicting terrain/obstacle collision within 45 seconds if the current flight path is maintained (**Figure 4-145**).
- A red FPM is a Warning alert predicting terrain/obstacle collision within 30 seconds if the current flight path is maintained (**Figure 4-146**).

#### NOTE

*The FPM shows the predicted path of the aircraft and lags in dynamic maneuvers.*



Figure 4-143  
Green FPM



Figure 4-144  
White FPM



Figure 4-145  
Amber FPM



Figure 4-146  
Red FPM

## WARNING

Accurate terrain information is predicated on the correct barometric pressure. Always ensure that you have accurate and timely barometric pressure information otherwise the terrain and obstacle elevation data could be erroneous.

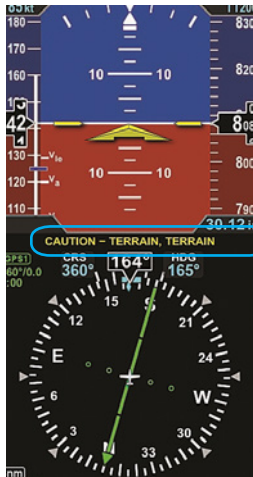


Figure 4-147  
Terrain Alert, Synthetic Vision  
Not Selected



Figure 4-148  
Terrain Alert, Synthetic Vision VIEW

### 4.10.6.4 Pop-up TERR Warnings

Unless inhibited, TWS operates in the background even when Synthetic Vision is not selected. If a caution or warning is generated (non-TAWS aircraft) the conflict can be instantly displayed by pressing the Lower Middle button labeled TERR (**Figure 4-147** and **Figure 4-148**).

When a terrain alert occurs with Synthetic Vision not displayed on the PFD, pressing the Lower Middle button will switch the display to SV3 for situational awareness. SV3 automatically presents the ARC mode with a 5nm range set on the HSI. After selection, the Lower Middle button changes to BACK (**Figure 4-148**) to enable the pilot to quickly return to the previous display.

If the BACK button is not pressed, the BACK label will be removed after 30 seconds and the SV3 display remains. Press the SV3 Hot Key to return to the previous display.

### 4.10.6.5 Airport Area Operation

When on approach to a runway, the terrain coloring is reduced. Only obstacles over 200 feet AGL, and terrain higher than 100 feet above the runway elevation will elicit a caution or warning indication. The terrain 100 feet above the aircraft will be red-colored. A white Flight Path Marker indicates that the system is operating within the airport environment where reduced terrain colorization and alerting is used. (TWS is operating at the in-range warning level).

On takeoff, the Flight Path Marker appears at 40 knots and is white in color until leaving the immediate runway vicinity or at 300 feet AGL.

What this means is under normal circumstances there should not be a terrain or obstacle conflict. In abnormal circumstances, cautions and warnings can be very helpful.



On a precision approach, terrain cautions or warnings are not anticipated. On a nonprecision approach, a terrain caution or warning is probable depending on the rate of descent toward the terrain.

Landings at most airports do not generate an alert. Some airports with unusual topography may generate alerts when the Flight Path Marker points toward nearby higher terrain.

If multiple landings are anticipated at a runway that elicits alerts, TWS can be inhibited in the Menu.

#### 4.10.6.6 TWS Inhibit

The Terrain Warning System (TWS) can be inhibited by the pilot, which removes the following features from the display (**Figure 4-149**):

- Terrain Coloring
- FPM Coloring
- Caution/Warning Text Annunciations and
- Aural/Audio Alert

**The TWS Inhibit is controlled from the MENU and has three settings;**

- **ON**                The TWS is enabled.
- **INH**                The TWS Alerts are inhibited.
- **SV ONLY**        The TWS Alerts are enabled only when Synthetic Vision is displayed.

Whenever TWS is inhibited, "TWS INH" is annunciated on the Nav Display



Figure 4-149  
TWS Inhibit Display

## Chapter 5

# Unusual Conditions and Annunciations

This section provides background information to enhance the pilot's understanding of emergency and abnormal conditions. The information supplements the AFMS, which contains the approved procedures.

## 5.1 Pitot/Static System Blockage

An obstructed pitot or static system will result in an "Attitude Degraded" message, where the EFD1000 PRO MAX PFD is using the GPS for attitude aiding. Limit maneuvering in accordance with the AFMS. Loss of GPS and airspeed will result in loss of attitude indication.

If the EFD1000 PRO MAX PFD attitude backup is the EFD1000 MAX MFD, both airspeed and GPS must be operational for flight in IMC.

