

SECTION 2 FLIGHT INSTRUMENTS



WARNING: If the airspeed, attitude, altitude, or heading indications become unusable, refer to the backup instruments.



NOTE: The Automatic Flight Control System (AFCS) provides additional readouts and bugs on selected flight instruments. Refer to the AFCS Section for details on these bugs and readouts, as they appear on the display during certain AFCS modes.

Increased situational awareness is provided by replacing the traditional instruments on the panel with an easy-to-scan Primary Flight Display (PFD) that features a large horizon, airspeed, attitude, altitude, vertical speed, and course deviation information. In addition to the flight instruments, navigation, communication, terrain, traffic, and weather information are also presented on the PFD and explained in other sections of this Pilot's Guide.

The following flight instruments and supplemental flight data are displayed on the PFD:

- Airspeed Indicator, showing
 - Indicated airspeed
 - True airspeed
 - Trend vector
 - Airspeed awareness ranges
 - Vspeed reference flags
- Attitude Indicator with slip/skid indication
- Altimeter, showing
 - Trend vector
 - Barometric setting
 - Reference altitude
- Vertical Deviation, Glideslope, and Glidepath Indicators
- Vertical Speed Indicator (VSI)
- Vertical Navigation (VNV) indications
- Outside air temperature (OAT)
- Horizontal Situation Indicator, showing
 - Turn Rate Indicator
 - Bearing pointers and information windows
 - Navigation source
 - Course Deviation Indicator (CDI)
 - DME Information Window
- Transponder Mode, Code, and Ident/Reply
- Timer/References Window, showing
 - Generic timer
 - Vspeed values
 - Barometric Minimum Descent Altitude (MDA)
- Wind data

The PFD also displays various alerts and annunciations.



- ① NAV Frequency Box
- ② Airspeed Indicator
- ③ True Airspeed
- ④ Current Heading
- ⑤ Turn Rate Indicator
- ⑥ Heading Bug
- ⑦ Outside Air Temperature (OAT)
- ⑧ Softkeys
- ⑨ System Time
- ⑩ Transponder Data Box
- ⑪ Horizontal Situation Indicator (HSI)
- ⑫ Barometric Altimeter Setting
- ⑬ Vertical Speed Indicator (VSI)
- ⑭ Reference Altitude Bug
- ⑮ Altimeter
- ⑯ Reference Altitude
- ⑰ COM Frequency Box
- ⑱ Navigation Status Box
- ⑲ Slip/Skid Indicator
- ⑳ Attitude Indicator

Figure 2-1 Primary Flight Display (Default)



- | | |
|--|------------------------------|
| ① Traffic Annunciation | ⑨ Flight Plan Window |
| ② Vspeed Reference | ⑩ Annunciation Window |
| ③ Selected Heading | ⑪ Selected Course |
| ④ Wind Data | ⑫ Current Vertical Speed |
| ⑤ Inset Map | ⑬ Glideslope Indicator |
| ⑥ DME Information Window | ⑭ Marker Beacon Annunciation |
| ⑦ Bearing Information Windows | ⑮ Terrain Annunciation |
| ⑧ Minimum Descent Altitude/Decision Height | ⑯ AFCS Status Annunciation |

Figure 2-2 Additional PFD Information

2.1 FLIGHT INSTRUMENTS

AIRSPEED INDICATOR



NOTE: Refer to the Pilot's Operating Handbook (POH) for airspeed criteria and Vspeed values.

The Airspeed Indicator displays airspeed on a moving tape rolling number gauge. The true airspeed is displayed in knots below the Airspeed Indicator. The numeric labels and major tick marks on the moving tape are shown at intervals of 10 knots. The minor tick marks on the moving tape are shown at intervals of five knots. Speed indication starts at 20 knots, with 60 knots of airspeed viewable at any time. The indicated airspeed is displayed inside the black pointer. The pointer remains black until reaching never-exceed speed (V_{NE}), at which point it turns red.

