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Document A-01-175-00 Revision D

FAA APPROVED

**EFD1000 (Pro) and EFD1000 (Pro Digital)
AIRPLANE FLIGHT MANUAL SUPPLEMENT
or
EFD1000 (Pro) and EFD1000 (Pro Digital)
SUPPLEMENTAL AIRPLANE FLIGHT MANUAL**

The information contained in this Supplement must be attached to the *FAA Approved Airplane Flight Manual* or placed with the Pilot's Operating Handbook or other operating information when the Aspen EFD1000 Electronic Flight Instrument System PRO or PRO DIGITAL MODEL is installed in accordance with AML STC **SA10822SC**.

The information in this Supplement supplements or supersedes the information in the FAA Approved Airplane Flight Manual or other operating information only as set forth herein.

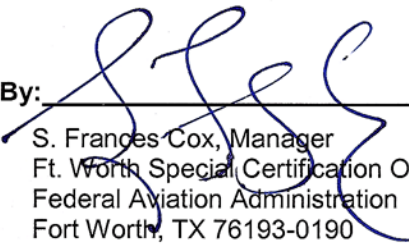
For limitations, procedures, and performance data not contained in this Supplement, consult the Airplane Flight Manual or other operating information.

Airplane Make: _____

Airplane Model: _____

Airplane Registration Number: _____

Airplane Serial Number: _____

FAA APPROVED By: 
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Document Revisions


Document Revision	Pages Revised	Description of Change	FAA Approval	ECO
A	All	Internal Release	None	1160
B	N/A	FAA APPROVED Release	March 17, 2008	1267
C	All	Added reference to Supplemental Airplane Flight Manual on page 1 Updated Airspeed Limitation Added two steps in the In-Flight AHRS Reset procedure. Added references for the "Pro Digital" System	July 14, 2008	1378
D	All	Clarified Pitot/static blockage scenario and improved the crosscheck attitude caution verbiage. FAA APPROVED By:  S. Frances Cox, Manager Ft. Worth Special Certification Office Federal Aviation Administration Fort Worth, TX 76193-0190	February 3, 2009	1533
Prepared By:	WCB	Original signatures on file. See ECO for release date and dispositions.	Release Authorization	
Reviewed By:	TAG		Release Date:	1/19/09
Usage Authorization / Master Control Number:			Release Signature	Danny Rickard

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1 General

1.1 System Overview

The Aspen Avionics’ EFD1000 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, etc., moving maps, pilot-selectable indices (“bugs”), and various annunciations that increase situational awareness and enhance flight safety. Moving map situational awareness information is displayed when the unit is connected to compatible GPS equipment. This aircraft flight manual supplement applies to the EFD1000 “Pro” and “Pro Digital” configuration.

The EFD1000 “Pro” system components include the EFD1000 display head, a Remote Sensor Module (RSM), a “Pro” Configuration Module (CM), and the optional Analog Converter Unit (ACU). The optional ACU enables the integration of the EFD1000 system to legacy panel-mounted GPS navigators, VOR/Localizer radios, and autopilots systems.

When interfaced with a compatible autopilot, the EFD1000 “Pro” system provides heading and course datum information to the autopilot, which enables the autopilot to follow the Course and Heading values set by the pilot on the EFD1000, the same as is done with a mechanical HSI. When interfaced to a compatible GPS system, the EFD1000 can convert the digital GPS steering (GPSS) signals that are output from the GPS into analog GPSS signals that are compatible with the autopilot heading mode.

The EFD 1000 “Pro Digital” system components include the EFD1000 display head, a Remote Sensor Module (RSM), and a “Pro Digital” Configuration Module (CM)

See Section 6 of this Aircraft Flight Manual Supplement for a description of the operation of the EFD1000 System.

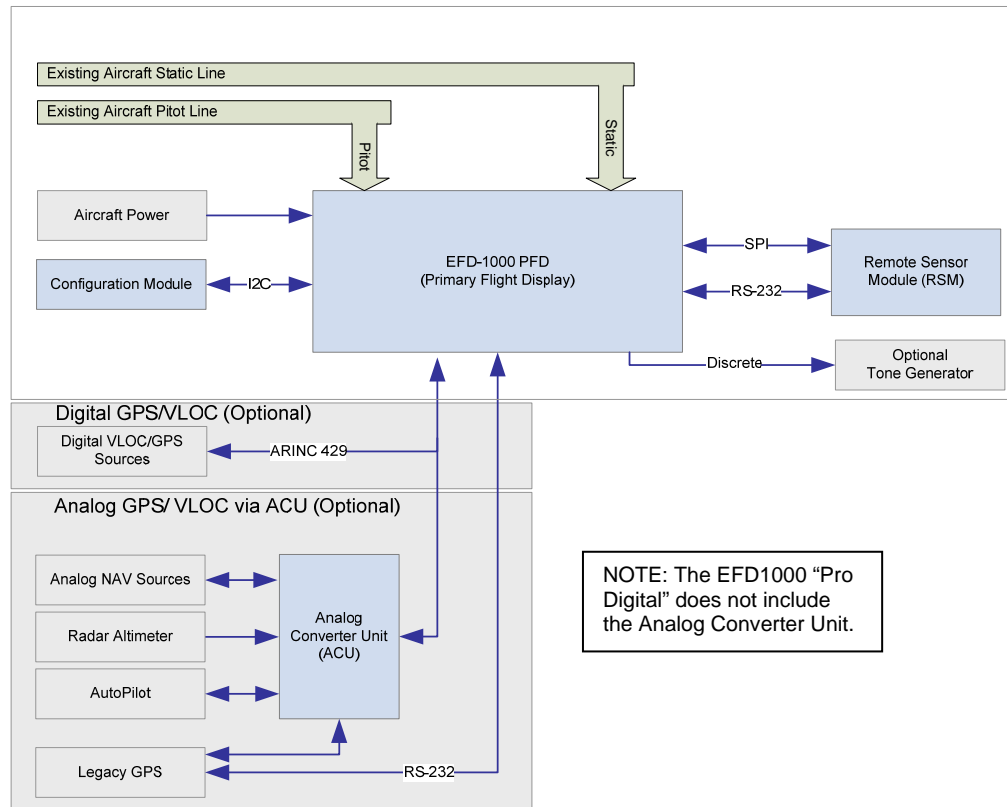


Figure 1 - EFD1000 “Pro” and “Pro Digital” System Overview

2 Limitations

2.1 Software Versions

The EFD1000 System must utilize the software versions listed below (or later FAA-approved versions). The system software version for the Main Application Processor (MAP) and for the Input-Output Processor (IOP), both of which are contained within the EFD display head, is displayed via the Main menu SYSTEM STATUS page. The ACU software version number is recorded on a software version label affixed to the ACU hardware.

Software Name	Version	AFM Supplement Revision
A-02-127-1.0 EFD1000 MAP SOFTWARE	RELEASE 1.0	A-01-175-00 Revision C
A-02-147-1.0 EFD1000 IOP SOFTWARE	RELEASE 1.0	A-01-175-00 Revision C
A-02-178-1.0 EFD1000 ACU SOFTWARE	RELEASE 1.1	A-01-175-00 Revision C

2.2 Airspeed Limitation

The maximum approved operating airspeed for this system is 264 KTS (304 MPH).

2.3 Weight & Center of Gravity

Installation of the EFD1000 system may result in a small net change to the aircraft empty weight and associated moment arm. Refer to the revised weight and balance records carried in the aircraft for details.

2.4 RSM GPS Usage

The EFD1000 RSM GPS is authorized for emergency use only. Position data from the RSM GPS will ONLY be presented following the loss or failure of a certified external GPS navigator.

NOTE:

When the RSM GPS is in use, magnetic variation data used by the basemap is not updated. This can result in misaligned basemap symbology whenever the external GPS position source is lost and the aircraft travels far enough to produce a significant change in the local magnetic variation.

2.5 Geographic Limitation

Like all compass systems, the magnetometer used in the EFD1000 system will experience degraded performance in the vicinity of the magnetic poles. When the horizontal component of the earth’s magnetic field is no longer strong enough to provide reliable heading data, the EFD1000 System will present a “CROSS CHECK ATTITUDE” annunciation, and will subsequently flag the magnetometer data as invalid, resulting in the annunciated loss of heading and attitude. Depending on the aircraft latitude and longitude, this effect could be observed as far away as 750 nm from the magnetic pole. In the Northern Hemisphere, this equates to operations in the Arctic Islands found north of continental North America

Use of the EFD1000 system for IFR operations within 750 nautical miles of the Magnetic Poles, based solely upon the attitude and heading data provided by the EFD1000, is prohibited.