## 5.2 Attitude Degraded Mode

The EFD1000 PRO MAX PFD uses airspeed-aiding to support the attitude indication, and GPS for backup. When the EFD1000 PRO MAX PFD detects a failure of airspeed (through a GPS groundspeed comparator) the system will automatically revert to GPS groundspeed and present the "Attitude Degraded" message. Limit maneuvering to half standard rate and  $\pm 5^\circ$  in pitch for satisfactory attitude indicator performance. Exiting IMC is appropriate unless the failed airspeed condition can be cleared.



Figure 5-1  
Degraded Mode

Warning	Requires immediate pilot attention
Caution	Abnormal condition that may require pilot intervention
Advisory	General information to the pilot

Table 5-1 Annunciations Summary Color Key

## 5.3 GPS Failures and RSM Emergency GPS Use






The EFD1000 is designed to dynamically respond to GPS failures. If the primary GPS is detected as failed, the secondary GPS will automatically be used. If the secondary GPS fails, the optional RSM GPS will provide a GPS position and groundspeed function. Check the AFMS to see if your airplane has an RSM GPS.

## 5.4 Annunciations Summary










The table below is a summary of the Annunciations that can be displayed on the EFD1000 PRO MAX PFD. The annunciation color is used to indicate the alert level of the annunciation. The Alert Levels are shown in **Table 5-1**.

Refer to the EFD1000 PRO MAX PFD for specific information on actions/procedures to be followed when an Annunciation occurs.

# WARNINGS






Annunciation	Description
	<p>Presented whenever the EFD system is operating on the internal battery or EBB. The countdown timer appears first, and is then replaced by the ON BAT and % charge annunciation.</p>
	<p>Attitude and Heading indications have failed.</p>
	<p>Red chevrons displayed on the Attitude Indicator's pitch scale to indicate extreme pitch up and down attitudes.</p>
	<p>Synthetic Vision Flight Path marker. Terrain or obstacle conflict within 30 seconds.</p>
	<p>Radar Altitude Failed.</p>


**WARNINGS**



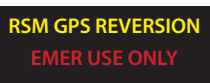




Annunciation	Description
 	Synthetic Vision system terrain or obstacle conflict within 30 seconds. Accompanied by the following audible annunciation: “Warning Terrain Terrain!” and “Warning Obstacle Obstacle!”
	Traffic Failure.
	FIS-B Weather data is not valid.
	Stormscope (STRK) has failed.
  	The navigation source is not available.
	The Angle Of Attack System has failed.







## CAUTION

Annunciation	Description
<p>PDF:</p>  <p>MFD:</p> 	<p>ATTITUDE DEGRADED mode. The Pitot input has failed (perhaps due to icing), and GPS aiding is used for the attitude indication. The attitude indication can be in error and maneuvering limitations are to be followed.</p>
	<p>The attitude indication could be in error.</p>
	<p>Possible Pitot Obstruction.</p>
	<p>GPS Invalid indications.</p>

 **CAUTION**







Annunciation	Description
	GPS 2 is invalid and the EFD1000 has automatically selected GPS 1.
	GPS 1 is invalid and the EFD1000 has automatically selected GPS 2.
	GPS 1 and GPS 2 are invalid and the EFD1000 has automatically selected the Emergency RSM GPS.
	Synthetic Vision Flight Path marker. Terrain or obstacle conflict within 45 seconds.
 	Synthetic Vision system terrain or obstacle conflict within 45 seconds,  Accompanied by the following audible annunciation "Caution Terrain Terrain!" OR "Caution Obstacle Obstacle!"
	GPS Integrity indication.



**CAUTION**

Annunciation	Description
	<p>The aircraft has reached or is below the set MINIMUMS. Accompanied by a one-second stuttered tone when the optional tone generator is installed.</p> <p>Accompanied by the following audible annunciation (at Minimums) "Minimums".</p>
	<p>The aircraft is approaching (steady) or deviated from (flashing) the selected altitude. Accompanied by a one-second steady tone when the optional tone generator is installed.</p> <p>Accompanied by the following audible annunciation "Altitude".</p>
	<p>The optional radar altimeter Decision height input indicates the aircraft is at or below the radar altitude set by the pilot.</p>
	<p>Indicates the GPSS source is invalid (e.g. the flight plan was deleted) or a different GPS was selected by the pilot. The autopilot will fly wings-level until valid GPSS signal is available and GPSS is re-engaged.</p>