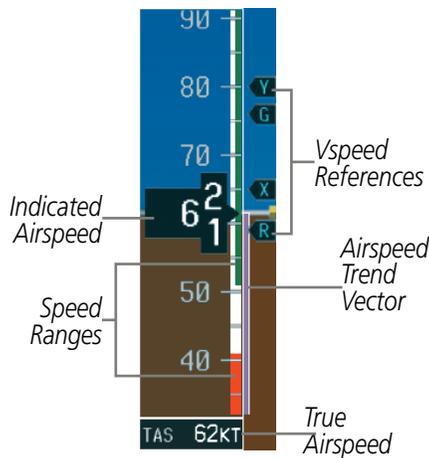


Figure 2-3 Airspeed Indicator (Model 182T)



Figure 2-4 Red Pointer Showing Overspeed (Model 172R)

A color-coded (white, green, yellow, and red) speed range strip is located on the moving tape. The colors denote flaps operating range, normal operating range, caution range, and never-exceed speed (V_{NE}). A red range is also present for low speed awareness.

The Airspeed Trend Vector is a vertical, magenta line that appears to the right of the color-coded speed range strip when airspeed is either accelerating or decelerating. One end of the magenta line is anchored to the tip of the airspeed pointer while the other end moves continuously up or down corresponding to the rate of acceleration or deceleration. For any constant rate of acceleration or deceleration, the moving end of the line shows approximately what the indicated airspeed value will be in six seconds. If the trend vector crosses V_{NE} , the text of the actual airspeed readout changes to yellow. The trend vector is absent if the speed remains constant or if any data needed to calculate airspeed is not available due to a system failure.

Vspeeds (Glide, V_R , V_X , and V_Y) can be changed and their flags turned on/off from the Timer/References Window. When active (on), the Vspeeds are displayed to the right of the airspeed scale.

Changing Vspeeds and turning Vspeed flags on/off:

- 1) Press the **TMR/REF** Softkey.
- 2) Turn the large **FMS** Knob to highlight the field of the desired Vspeed to be changed.
- 3) Use the **FMS** Knob to enter the desired value. When a speed has been changed from a default value, an asterisk appears next to the speed.
- 4) Press the **ENT** Key or turn the large **FMS** Knob to highlight the ON/OFF field.
- 5) Turn the small **FMS** Knob clockwise to ON or counterclockwise to OFF.
- 6) To remove the window, press the **CLR** Key or the **TMR/REF** Softkey.

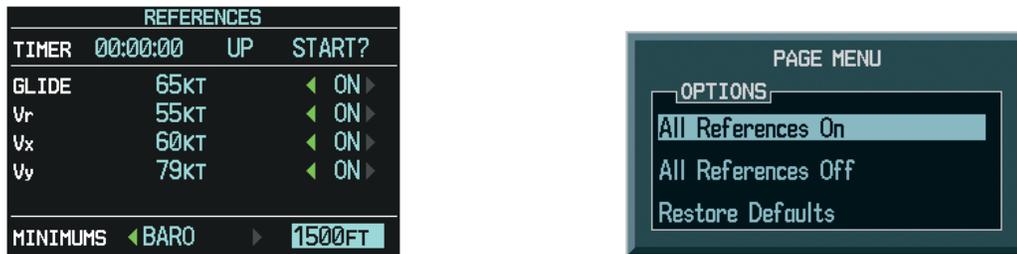


Figure 2-5 Timer/References Window and Menu

Turning all Vspeed flags on/off:

- 1) Press the **TMR/REF** Softkey.
- 2) Press the **MENU** Key.
- 3) To activate all Vspeed flags, press the **ENT** Key with All References On highlighted.
- 4) To remove all Vspeed flags, turn the **FMS** Knob to highlight All References Off and press the **ENT** Key.

Restoring all Vspeed defaults:

- 1) Press the **TMR/REF** Softkey.
- 2) Press the **MENU** Key.
- 3) Turn the **FMS** Knob to highlight Restore Defaults and press the **ENT** Key.