2.6 Placards and Decals

The following electronic placard is provided on the EFD1000 display whenever the RSM GPS is providing position data for the basemap display:

"RSM GPS REVERSION
EMER USE ONLY"

2.7 Seaplane Operation

The EFD1000 system may not be able to align when on water as a function of the wave action being experienced by the aircraft. When aligning on water, always perform a visual verification of the attitude reference with a secondary source, such as a mechanical gyro or the horizon. If the alignment is not successful, it is acceptable to depart under VFR/VMC and, while maintaining VFR/VMC, perform an AHRS in flight alignment per section 3.

3 Emergency and Abnormal Procedures

3.1 In-Flight AHRS Reset

ATTITUDE Maintain straight and level flight
 FLY BY VISUAL REFERENCE, OR BY STANDBY INSTRUMENTS
 DISCONNECT THE AUTOPILOT
 MENU Select “GENERAL SETTINGS” Page
 “AHRS: RESET?” LINE SELECT KEY PRESS
 “AHRS: RESET?” LINE SELECT KEY PRESS AGAIN TO CONFIRM RESET

NOTE:

When the EFD1000 AHRS is reset in flight, it performs an abbreviated initialization.

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

The AHRS reset is considered complete when the EFD1000 attitude and heading is once again displayed, stable, and correct with respect to the horizon or standby indicator.

3.2 Pitot/Static System Blockage

CAUTION:

Most light aircraft have only a single pitot and static port available for flight instrument use. As such, the pitot and static lines used by the EFD1000 system are shared with those lines used by the standby airspeed indicator and altimeter. Should these lines become blocked, such as might occur due to inadvertent icing encounter, both the standby indicators and the EFD1000 indicators will display erroneous information.

Because the EFD1000 uses pitot and static pressures as part of the ADAHRS solution, loss or corruption of this data, such as from a line blockage, will impact the accuracy of data output by the ADAHRS. Affected parameters can include the airspeed, altitude and attitude information displayed by the EFD1000.

If erroneous pitot or static inputs are detected by the EFD1000, the EFD1000 will present a “CROSS CHECK ATTITUDE” annunciation.

A static line blockage will result in altitude remaining fixed and a zero vertical speed despite aircraft pitch and/or power setting changes. In addition, IAS indications will be incorrect if the static line is blocked. Errors will typically be noticed in the climb or descent phase of flight. When descending, ambient pressure increases which will result in the indicated airspeed reading less than the actual airspeed. The opposite effect will be observed in a climb. A static line blockage can also affect the EFD1000 attitude indication.

A pitot line blockage will result in the airspeed indicator behaving like an altimeter when the aircraft altitude changes, and it would not respond to airspeed changes. A pitot line blockage can also affect the EFD1000 attitude indication.

If a blocked pitot or static line is suspected, take the following actions:

ALTERNATE STATIC SOURCE SELECT

PITOT HEAT ON

3.3 Loss of External Power

In the event that external power to the unit is degraded or fails, the EFD1000 will automatically switch to its internal battery.

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

An annunciation of this operating state and the estimated battery charge remaining is displayed in the lower portion of the attitude indicator.



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±0.3V (14V Electrical System) or 25.0±0.6V (28V Electrical System) will cause the EFD to automatically switch to its internal battery.

This will be accompanied by an "ON BAT" annunciation.

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

NOTE:

When fully charged the EFD1000 internal battery will allow for operation for the AHRS, display and RSM emergency GPS for at least 30 minutes.

3.4 Power Override

In the event that the pilot wishes to override the automatic power configuration of the equipment:

MENU..... Select "POWER SETTINGS" Page

To switch FROM External Power TO Battery:

"BATTERY" LINE SELECT KEY PRESS

To switch FROM Battery TO External Power:

"EXT PWR" LINE SELECT KEY PRESS

NOTE:



When airborne, if the EFIS input voltage is below the 12.5±0.3V (14V Electrical System) or 25.0±0.6V (28V Electrical System) automatic battery transition threshold, and "EXT PWR" is selected the EFD will automatically transition back to its internal battery.






3.5 Abnormal Shutdown Procedure




Circuit Breaker..... PULL


REV Button..... HOLD UNTIL DISPLAY BLANKS

3.6 Warning, Caution, and Advisory Summary

WARNINGS		
ON BAT		Red annunciation presented whenever the EFD1000 is operating on the internal battery. Will be accompanied by an indication of the estimated battery charge remaining.
Function FAIL ("X")		Red annunciation presented whenever the EFD1000 has determined that the associated function is invalid or failed and should not be used. The data is removed from the display and replaced by a red "X" over the affected display feature.

CAUTIONS		
CROSS CHECK ATTITUDE		<p>Amber annunciation presented centered in the upper half of the attitude indicator whenever the EFD1000 AHRS internal integrity monitor determines that attitude is potentially degraded. If a CROSS CHECK ATTITUDE annunciation is provided the pilot should cross check attitude, airspeed and altitude indications.</p>
GPS1 GPS 2 and/or RSM GPS		<p>Amber annunciation presented on the left edge of the display to indicate when a configured GPS flight plan and mapping data is invalid or not available.</p>
RSM GPS REVERSION EMER USE ONLY		<p>Amber annunciation presented whenever the EFD1000 reverts to RSM GPS data and indicates that the RSM GPS is the current GPS source. RSM GPS usage is limited to "EMER USE ONLY"</p>
INTEG		<p>Amber annunciation presented when the GPS source coupled to the HSI "flags" the GPS integrity. See the GPS AFMS for more information.</p>
MINIMUMS		<p>Amber annunciation presented whenever the aircraft is at or below the MINIMUMS altitude set by the pilot. May be accompanied by an optional one-second stuttered tone.</p>

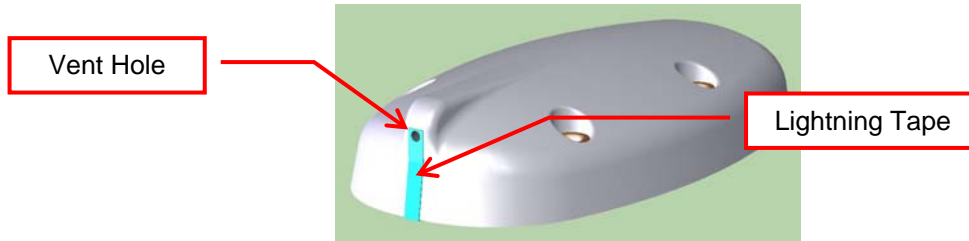
ADVISORY		
Altitude alerter		Amber flag presented to indicate the aircraft is reaching (steady) or deviating (flashing) from the preselected altitude. May be accompanied by an optional one-second steady tone.
DH alert		Yellow "DH" annunciation provided whenever a connected radio altimeter indicates it has reached the altitude set by the pilot. See the Radio Altimeter AFMS for more information.
GPS Annunciations: "APPR" "WPT" "MSG"		Green Annunciations associated with the GPS coupled to the HSI. See the GPS AFMS for more information.

INVALID DATA		
Slashing (red line)		A horizontal or vertical red line through the source legend of selected data indicates that the data is invalid or unavailable.

4 Normal Procedures

4.1 Exterior Inspection

- RSM..... Check condition and security
- RSM Vent Hole..... CLEAR OF OBSTRUCTIONS
- RSM Lightning Tape..... Check Condition and security



4.2 Before Taxi Checks

- EFIS MASTER (If installed)..... ON
- Avionics and Instruments SET as desired

NOTE:

The AHRS will perform an internal test during EFD1000 power up.

The aircraft should remain stationary during the AHRS power up and alignment sequence.

If the aircraft is moved during AHRS alignment it will take longer for accurate attitude and heading information to be presented to the pilot.

Attitude and heading information is presented once the AHRS completes the alignment process

4.3 Before Take-Off Checks

- EFIS POWER SETTINGS PAGE..... Check Battery Status
- EFIS POWER SETTINGS PAGE..... Check Input Voltage > 12.3V/24.6V

NOTE:

If the EFIS input voltage is below 12.5±0.3V (14V Electrical System) or 25.0±0.6V (28V Electrical System) then the EFD will transition to internal battery as soon as the indicated airspeed exceeds 30 KIAS.

Voltages below these thresholds are indicative of an aircraft electrical system charging problem and should be resolved prior to flight.

4.4 Shutdown Checks

- EFIS MASTER (If installed)..... OFF

5 Performance

No change to basic Airplane Flight Manual or other performance information or placards.

6 System Description

6.1 General

The EFD1000 system is a flat-panel LCD primary flight instrument that presents the pilot with displays of attitude, airspeed, altitude, vertical speed, slaved compass, slip/skid, and rate of turn information. The display head incorporates a solid-state Air Data and Attitude Heading Reference System (ADAHRS) to provide data for the flight instruments. The ADAHRS system uses data from its internal solid state rate gyros and accelerometers, pitot and static sensors, solid state magnetometer, and solid state temperature probes, all contained within the display head and RSM, to derive the aircraft attitude and air data solutions. An optional analog converter unit (ACU) provides interfaces necessary for third party navigation and autopilot equipment that accept or transmit data in analog signal formats.