 **CAUTION**






Annunciation	Description
	Traffic Alert.
	TIS-A option: Traffic data is unavailable.
	TIS-A option: Traffic was removed. The PFD does not display the AGE.
	<p>ADS-B OUT: The UAT link between the ADS-B system and the PFD has failed.</p> <p>This message can only be presented when integrated with the Aspen or FreeFlight ADS-B OUT System.</p>
	<p>ADS-B OUT: The UAT position source has failed.</p> <p>This message can only be presented when integrated with the Aspen or FreeFlight ADS-B OUT System.</p>
	<p>ADS-B OUT: The UAT transmitter has failed.</p> <p>This message can only be presented when integrated with the Aspen or FreeFlight ADS-B OUT System.</p>

 <b>CAUTION</b>	
Annunciation	Description
      	Weather product data not received.
	When the EFD1000 MFD is used for attitude backup and the aircraft is approaching an area where the external magnetic field is insufficient for Attitude and Heading operation.
	Annunciation presented when the external magnetic field is insufficient for Attitude and Heading operation. After four minutes of Free Gyro operation the attitude and heading indications will Red-X.








 **CAUTION**

Annunciation	Description
	Annunciation presented in the menus when the connected EFD battery is not detected or failed.
	GPSS is operational.
	GPS annunciations that are provided by the GPS source. TERM can also be displayed in the same location as APPR.
	When this message is displayed, the PFD is the UAT controller.


**CAUTION**

Annunciation	Description
	<p>Green annunciation that indicates that the traffic sensor is enabled. ID after TFC indicates that traffic identification is displayed if available.</p> <p>This annunciation does not indicate the status of the ADS-B traffic data uplinked from the ground.</p>
	<p>Green annunciation that indicates that the traffic sensor is in standby.</p>
	<p>Green annunciation that indicates that the TIS A traffic data has not been refreshed within 6 seconds.</p>
	<p>Stormscope (strike) option: The rate indicates the approximate number of lightning strikes detected per minute.</p>
	<p>Stormscope (strike) option: Cell clustering display mode selected. The rate indicates the approximate number of lightning strikes detected per minute.</p>

 **CAUTION**

Annunciation	Description
	A data age annunciation for XM Datalink products.
	A data age annunciation for ADS-B weather products.
	Synthetic Vision Option: Failed
	Synthetic Vision Option: Failed
	Synthetic Vision Option: Failed
	Synthetic Vision Option: Not yet operational
	Synthetic Vision Option: Failed



## CAUTION

Annunciation	Description
<b>SV LOADING...</b>	Synthetic Vision Option: Not yet operational
<b>MAP LOADING...</b>	Synthetic Vision Option: Not yet operational
<b>OBSTACLE BEHIND AOA</b>	Synthetic Vision Option: An obstacle that is behind the AOA indicator for more than five seconds will elicit this message.
<b>AOA AUTO</b>	The AOA indicator is available for display but removed to reduce clutter. This message will be shown until the AOA indicator presents useful information.
<b>TIMER 1 EXPIRED</b>	Indication that a timer has expired.  Accompanied by the following audible annunciation: "Timer"

# Chapter 6

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## Appendices

### 6.1 Register Your New Aspen Display

Registering your new Aspen Display is easy to do and provides many benefits and resources for using your new system such as:

- View and post to the Aspen Customer Gallery
  - Show off your Aspen Equipped Aircraft
- View recent Aspen Customer News and Notifications
- Receive email notifications from Aspen Avionics
  - Software Releases with new/updated features
  - Aspen sponsored events
  - Special offers
- Technical information on using your Aspen Display
- Option to register for a free 90 day subscription to Jeppesen Database updates for your system. Registering the display does not automatically get you jepp data.

To register your system,

- Have the following information ready
  - Aircraft Registration Number and Serial Number
  - EFD unit type and serial number(s)
- Go to <https://aspenavionics.com/customerport>

If you have not created a customer account, visit [www.aspenavionics.com](http://www.aspenavionics.com) and click the Customer Login button at the top of the page. Click “Create New Customer Account” and follow the prompts to create your account.

- Once logged in, click the “Customer Resources” link at the top of the page, and Register Your Products using the form.
- Fill out the information on your aircraft and system.
- If your installation includes more than one display system, press the “Add another Component” link in the Aspen Equipment Information box.
- Submit your registration.



## 6.2 Jeppesen Data

The Jeppesen data includes the following elements: NavData®, Obstacles, Cultural, and Terrain as outlined in **Table 6-1**. All data types will be pre-loaded onto the micro SD card that is shipped with the unit. NavData, Obstacle, and Cultural data are combined and presented as a single update file.