NOTE:

Although intuitive, a reasonable degree of familiarity is required to use the EFD1000.

6.2 Pilot Controls

6.2.1 Overview

Pilot interaction with the EFD1000 is accomplished through two knobs with push/rotate function and 11 buttons located on the display bezel. Refer to Figure 2.

Two control knobs are used to control pilot settable bugs and references.

Three lower push buttons, located between the control knobs, are used to select navigation sources for the bearing pointers and the HSI.

Three dedicated buttons on the upper side of the right bezel control map range, display reversion, and provide access to the main menu.

Five soft keys on the lower half of the right bezel control frequently used commands, such as the HSI mode or map declutter setting. These five keys are also used when navigating the main menu.

6.2.2 Power Control

To enhance safety, the EFD1000 includes an internal battery that allows the system to continue to operate in the event of a failure of the aircraft electrical system. This ensures that in addition to the standby instruments, the EFD1000 primary flight instrument continues to remain available for a period of time following the loss of all external supply power.

This internal battery is not required by regulation; however, it is good practice to verify that the status of the battery prior to takeoff.

The typical EFD1000 installation receives aircraft power from the battery bus via a dedicated circuit breaker and optionally, via an EFIS Master Switch.

Whenever indicated airspeed is invalid or below 30 KIAS the EFD1000 will power up and power down with the application or removal of external power. To turn on the system, turn on the aircraft Battery Master switch and, if installed, the optional EFIS Master switch. Reverse this process to turn the system off. A message is presented during the normal power down sequence to enable the pilot to abort the shutdown and switch to internal battery.

When IAS is greater than 30 KIAS and the input voltage is below $12.5\pm 0.3V$ (14V Electrical System) or $25.0\pm 0.6V$ (28V Electrical System) the EFD will automatically switch to its internal battery (e.g. aircraft charging system failure).

The EFD1000 internal battery will provide at least 30 minutes of power when it is fully charged. The battery provides power to the display head, RSM and emergency GPS. Reducing the backlight intensity will extend the battery operating time.

When operating from battery, a red "ON BAT" annunciation and battery charge status indication is presented in the lower portion of the Attitude Indicator.

NOTE:

As a protection mechanism, the EFD1000 internal battery may not charge when the battery temperature is at extreme high or low temperatures. This situation may occur when the battery was being used and system power is subsequently restored, or it may occur under high or low ambient temperatures.

If operation from the internal battery occurs during night and/or IFR operations, one should land as soon as possible, even if external power is restored, as the battery will not recharge following restoration of external power until the battery temperature has returned to normal.

A unit operating from battery may be powered off using the "Shut Down" command available in the Power Settings Menu.

In the unlikely event that the normal power control is not working, the EFD may be forced to shut down by first pulling its associated circuit breaker and then pressing and holding the REV button for at least 5 seconds. (Refer to section 3.4 Abnormal Shutdown Procedure)

Battery charge status may be viewed from the "Power Settings" page of the Main Menu. See section 6.7 for more information.

6.2.3 Display Screen and Control Layout

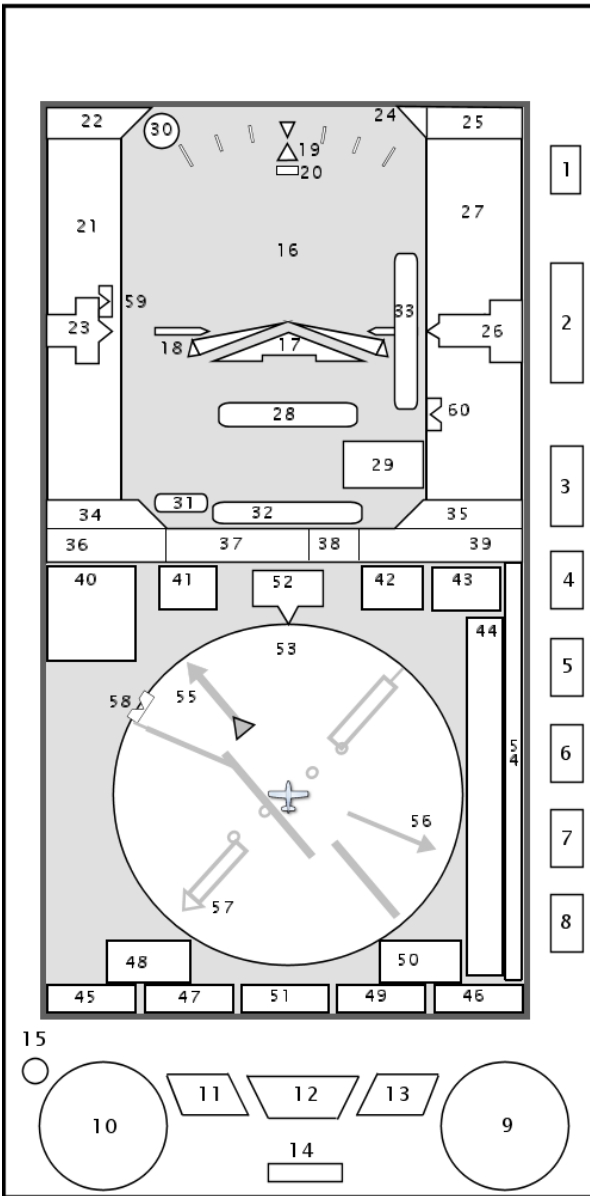


Figure 2 - PFD Display Features

- 1) Reversion Control
- 2) Range Control
- 3) Menu Control
- 4) "TPS" Tapes ON/OFF Control
- 5) "MIN" Minimums ON/OFF Control
- 6) "360/ARC" HSI View Control
- 7) "MAP" Map declutter logic Control
- 8) "GPSS" GPS Steering ON/OFF Control
- 9) Right Control Knob
- 10) Left Control Knob
- 11) Single-Line Bearing Pointer Source Select

- 12) CDI Source Control
- 13) Dual-Line Bearing Pointer Source Select
- 14) Micro SD Card slot
- 15) Automatic Dimming Photocell
- 16) Attitude Indicator
- 17) Aircraft Symbol
- 18) Single Cue Flight Director (optional – compatible autopilot required)
- 19) Roll Pointer
- 20) Slip / Skid Indicator
- 21) Airspeed Indicator Tape
- 22) Selected Airspeed Field
- 23) Airspeed Drum/Pointer
- 24) Altitude Alert
- 25) Selected Altitude Field
- 26) Altitude Drum/Pointer
- 27) Altitude Tape
- 28) MINIMUMS annunciation
- 29) Selected Minimums Field
- 30) Decision Height "DH" Annunciation (compatible Radar Altimeter required)
- 31) LDI Navigation Source Indication
- 32) Lateral Deviation Indicator
- 33) Vertical Deviation Indicator
- 34) True Airspeed
- 35) Barometric Pressure Setting Field
- 36) Ground Speed
- 37) OAT
- 38) Wind Direction Arrow
- 39) Wind Direction and Speed
- 40) Selected Source Information Field
- 41) Selected Course (CRS)Field
- 42) Selected Heading Field
- 43) Vertical Speed Digital Value
- 44) Vertical Speed Tape
- 45) Left Control Knob state
- 46) Right Control Knob state
- 47) Single-Needle Bearing Pointer Source
- 48) Single-Needle Source Info Block
- 49) Dual-Needle Bearing Pointer Source
- 50) Dual-Needle Source Info Block
- 51) CDI Navigation Source
- 52) Magnetic Heading
- 53) Compass Scale
- 54) Hot Key legend
- 55) CRS Pointer
- 56) Single-Needle Bearing Pointer
- 57) Double-Needle Bearing Pointer
- 58) Heading Bug
- 59) Airspeed Bug
- 60) Altitude Bug

6.2.4 Control Knobs

General

Two control knobs on the EFD bezel are used to adjust pilot editable data fields. The left knob adjusts data fields on the left side of the display, and the right knob adjusts data fields on the right side of the display.

The knob logic includes active and inactive states to prevent inadvertent adjustment of editable fields. After 10 seconds of inactivity, the knob returns to an inactive state and also returns to the "home" state defined for that knob. A single push activates an inactive knob. Pushing the knob again will advance the knob to the next editable field in a round-robin sequence.

When inactive, the knob legend is rendered in Cyan. Once activated, the knob legend and associated data field and bug (where appropriate) are rendered in magenta.

Left control knob

The left control knob adjusts the CDI Course Set "CRS" and Indicated Airspeed Bug "IAS" editable fields. To adjust these values **PUSH** the knob in a round robin fashion until the desired field text turns magenta, then **ROTATE** the knob to set the value (clockwise to increase, counterclockwise to decrease).

The home state for the left knob is "CRS."

Right control knob

The right control knob controls Heading Bug "HDG", Altitude Bug "ALT", Barometric Pressure Setting "BARO", and Minimums setting "MIN" editable fields in that order. To adjust these values **PUSH** the knob in a round robin fashion until the desired field text turns magenta, then **ROTATE** the knob to set the value (clockwise to increase, counterclockwise to decrease).

To adjust the "MIN" field the field must first be enabled using the MINs hot key. See section 6.2.7 for more information.

The home state for the right knob is "HDG."

6.2.5 Setting Flight Instruments

The following procedures are used to adjust pilot-editable data on the EFD1000:

Heading Bug Set

To set the heading bug, repeatedly **PUSH** the right control knob until the HDG field is enabled for editing. **ROTATE** the knob to the desired setting.

Altitude Bug Set

To set the altitude bug, repeatedly **PUSH** the right control knob until the ALT field is enabled for editing. **ROTATE** the knob to the desired setting.

Barometric Pressure Set

To set the barometric pressure, repeatedly **PUSH** the right control knob until the BARO field is enabled for editing. **ROTATE** the knob to the desired setting.

NOTE:

The barometric pressure setting on the standby altimeter must be set whenever the value is adjusted on the EFD1000

Minimums Set

To set the MINIMUMS alert, repeatedly **PUSH** the right control knob until the MIN field is enabled for editing. **ROTATE** the knob to the desired setting.

The MIN field must first be enabled via the Hot Keys before it may be adjusted.

See section 6.2.7 for a description of Hot Key operation.

CDI Course Set

To select the CDI value, repeatedly **PUSH** the left control knob until the CRS field is enabled for editing. **ROTATE** the knob to the desired value.

NOTE:

When the CDI navigation source is selected to a GPS receiver, and AUTO CRS is enabled via the main menu, the course is automatically set by the GPS and is not pilot adjustable.

Indicated Airspeed Bug Set

To set the indicated airspeed bug, repeatedly **PUSH** the left control knob until the IAS field is enabled for editing. **ROTATE** the knob to the desired setting.

6.2.6 Knob Sync Function

Editable fields may be synchronized as a function of data type as described in Table 1 below. Whenever a control knob is held for approximately one second the active data type will be "sync'd" as follows:

Left Knob Data Type	SYNC Behavior	Right Knob Data Type	SYNC Behavior
IAS	The airspeed bug is set to the current IAS.	HDG	The heading bug is set to the current heading.
VOR CRS	The CRS is set to the bearing to the tuned VOR Station (this will result in the deviation bar centering with a "TO" indication).	ALT	The altimeter bug is set to the current altitude.
ILS CRS	The CRS is set to the current aircraft heading.	BARO	The barometric pressure is set to standard pressure of 29.92 in Hg or 1013 mB.
GPS CRS	AUTO CRS disabled – CRS is set to the Desired Track to the GPS active waypoint. AUTO CRS enabled – No effect. NOTE: AUTO CRS is enabled/disabled via the Main menu.	MIN	The MINIMUMS value is set to the current altitude.

Table 1 - Knob "Sync" Operation

6.2.7 Hot Key Operation

During normal operations, the five line select soft-keys on the lower right side of the display bezel are referred to as "Hot Keys." Hot Keys provide single-action access to frequently used functions. An electronic legend adjacent to each Hot Key indicates its hot key function. When the legend is green, the function is active. When it is grey, the function is inactive. The legend always annunciates the current state.



Figure 3 - Hot Keys and Legend

Tapes

When enabled at installation, Hot Key 1 enables/disables the display of the airspeed and altitude tapes. If not enabled at installation, the TPS hot key will be disabled and it will not be possible for the pilot to disable the airspeed and altitude tapes.

Minimums

Hot Key 2 enables / disables the MINIMUMS display. When enabled, the minimums field is available for editing and minimums alerts are provided. When disabled, no minimums alerting is provided and the field may not be selected for editing. Upon enabling the MINs field, the right knob is activated for editing the MINs value.

Compass Presentation Format

Hot Key 3 toggles the compass between a 360 rose display and a 100 deg ARC display.

Basemap and Declutter Level

Hot Key 4 is used to enable the basemap and control the amount of basemap symbology that is presented to the pilot. Refer to Section 6.5 for additional information about the basemap.

Each successive push of the MAP hot key will change the basemap declutter level in a round-robin sequence. Available selections are HIGH, MEDIUM, LOW, FP ONLY, and OFF. In the HIGH, MEDIUM, and LOW settings the basemap symbology is rendered according to selections made by the pilot in the main menu.

The FP ONLY selection displays just the flight plan legs and waypoints associated with the GPS flight plan, and no other basemap features.

OFF removes all basemap and flight plan symbology.

Separate basemap declutter and range settings are retained for the 360 and ARC compass modes.

A basemap feature display level icon is presented with the range in the lower left portion of the display as follows:

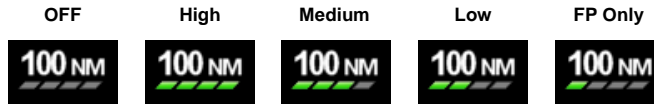


Figure 4 - Basemap Range and Declutter Settings

GPSS (“Pro” only)

Hot Key 5 is used to enable or disable GPS Steering (GPSS) outputs to the autopilot. See Section 6.6 for more information about GPSS.

6.2.8 CDI and Bearing Pointer Source Selection

Overview

The pilot may couple navigation data from external GPS or VOR/Localizer (VLOC) radio system to the HSI and bearing pointers. Navigation source selection is controlled by the three buttons located between the control knobs.

The center button is used to control the source coupled to the Course Deviation Indicator on the HSI.

The left button controls the source coupled to the single-needle bearing pointer.

The right button controls the source coupled to the double-needle bearing pointer.

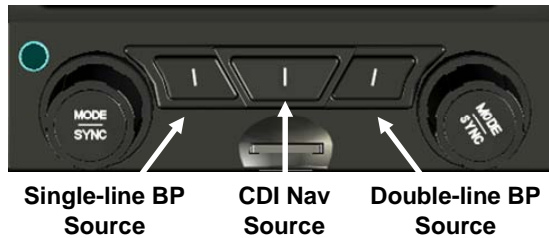


Figure 5 - Navigation Source Selection Controls

Nav Source Selection

To couple a navigation source to a bearing pointer or the CDI press the associated button to sequence between the available sources in a round-robin sequence. Available sources are VLOC1, GPS1, VLOC2 and GPS2.

For integrated GPS/VHF radios, such as the Garmin GNS4xx/5xx, control of the data type (i.e. GPS or VLOC) coupled to HSI course deviation indicator (but not for bearing pointers) is controlled by the radio. When coupled to a radio of this type, the EFD1000 will not toggle the operating state of the radio, but will annunciate the radio’s current operating state in the CDI Nav Source display field. If the integrated radio is not reporting its current state to the EFD1000, such as when the equipment is OFF, failed, or a GPS waypoint has not been programmed, the EFD1000 will default to the VLOC mode.

Refer to the operating instructions or Aircraft Flight Manual Supplement for the associated GPS or VLOC radio system for instructions on how to operate that equipment.

Nav Source Display

The name of the currently coupled CDI or bearing pointer navigation source will be displayed directly above the associated button. When the coupled source data is invalid or not available, the legend is slashed with a red line.



Figure 6 - Source Selection Display

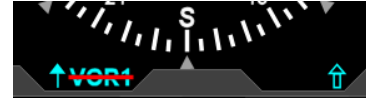


Figure 7 - Invalid Data Annunciation

6.2.9 Back Light Control

The EFD includes an adjustable LCD backlight that provides both automatic and manual brightness adjustments over a wide dimmable range. A single bezel-mounted photocell measures the ambient light, allowing an automatic dimming mode to be selected by the pilot.

Manual dimming control is enabled by the pilot to override the photocell input and adjust the display to any desired intensity level (except off).

In either mode, the bezel-key backlighting is maintained at a fixed brightness level.

To adjust backlight intensity, press the MENU button and then press the left control knob to toggle between auto (BRT AUTO) and manual brightness (BRT ADJUST) control.

To manually adjust the brightness, with BRT ADJUST displayed above the left knob rotate the knob until the desired brightness level is set. Valid brightness settings are 1 to 100.

On power up, the display defaults to AUTO brightness control.

When operating on the internal battery, backlight intensity setting is capped at a value of 70 for both manual and automatic operation.

Under extreme temperature conditions, such as may be encountered during ground operations on extremely hot days, the system backlight will automatically dim to an intensity of 30 whenever internal sensors determine that the system operating temperature has exceeded 65°C. Should this occur the pilot should take steps to reduce the cockpit ambient temperature.



Figure 8 - Lighting control adjustment

6.2.10 Map Range Control

The EFD1000 basemap range may be set to ranges of 2.5, 5, 10, 15, 20, 30, 40, 60, 80, 100, and 200 nautical miles. Map range is measured from the own ship position to the outside of the compass arc.

To increase the range push the '+' side of the range key located on the upper right side of the bezel. To decrease the range push the '-' side of the key. The currently selected map range is displayed in the lower left corner of the display.