Updated Jeppesen data is delivered via JDM every 28 days ([www.jeppesen.com/jdm/download](http://www.jeppesen.com/jdm/download)). To receive updates pass the initial 90 day you will need to register your Aspen product and register with Jeppesen.

- If you have a PFD system with Evolution Synthetic Vision option enabled, or have an MFD system, visit our “Customer Resources” page on the Customer click the “Register for Complimentary 90-Day Jeppesen Data Subscription” to get started with data updates for Evolution Synthetic Vision or MFD’s Nav Data. Ensure that your products are registered first before completing the request for complimentary data from Jeppesen. See Section 6.1.
- It is important to fill out and submit the “Service Activation Date” field on the Jeppesen Data Subscription request form as accurately as possible. This is the date which Jeppesen will use to begin the service of your 90-Days of free data.
- Customers will receive a confirmation email from Jeppesen indicating service activation as well as automatic renewal option for continuing data service.

For more information on Aspen Database Cards, visit our Support page <https://AspenAvionics.com/support/> and view the video on Aspen Database Cards linked in the FAQ section

If you lose your microSDHC card or would like to have an extra one, contact your nearby Aspen Avionics Dealer directly to purchase an additional or replacement Database Card.

Data Type	Description
NavData®	Enroute, SID, STAR and Terminal approach procedure information, Airports, Runways, Frequencies, Waypoints, Nav aids, Controlled Airspace, Restricted Airspace.
Obstacle data	Depiction of the location and height of man-made obstacles that extend above the ground.
Cultural data	Contains boundary and reference information for countries, other major political subdivisions, large water bodies, coastlines, time zones, and other physical and political features.
Terrain data	Data that depicts the contours and shapes of the surface of the earth. The primary source for Jeppesen terrain is the SRTM Shuttle Radar Topography Mission terrain database.

Table 6-1 Jeppesen Data Types

## 6.2.1 Jeppesen Technical Support

For questions and troubleshooting on installing and/or using the JDM application and loading data from JDM to the micro SD card, contact Jeppesen Technical Support. This team can also direct your call if you have questions about the content of your Jeppesen data.

Please contact: <https://support.jeppesen.com/>

For questions about Customer accounts, username/passwords, other Jeppesen products and services contact Jeppesen Customer Service.

Please contact: <https://support.jeppesen.com/>

For questions about Evolution Flight Display functionality, contact Aspen Avionics.

[salesupport@aspenavionics.com](mailto:salesupport@aspenavionics.com)  
505-856-5034

## 6.3 XM Weather Receiver Activation

An Evolution Weather Receiver (or equivalent) and subscription to XM WX Satellite Radio Service is required for display of the EFD1000/500 MFD Weather Products. If the EFD1000/500 MFD is installed with a weather receiver, when the EFD1000/500 MFD is turned on for the first time an annunciation will display alerting you that the XM WX Satellite Radio Service is not yet activated.

To activate the XM WX Satellite Radio Service contact XM WX Satellite Radio through the e-mail address listed on their web site ([www.xmradio.com](http://www.xmradio.com)) or by the customer service phone number listed on the web site (1-800-985-9200). Follow the instructions provided by XM Satellite Radio services.

You will need the XM Serial Number found on the XM RECEIVER page of the Main Menu.

### 6.3.1 View the XM Serial Number

1. Push the MENU Button. The Main Menu displays adjacent to the Hot Keys.
2. Navigate to the XM RECEIVER menu page (**Figure 6-1**).
3. Note the number.
4. Push the MENU Button to exit the Main Menu.



Figure 6-1  
XM RECEIVER Main Menu Page

## 6.4 Optionally Enabled Features

The following are separately purchased features that can be enabled on the EFD1000 MAX PFD. See your dealer for information on enabling these features.

- Evolution Synthetic Vision (Included in Max Pro Plus)
- Aspen Angle of Attack (Included in Max Pro Plus)
- ADS-B In
- Flight Director Input
- Evolution Hazard Awareness
  - Includes Traffic, XM Weather, Stormscope
- Advanced Autopilot Integration

## 6.5 Glossary

A/D	Analog to Digital
AC	Alternating Current
Accuracy	Estimated position accuracy in feet or meters
ACU	Analog Converter Unit
ADC	Air Data Computer
ADI	Attitude Director Indicator
AFMS	Airplane Flight Manual Supplement
AGL	Above Ground Level
AHRS	Attitude Heading Reference System
AI	Attitude Indicator
AIM	Aeronautical Information Manual
AIRMET	Airman's Meteorological Information
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
AWOS	Automated Weather Observation System