6.2.11 Display Reversion Control and Abnormal Shutdown

Single PFD installations do not have a display reversion capability that can be activated by the REV button. As such, the reversion function is inoperative in single display installations.

In addition to display reversion control, the REV button may be used to force the unit to power off should, for example, the display stop responding to pilot inputs. When external power has been removed, pressing and holding the REV button for 5 Seconds will produce in an immediate system shut down. When external power is available, pressing and holding the REV button for 5 seconds will result in a system restart.

While the button is pressed, the following annunciation is provided adjacent to the button:



Figure 9 - Power Reversion Annunciation

6.3 Primary Flight Instruments

6.3.1 Attitude Indicator

The Attitude Indicator consists of a conventional blue over brown attitude 'ball' rendered behind a fixed aircraft symbol to display pitch, roll and slip/skid information. The horizon line is represented by a fixed white line extending to each edge of the display area separating the blue sky and brown ground of the artificial horizon. A fixed roll pointer reads degrees of bank against a moveable roll scale.

The AHRS attitude solution continually self-monitors and will present a "CROSS CHECK ATTITUDE" annunciation whenever it determines that the AHRS solution may be degraded. Should this alert be presented, the pilot should immediately cross compare the attitude against backup sources of attitude information.

If the AHRS attitude is suspect, the pilot may perform an in-flight ARHS reset as described in Section 6.3.2.

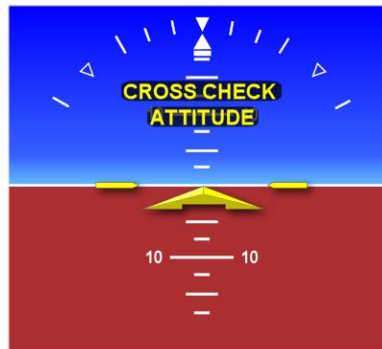


Figure 10 - Attitude Indicator

Pitch Markings

The pitch scale consists of minor pitch marks in 2.5° increments up to ±20° and major pitch marks in 10° increments up to ±90°

Roll Markings

The roll scale is indicated by tick marks at 10°, 20°, 30°, 45° and 60° on both sides of the zero roll inverted solid white triangle. The 45° marks are represented as hollow triangles.

Slip / Skid Indicator

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



Figure 11 - Slip/ Skid Indicator

Unusual Attitude Cues

Red chevrons are presented on the pitch ladder to guide in unusual attitude recovery. The Chevrons begin to come into view at pitch attitudes greater than approximately 15° nose up or 10° nose down. The Chevrons indicate the direction to the horizon.

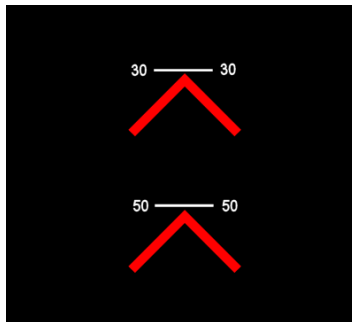


Figure 12 - Excessive Pitch Down



Figure 13 - Excessive Pitch Up

6.3.2 AHRS in-Flight Reset

Should an in-flight degradation of AHRS performance be experienced, an airborne reset and re-alignment of the AHRS may be performed.

During in-flight AHRS alignment the aircraft should be nominally operated in straight and level un-accelerated flight to ensure the quickest alignment times. Mild maneuvers up to 20 degrees of bank are permitted, however this may result in longer AHRS initialization times.

To perform an AHRS in flight alignment, perform the following steps:

1. Maintain straight and level un-accelerated flight.
2. Fly by visual reference, or by standby instruments.
3. Disconnect the autopilot.
4. Access the Main Menu by pressing the MENU button.

5. Rotate the right control knob until reaching the GENERAL SETTINGS page.
6. Press the "AHRS: RESET?" line select key
7. Press the "AHRS: RESET?" line select key again to confirm the reset.

The AHRS will then re-initialize and all AHRS data will be flagged invalid (red X'd) until the initialization is complete. AHRS data is again displayed once the AHRS initialization is complete and AHRS data is valid.

Typical AHRS in flight alignments will be completed in less than 30 seconds.

6.3.3 Airspeed Indicator

Airspeed is indicated by a moving airspeed tape against a fixed position airspeed pointer. A digital, rolling drum readout indicating airspeed values to the closest one knot or mile per hour is provided adjacent to the fixed pointer. Tick marks are provided on the airspeed tape every 10 knots (or mph if so configured). The integral ADC will compute airspeeds between 20 kts (23mph) to 450 kts (518mph). Outside of this range the airspeed value is dashed.

NOTE:

The airspeed tape and drum may be de-cluttered from the display by pilot selection or through installer configuration.

Speed Bands

Color speed bands are displayed on the indicated airspeed tape corresponding to the colored arcs found on a traditional airspeed instrument. The range of these markings are determined by the Federal Regulations, and correspond to the aircraft limiting speeds that are identified in the Aircraft Flight Manual.

The color bands are configured during installation and are not pilot adjustable.

Band Color	Band Range	Description
Red	$>V_{NE}$	Red arc displayed at all speeds above aircraft never exceed speed (V_{NE})
Yellow	$V_{NO} - V_{NE}$	Yellow arc extending from maximum structural cruising speed (V_{NO}) to never exceed speed (V_{NE}).
Green	$V_S - V_{NO}$	Green arc corresponding to the normal operating range extending between the no flap stall speed (V_S) to the maximum structural cruising speed (V_{NO}).
White	$V_{SO} - V_{FE}$	White arc corresponding to the flap operating range extending from the full-flap stall speed (V_{SO}) up to the full flap extend speed (V_{FE})
Red	$<V_{SO}$	Red arc extending from the bottom of the airspeed tape range up to full flap stall speed (V_{SO}). This band is disabled on the ground and during takeoff.

Table 2 - Airspeed Bands

Speed Markers

Color speed markers are displayed on the indicated airspeed tape corresponding to the colored radial lines found on traditional airspeed instruments. These speed markers are depicted in accordance with requirements in the Federal Regulations, and correspond to the aircraft limiting speeds that are identified in the Aircraft Flight Manual.

The color bands are configured during installation and are not pilot adjustable.

Speed Marker	Value	Description
Red Line	V_{NE}	A Red line is displayed across the airspeed tape at the aircraft never exceed speed (V_{NE})
Blue Line	V_{VSE}	Multi Engine Aircraft Only. A blue line is displayed across the airspeed tape at the aircraft single engine best rate of climb speed
Red Line (multi engine only)	V_{MC}	Multi Engine Aircraft Only. A red line is displayed across the airspeed tape at the aircraft single engine minimum control speed.
◁	Initial flap extension airspeed	If the aircraft manufacturer has published an initial flap extension speed, a white triangle will be presented on the airspeed tape at the speed corresponding to this limitation.

Table 3 - Speed Markers

V-Speed Markings

Pilot-adjustable V-speeds can be configured and/or viewed via the Main Menu. Choices include: V_a , V_{bg} (best glide speed), V_r , V_{ref} , V_x , and V_y , and for retractable gear aircraft: V_{le} and V_{lo}

NOTE:

V-speed editing can be locked during installation to prevent inadvertent or unauthorized adjustment.

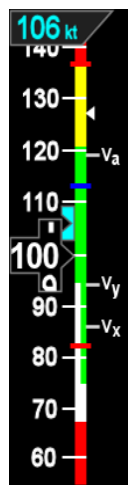


Figure 14 - Airspeed Indicator

6.3.4 Altimeter

Altitude is indicated by a moving altitude tape against a fixed position altitude pointer. A digital, rolling drum readout indicating altitude values to the closest 20 feet is provided adjacent to the fixed pointer. Minor tick marks are provided on the tape at 20 foot intervals, and major tick marks are provided at 100 foot intervals. The thousands and ten-thousands digits are larger than other digits on the tape. Negative altitudes are indicated by a "-" sign preceding the numerical altitude value in the drum.

The calibrated range of the altimeter is -1,600 to +51,000 and the value will be "dashed" if it is outside of this range..

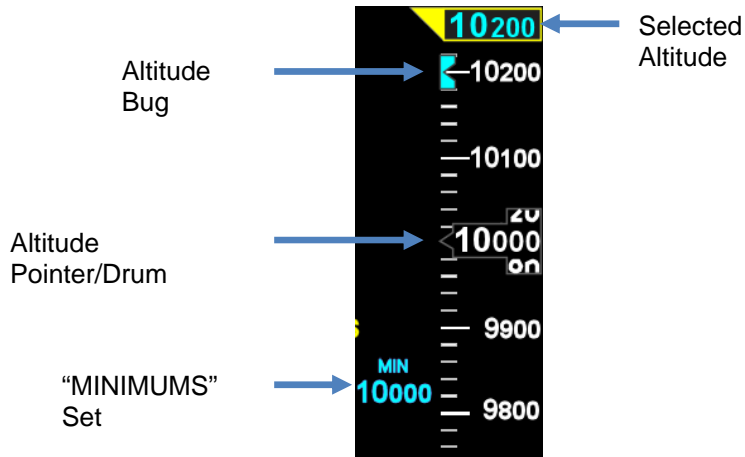


Figure 15 - Altitude Tape

Altitude Alerts

Visual (and optional aural) altitude alerts are generated for level-off and deviation conditions. A yellow, level-off alert illuminates next to the selected altitude numerical field when the aircraft is within 15 seconds or 50 feet (whichever is greater) of the selected altitude. When an optional aural alerter is installed, a steady tone of one-second duration is also provided.