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.
Battery Time	The time remaining on the battery before it is fully discharged.
BC	Back Course
Bearing	The compass direction from the current position to the destination.
BP	Bearing Pointer
Calibrated Air-speed	Indicated airspeed corrected for installation and instrument errors.
CDI	Course Deviation Indicator
CFR	Code of Federal Regulations
CM	Configuration Module
Comm	Communication radio
Course	The route taken from the starting position to destination.
Course to Steer	The recommended direction to steer in order to reduce cross-track error and return to the course line.
Cross Track	The perpendicular distance, left or right, away from the selected course.
Crosstrack Error	The distance the aircraft is off the desired course.
CRS	Course
CTS	Course to Steer
dBZ	decibels 'Z' (radar return)
DC	Direct Current

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.
Declutter	Reduce the number of basemap symbols displayed on screen.
Deg	Degree
Desired Track	The desired course between the active "FROM" and "TO" waypoints.
DH	Decision Height
Distance (Next)	The great circle distance from current location to a Go To destination or the final waypoint in a route.
DME	Distance Measuring Equipment
DTK	Desired Track
EASA	European Aviation Safety Agency
EFIS	Electronic Flight Instrument System
Elevation	The height above mean sea level.
ESV	Evolution Synthetic Vision
ETA (Destination)	Estimated Time of Arrival. The estimated time you will reach a Go To destination or the final waypoint in a route.
ETA (Next)	Estimated Time of Arrival. The estimated time you will reach a Go To destination or the next waypoint in a route.

ETSO	European Technical Standard Order
FAA	Federal Aviation Administration
FAF	Final Approach Fix
FD	Flight Director
FIS-B	Flight Information Services – ADS-B
FOV	Field Of View
fpm	Feet Per Minute
FPM	Flight Path Marker
ft	Feet
GPS	Global Positioning System
GPSS	GPS Steering
Ground Speed	The velocity that the aircraft is travelling relative to a ground position.
Ground Track	see Track
GS	Glide Slope or Ground Speed
Heading	The direction an aircraft is pointed, based upon indications from a magnetic com-pass or a properly set directional gyro.
Hg	Mercury
Hot Key	Refers to the five hot keys on the right side of the display when the Main Menu is not enabled (Figure 2-1).
HIS	Horizontal Situation Indicator
Hz	Hertz (frequency)
IAF	Initial Approach Fix



IAS	Indicated Air Speed
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
in Hg	Inches of Mercury
Indicated	Information provided by properly calibrated and set instruments on the aircraft panel.
IOP	Input/Output Processor
JDM	Jeppesen Distribution Manager
kHz	Kilohertz
KIAS	Knots Indicated Air Speed
km	Kilometer
kt	Knots
LAT	Latitude
LCD	Liquid Crystal Display
LDI	Lateral Deviation Indicator
Leg	The portion of a flight plan between two waypoints
LOC	Localizer
MAP	Main Application Processor
mB	Millibars
MFD	Multi-Function Display
MHz	Megahertz
MSG	Message

MSL	Mean Sea Level
NAVAID	Navigation Aid
NDB	Non-Directional Beacon
nm	Nautical Miles
NRST	Nearest
NXRD	Next Generation Weather Radar
OAT	Outside Air Temperature
OBS	Omni-Bearing Selector
°C	Degrees Celsius
°F	Degrees Fahrenheit
PFD	Primary Flight Display
RMI	Radio Magnetic Indicator
RSM	Remote Sensor Module
SDHC	Secure Digital High Capacity (microSDHC card)
SV	Synthetic Vision
TA	Traffic Advisory
TACAN	Tactical Air Navigation System
TAS	True Air Speed
TCAS	Traffic Collision Avoidance System
TERM	Terminal Mode
TFC	Traffic
TIS	Traffic Information System

TIS-B	Traffic Information System – ADS-B
Track	Direction of aircraft movement relative to a ground position; also Ground Track'
TSO	Technical Standard Order
TWS	Terrain Warning System
VAC	Volts, Alternating Current
VDC	Volts, Direct Current
VDI	Vertical Deviation Indicator
VFR	Visual Flight Rules
VHF	Very High Frequency
VLOC	VOR/Localizer
VOR	VHF Omni-Directional Radio Range
VORTAC	VHF Omni-Directional Radio Range and Tactical Air Navigation
VSI	Vertical Speed Indicator
WAAS	Wide Area Augmentation System
WPT	Waypoint
WX	Weather
ZPL	Zero Pitch Line

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