After reaching the selected altitude if the aircraft altitude deviates by more than ±200 feet from the preselect value then a flashing yellow altitude deviation alert is generated, accompanied by a steady one-second tone from the optional aural alerter.



Figure 16 - Alert ON



Figure 17 - Alert OFF

6.3.5 Vertical Speed Indicator (VSI)

Whenever the vertical speed exceeds +/- 100 fpm the vertical speed is indicated by presenting a rising / sinking white vertical tape and associated scale markers immediately to the right of the compass rose. A numerical indication or current aircraft vertical speed is shown directly above the tape. Rates of ± 2000 feet per minute (FPM) are indicated by the tape while the numerical value will display rates of up to ± 9990 FPM. A triangle caps the tape whenever rates exceed ± 2000 FPM. The vertical speed data field will be "dashed" whenever the vertical speed is 10,000 fpm or greater.

In the ARC compass mode only the digital vertical speed value is presented.



Figure 18 - Positive Rate of Climb

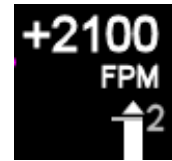


Figure 19 - Rate exceeding 2000fpm

6.3.6 Rate of Turn Indicator

A rate of turn indicator with a range of 0 to 6 degrees per second is provided for both the 360 and ARC Compass modes. The indicator consists of a curved white tape originating from the heading index mark and extending in the direction of the turn along the outer curve of the compass card.



The rate of turn indicator features scale marks for full (thick tick mark) and half "standard" (thin tick mark) rate turns ("standard" rate of turn = 3 degrees per second). When the rate of turn exceeds 6 degrees per second, an arrowhead is added to the end of the tape to show that the rate of turn has exceeded the limits of the instrument.

6.3.7 Data Bar (TAS, GS, OAT, Winds, Barometric pressure Set)

The Data Bar visually separates the upper and lower halves of the EFD display. When available, True Airspeed (TAS), GPS Ground Speed (GS), Outside Air Temperature (OAT), Wind Direction, Wind Speed, and Barometric Pressure Setting data are presented in the data bar. When any of these values are unavailable or invalid, the corresponding data field is "dashed."

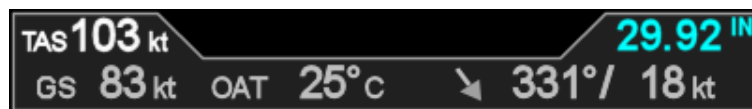


Figure 20 - Data Bar

6.4 Navigation Flight Instruments

6.4.1 Horizontal Situation Indicator

The traditional HSI is an instrument which combines a Direction Indicator overlaid with a rotating Course Deviation Indicator (CDI). The HSI on the EFD1000 can be presented in either a full 360 degree compass rose mode, or in a 100 degree ARC format.



Figure 21 - 360 Compass Mode

Within the ARC mode, the pilot may select (via the main menu) between two different formats of CDI presentation – ARC HSI mode and ARC CDI mode. The ARC HSI mode, presents traditional rotating CDI symbology which resembles that used in the HSI 360 Compass mode. The ARC CDI mode presents a fixed, non-rotating CDI resembling that used in contemporary GPS navigation displays.



Figure 22 - ARC HSI Mode



Figure 23 - ARC CDI Mode

Lateral and Vertical Deviation Indicators

A Lateral Deviation Indicator (LDI) is presented on the attitude indicator whenever the pilot has coupled an ILS, LOC, LOC(BC), or a GPS in Approach Mode to the HSI and valid lateral guidance is being provided.

Back course deviation indications are automatically corrected for reverse sensing. Therefore, there is no further pilot action required to enable reverse sensing other than setting the inbound course on the HSI. "BC" will be annunciated to the left of the "LDI" indicator.

A Vertical Deviation Indicator (VDI) is presented on the attitude indicator whenever the LDI is shown and valid vertical guidance is provided, such as from an ILS or WAAS GPS.

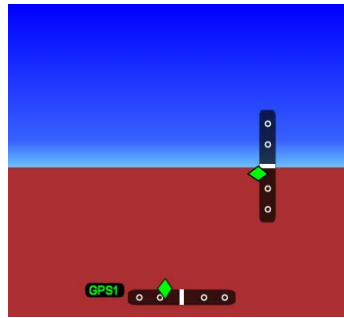


Figure 24 - LDI & VDI Displays

Navigation Source Information Block

A Navigation Source Information Block is presented in the upper left corner of the HSI display area. The Source Information Block indicates the navigation source coupled to the HSI and its associated mode (e.g. VOR, ILS, LOC, etc). Information is provided related to the coupled source including, when available, waypoint or navaid identifier or frequency, bearing and distance, and the estimated time to the active waypoint.



Figure 25 - Navigation Source Information Block

Off Scale Indication

Whenever the lateral deviation exceeds the maximum displayable range of 2.5 dots, the deviation needle of the CDI and the deviation diamond of the LDI or VDI are rendered as hollow ghosted images "pegged" to the corresponding side.

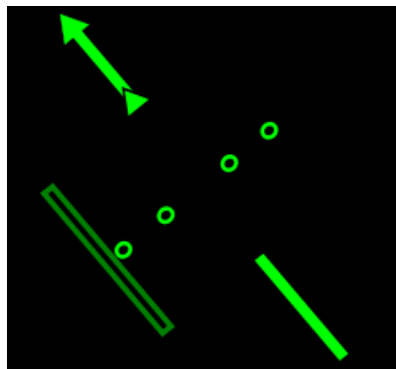


Figure 26 - Off Scale CDI



Figure 27 - Off Scale LDI



Figure 28 - Off Scale VDI

Auto Course Control

The pilot may configure the EFD1000 (via the main menu) to enable "Auto Course Select" whereby a connected GPS will automatically set the course (CRS) value whenever the GPS is auto sequencing between waypoints. This capability relieves the pilot from manually setting the course at each waypoint transition along a GPS route. When Auto Course Select is active the pilot can not adjust the CRS value.

Auto Course Select is indicated by an inverted green "A" presented adjacent to both the numerical CRS value and the "CRS" knob legend.



Figure 29 – Auto Course Select Legends

GPS Annunciations

When a compatible GPS system is coupled to the HSI, annunciations of MSG, WPT, TERM or APPR, and INTEG that are associated with that GPS navigation source are shown on the HSI display whenever these annunciations are output by the GPS. If a configured GPS fails, an amber failure annunciation is also provided indicating the failed GPS (i.e. "GPS1", "GPS2", "RSMGPS"). No other GPS annunciations are provided on the EFD1000 display. Refer to the GPS Flight Manual for information related to GPS annunciations, including a list of all possible annunciations that can be provided by any particular GPS system.

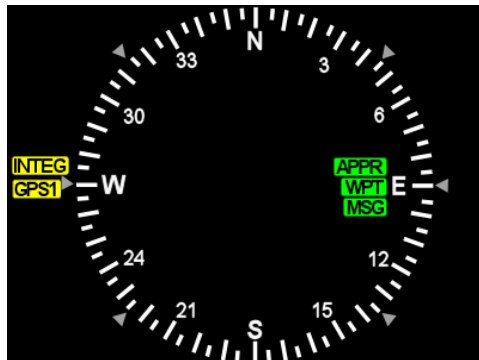


Figure 30 - GPS Annunciations

GPS Track Indicator

Whenever the EFD1000 is connected to a compatible GPS a track indicator is provided. Track is indicated as a blue diamond rendered on the compass scale at the value that corresponds to the current aircraft track.



Figure 31 - Ground Track Indicator

6.4.2 Bearing Pointers

General

Two bearing pointers that show the radial of a VOR station or the bearing to a GPS waypoint are provided. Bearing Pointers are only available in the 360 Compass mode. Any available navigation source may be coupled to either bearing pointer. If coupled to a source that does not provide angular bearing data, such as a localizer, the bearing pointer is not presented and the source is flagged as invalid.



Figure 32 - Bearing Pointers

Bearing Pointer Source Information Block

Each bearing pointer has an associated source information block that can display miscellaneous information about the source of the bearing pointer data. Information that can be displayed includes distance to station (if coupled to a GPS waypoints) and either the station identifier or the tuned frequency for a VLOC radio. This data is only presented when it is reported to the EFD1000 by the connected equipment, and thus is not available in all installations.

6.5 Situational Awareness Map Display

Basemap

The basemap presents map symbols for nearby nav aids, intersections, airports, and GPS flight plan waypoints, including curved and straight flight legs. Basemap data is presented whenever the EFD1000 system is connected to a compatible GPS. These basemap symbols underlay all other instruments and annunciations in the lower half of the display. Map and flight plan elements are received from the GPS and are only available when connected to compatible GPS equipment, such as the Garmin GNS4xx/5xx navigators.

The base map is always oriented with magnetic heading up and centered so that the current aircraft position coincides with the aircraft own ship symbol.

Map Features

When available, flight plan waypoints, airports, VORs, DMEs, NDBs, and intersection symbols are rendered as shown in Figure 33. Identifiers, when displayed, are shown adjacent to their associated symbol.

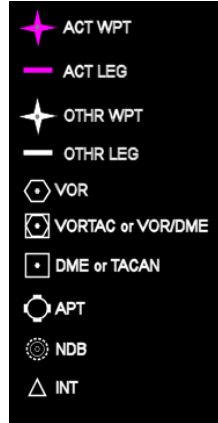


Figure 33 - Map Feature Symbols

Flight Plan

When a flight plan is received from a compatible GPS system the Basemap will show the current and future flight plan waypoints and legs. The active leg waypoint and its associated identifier are displayed in magenta. Other waypoints and legs are white. Depending on the range and selected feature display level, waypoint identifiers are displayed adjacent to their associated waypoints.

Flight plan depictions are rotated within the display to maintain their correct compass orientations at all times.



Figure 34 - Basemap Flight Plan

Basemap Position Source and Reversion

Position and flight plan data for the basemap is provided at all times by GPS1, except when GPS2 is the navigation source coupled to the HSI. In the event that the basemap position source fails an amber GPS failure annunciation will be provided, but the basemap will continue to present flight plan and mapping symbols that were associated with the failed GPS sensor by using position data from another available GPS sensor. When the basemap position is in the reversion mode, no flight leg or fly-to waypoint is indicated as 'active' (i.e. in magenta), no fly to waypoint data is provided (e.g. bearing, distance, etc), no flight plan waypoint sequencing is provided, and navigation data coupled to the CDI is flagged as invalid.

When an alternate GPS is being used as the Base map position source, the message "GPS# REVERSION" (where "#" indicates the source of the reversionary GPS position, either "1" or "2") is presented.



Figure 35 – GPS1 Failure, Reversionary Navigation

Emergency GPS Position Reversion

When the RSM GPS is enabled at installation this emergency-use only GPS may be used as the basemap position source, but only if all external GPS systems have failed or become invalid. In this case, the basemap will continue to show the last programmed flight plan information from the external GPS system, but no flight leg or fly-to waypoint is indicated as 'active' (i.e. in magenta), no fly to waypoint data is provided (e.g. bearing, distance, etc), no flight plan waypoint sequencing is provided, and navigation data coupled to the CDI is flagged as invalid..

The RSM GPS will only be activated upon failure of the external GPS system and can not be used as a primary source of position data.

When the RSM GPS is being used as the base map position source, the message: "RSM GPS REVERSION EMER USE ONLY" is presented.



Figure 36 – GPS Failure, RSM GPS Reversion

6.6 Autopilot Integration ("Pro" only)

NOTE:

**The EFD1000 "Pro Digital" does not integrate with the Autopilot.
The GPSS Hot Key is always rendered in grey.**

General

The EFD1000 "Pro" can connect with many different legacy autopilot systems that are typically found in general aviation aircraft. The EFD1000 "Pro" emulates the HSI and/or Flight Director (FD) indicator with which the autopilot was originally certified. Autopilot integration is limited to heading and navigation modes, including vertical approach modes.

When connected to an autopilot system that includes Nav or Approach couplers, the EFD also acts as the navigation source selector switch to the autopilot. This assures that the navigation information presented on the EFD1000 "Pro" 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 installation of the EFD1000 system.

The EFD1000 "Pro" does not currently provide vertical coupling to barometric references such as altitude hold, vertical speed, or altitude capture.

NOTE:

**Refer to the autopilot AFMS for information on the operation of
the autopilot or flight director.**

See the "Typical Autopilot Operation" section below for additional details on EFD1000 "Pro" operation with the autopilot systems during typical aircraft operations, such as VOR/ILS/GPS approaches.

GPSS

GPS Steering represents a modernized 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-tack 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 change, nor can it fly curved flight paths without pilot assistance. Upon reaching a waypoint, the pilot must set the course for the next leg (unless Auto Course Select is enabled – see 6.4.1), and the autopilot will then intercept and track that leg. In this type of operation, the CDI must always be set to the current desired navigation course.

With GPS Steering, the EFD1000 "Pro" can unlock the GPS Steering capability already available in many models of General Aviation GPS computers. In GPS systems with this capability, the GPS continually computes the desired bank angle to track the GPS flight plan, and outputs that information over an ARINC 429 data bus. The GPS Steering command includes anticipation of upcoming turns, including the turn rate and turn initiation point required to roll out centered on the next leg with the deviation needle centered. Some GPS systems, such as the Garmin 4xx/5xxW series of WAAS navigators, even provide GPS Steering commands for complex procedures, such as

DME arcs, holding patterns, procedure turns, etc., allowing the autopilot to fly these maneuvers without pilot input. Check with your GPS manufacturer to see if your GPS supports these capabilities.

The EFD1000 “Pro” translates GPS steering commands received over an ARINC 429 bus into a signal that is compatible with the autopilot Heading channel. Thus, by selecting GPSS on the EFD1000 “Pro” and the Heading mode of the autopilot, the autopilot is able to fly GPS Steering commands.

When GPSS is not selected, the autopilot will follow the heading bug value manually set by the pilot.

If the connected GPS system does not provide the required roll steering command, the GPSS legend adjacent to the GPSS Hot Key will be rendered in grey and it will not be possible to enable GPSS operation via the Hot Key.

NOTE:

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

The autopilot must be in Heading Mode to receive GPSS signals from the EFD1000.

Flight Director

When connected to a compatible autopilot system the EFD1000 will display a single-cue flight director. The flight director command bars visually represent the lateral and vertical steering cues transmitted to the EFD by the autopilot. When the FD output from the autopilot is unavailable or flagged invalid, the FD command bars are removed from the display.



Figure 37 – Flight Director

Typical Autopilot Operations

Whenever the EFD1000 installed configuration includes connections to GPS, VLOC and autopilot systems, the EFD1000 acts as a conduit of data between the navigation radios and the autopilot system. This configuration enables any navigation sensor available for display on the EFD system to be coupled to the autopilot.

NOTE:

Refer the autopilot system Aircraft Flight Manual Supplement and/or POH for details regarding use and operation of the autopilot system. Examples provided here are provided for reference only, and actual operation may vary depending on the autopilot system installed in your aircraft.

It is your responsibility as Pilot in Command to ensure that you are conversant with the operation of all installed equipment. Operation of the EFD1000 system in IMC conditions should not be undertaken unless you are proficient in its use and operation, as described herein.

NOTE:

When GPSS is selected on the EFD1000, the HSI heading bug is not coupled to the autopilot. To connect the heading bug to the autopilot, deselect GPSS via the GPSS Hot Key

NOTE:

The autopilot must be in Heading Mode to receive GPSS signals from the EFD1000.

NOTE:

When using an integrated VLOC/GPS radio system, select the VLOC or GPS portion of the integrated radio by pressing the CDI source select until the desired source is indicated above the EFD1000 HSI source select button.

NOTE:

The EFD1000 enables GPS LPV approaches 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.

"HDG" Mode Operation – Heading Bug Steering

1. Set the heading bug on the EFD1000 "Pro" to the desired heading
2. Verify that GPSS is not selected (GPSS Legend on Hot Keys shown in GREY)
3. Select the autopilot's heading mode.
4. Engage the autopilot
5. Verify that the autopilot turns the aircraft to the desired heading.

"HDG" Mode Operation – GPS Steering (GPSS)

1. Couple the EFD1000 "Pro" HSI to a GPS sensor
2. Select GPSS by pressing the GPSS Hot Key so that GPSS is rendered in GREEN (e.g. GPSS Active).
3. Select the autopilot's heading mode.
4. Engage the autopilot
5. Verify that the autopilot turns the aircraft to follow the GPS flight plan.

"NAV" Mode Operation – VLOC Navigation

1. Using the CDI Nav Source Select switch, couple a tuned/valid VLOC radio to the HSI and set the desired course (See 6.2.8)
2. Set the EFD1000 "Pro" heading bug to a value that will intercept the desired course
3. Engage the autopilot in heading mode and verify that the aircraft turns to the desired heading
4. ARM the nav mode of the autopilot by selecting its NAV mode.
5. Monitor the CDI deflection and verify that upon intercepting the desired course that the autopilot switches to NAV Capture, and turns to track the desired course

"NAV" Mode Operation – GPS Navigation

1. With a valid flight plan programmed in the GPS, use the CDI Nav Source Select Switch to couple the GPS to the HSI (See 6.2.8).
2. With GPSS OFF, set the EFD1000 "Pro" heading bug to a value that will intercept the active leg of the flight plan.

- OR -

Select GPSS ON via the GPSS Hot Key.

3. Engage the autopilot in heading mode and verify that the aircraft turns to a heading to intercept the active leg of the flight plan.
4. ARM the nav mode of the autopilot by selecting its NAV mode.
5. Monitor the CDI deflection and verify that upon intercepting the flight plan leg that the autopilot switches to NAV Capture, and turns to track the desired course.

"APPR" Mode Operation – ILS Approach

1. Use the CDI Nav Source Select Switch, couple a tuned/valid ILS radio frequency to the HSI, and set the desired approach course (See 6.2.8).
2. Set the EFD1000 "Pro" heading bug to a value that will intercept the desired course, or as instructed by ATC
3. Engage the autopilot in heading mode and verify that the aircraft turns to the desired heading
4. Once cleared for the ILS approach, arm the autopilot's Approach mode.
5. Monitor the CDI localizer deflection and verify upon intercepting the localizer that the autopilot switches to Approach NAV Capture, turns to track the localizer course, and arms the glide slope.
6. Monitor the autopilot localizer tracking performance. Upon intercepting the glide slope verify that the autopilot switches from glide slope ARM to glide slope capture, and initiates a descent to track the glide slope.

"APPR" Mode Operation – GPS or GPS LPV WAAS Approach

1. With a valid GPS Approach programmed in the GPS, use the CDI Nav Source Select switch to couple the GPS to the HSI (See 6.2.8).
2. With GPSS OFF, set the EFD1000 "Pro" heading bug to a value that will intercept the active leg of the flight plan.
- OR -
Select GPSS ON via the GPSS Hot Key.
3. Engage the autopilot in heading mode and verify that the aircraft turns to a heading to intercept the active leg of the approach
4. Monitor the CDI cross track deviation and verify that upon intercepting the active leg of the approach that the autopilot turns to track the GPS Approach guidance

THE FOLLOWING APPLIES FOR GPS LPV APPROACHES ONLY

5. Once cleared for the GPS LPV approach, arm the autopilot's Approach mode.
6. Monitor the CDI GPS Lateral Deviation and verify that while tracking and/or intercepting the final approach course that once the GPS APPROACH mode goes active and LPV vertical deviation is presented on the EFD that the autopilot arms the glide slope.
7. Monitor the autopilot lateral approach course tracking. Upon intercepting the LPV glide slope verify that the autopilot switches from glide slope ARM to glide slope capture, and initiates a descent to track the LPV glide slope.

GPSS "APPR" Mode Operation – GPS Underlay to ILS Approach

1. With a valid GPS Approach programmed in the GPS, use the CDI Nav Source Select switch to couple the GPS to the HSI (See 6.2.8).
2. Select GPSS ON via the GPSS Hot Key.
3. Engage the autopilot in heading mode and verify that the aircraft turns to a heading to intercept the active leg of the approach
4. Monitor the CDI cross track deviation and progress along the ILS GPS Approach Underlay
5. Verify that the ILS frequency is tuned
6. Once cleared for the ILS approach, couple the EFD1000 "Pro" HSI to the tuned ILS (if not done automatically by the coupled radio) and arm the autopilot's Approach mode.
7. Monitor the CDI localizer deflection and verify that upon intercepting the localizer that the autopilot switches to Approach NAV Capture, turns to track the localizer course, and arms the glide slope.
8. Monitor the autopilot localizer tracking performance. Upon intercepting the glide slope verify that the autopilot switches from glide slope ARM to glide slope capture, and initiates a descent to track the glide slope.

6.7 Main Menu Operation

6.7.1 Menu Controls

The EFD1000 Main menu is used to adjust various system configuration settings and preferences. To select the Main Menu, press the MENU button on the right side of the display bezel. To leave the menu, press the MENU button again. Menu items are shown exclusively in the lower half of the EFD1000 display in the region below the data bar.

Main Menu Navigation

Once the Main menu is activated, rotating the lower right control knob selects between the various menu pages. Figure 38 below shows a typical menu structure when the main menu is activated. In this example, the "360 Map Settings" page is selected. The current menu page is indicated by the page name and legend "page # of #", and by the location of the green segment within the segmented menu navigation bar displayed at the bottom of the display.



Figure 38 - Main Menu Navigation

Configuring Menu Items

Each menu page shows a series of menu selections adjacent to the right bezel line select keys (See Fig. 39). Editable menu selections are indicated by white text, while status only or non-editable items are shown in green. Items that have been inhibited from editing are shown in gray.

Pressing a line select key adjacent to an editable field enables the item for editing, indicated by showing the editable value in magenta. Rotating the lower right control knob adjusts the editable value. Changes are effective immediately.



Figure 39 - Main Menu Line select keys

To exit the edit mode press the adjacent line select key, press the right control knob, or leave the menu by pressing the MENU button.

6.7.2 Menu Options

General Settings Page

From the GENERAL SETTINGS page the pilot may:

- Configure the barometric altimeter setting units to inches or millibars (IN / mB)
- ENABLE or DISABLE the display of V-Speeds
- ENABLE or DISABLE GPS Auto Course operations
- Select between ARC HSI and ARC CDI compass view modes.
- Perform an AHRS RESET.

360 and ARC Map Settings Display Level Pages

From the 360 and ARC Map Settings Pages the pilot may configure the way basemap features are displayed in either the 360 or ARC HSI view modes. Separate settings are possible for each view mode. For each feature, the pilot may select either "ON", "AUTO", or "OFF".

When a display feature is selected "ON", it will always be displayed on the basemap.

When a feature is "OFF", it will never be displayed on the basemap.

When a feature is set to "AUTO", it will be displayed in accordance with a pre-set relationship that is a function of the feature display level setting (e.g. High, Medium or Low), the current map range, and the type of feature.

For example, when set to "AUTO" Terminal VOR/DME's are shown at range scales less than 30nm on the HIGH feature display level setting, but would not otherwise be shown. Similar logic is employed for all basemap features.

V-Speed Setting Pages

The V-Speed settings page allows the pilot to set the values at which V-Speed markers will be presented on the airspeed tape. When set to a value of zero the associated V-Speed icon is not rendered.

V-Speed values may be set for:

- V_a – Design Maneuvering Speed
- V_{bg} – Best Glide Speed
- V_{ref} – Approach Reference Speed
- V_r – Rotation Speed
- V_x – Best Angle of Climb Speed
- V_y – Best Rate of Climb Speed
- V_{lo} – Maximum Landing Gear Operating Speed
- V_{le} – Maximum Landing Gear Extended Speed

NOTE:

V-Speed editing may be inhibited in the installation configuration menus. When inhibited, V-speed values are rendered in grey and can not be adjusted by the pilot.

Power Settings Page

The POWER SETTINGS page is used to monitor and control the source of power to the EFD1000, including overriding automatic power states. From the POWER SETTINGS Page the pilot may:

- Switch to Battery Power from External Power
- Switch to External Power from Battery Power
- Shut down or Restart the unit
- View the External Power Source Voltage
- View the Internal Battery Status

System Status

The SYSTEM STATUS page is used to display information about the EFD1000 system and software. From the SYSTEM STATUS page the pilot may:

- View the Main Application Processor software version
- View the Input Output Processor software version
- View the EFD1000 Feature load version

6.8 List of Acronyms

ACU.....	Analog Converter Unit
AFMS.....	Airplane Flight Manual Supplement
AHRS.....	Attitude Heading Reference System
BARO.....	Barometric Pressure Setting
BC.....	Back Course
BP.....	Bearing Pointer
CDI.....	Course Deviation Indicator
CM.....	Configuration Module
DH.....	Decision Height
DME.....	Distance Measuring Equipment
EFIS.....	Electronic Flight Instrument System
GPS.....	Global Positioning System
GPSS.....	GPS Steering
GS.....	Ground Speed
HDG.....	Heading
HSI.....	Horizontal Situation Indicator
IAS.....	Indicated Airspeed
IMC.....	Instrument Meteorological Conditions
LDI.....	Lateral Deviation Indicator
MSL.....	Mean Sea Level
NDB.....	Non-Directional Beacon
OAT.....	Outside Air Temperature
OBS.....	Omni Bearing Selector
PFD.....	Primary Flight Display
RMI.....	Radio Magnetic Indicator
RSM.....	Remote Sensor Module
TAS.....	True Airspeed
VDI.....	Vertical Deviation Indicator
VLOC.....	VOR / Localizer navigation
VOR.....	VHF Omni-directional Radio Range
VSI.....	Vertical Speed Indicator