ATTITUDE INDICATOR

Attitude information is displayed over a virtual blue sky and brown ground with a white horizon line. The Attitude Indicator displays the pitch, roll, and slip/skid information.

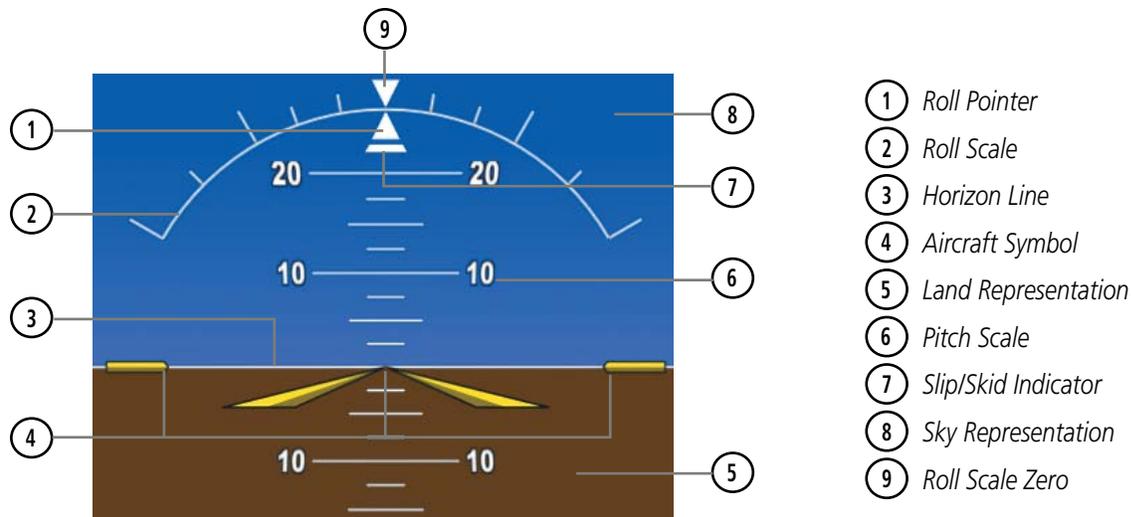


Figure 2-6 Attitude Indicator

The horizon line is part of the pitch scale. Above and below the horizon line, major pitch marks and numeric labels are shown for every 10°, up to 80°. Minor pitch marks are shown for intervening 5° increments, up to 25° below and 45° above the horizon line. Between 20° below to 20° above the horizon line, minor pitch marks occur every 2.5°. If the Synthetic Vision System (optional) is activated, the pitch scale is reduced to 10° up and 7.5° down; refer to the Additional Features section.

The inverted white triangle indicates zero on the roll scale. Major tick marks at 30° and 60° and minor tick marks at 10°, 20°, and 45° are shown to the left and right of the zero. Angle of bank is indicated by the position of the pointer on the roll scale.

The Slip/Skid Indicator is the bar beneath the roll pointer. One bar displacement is equal to one ball displacement on a traditional inclinometer. The indicator bar moves with the roll pointer and moves laterally away from the pointer to indicate uncoordinated flight. Slip (inside the turn) or skid (outside the turn) is indicated by the location of the bar relative to the pointer.



Figure 2-7 Slip/Skid Indication

ALTIMETER

The Altimeter displays 600 feet of barometric altitude values at a time on a moving tape rolling number gauge. Numeric labels and major tick marks are shown at intervals of 100 feet. Minor tick marks are at intervals of 20 feet. The indicated altitude is displayed inside the black pointer.

The Selected Altitude is displayed above the Altimeter in the box indicated by a selection bug symbol. A bug corresponding to this altitude is shown on the tape. If the Selected Altitude exceeds the range shown on the tape, the bug appears at the upper or lower edge of the tape. When the metric value is selected it is displayed in a separate box above the Selected Altitude.

A magenta Altitude Trend Vector extends up or down the left of the altitude tape, the end resting at the approximate altitude to be reached in six seconds at the current vertical speed. The trend vector is not shown if altitude remains constant or if data needed for calculation is not available due to a system failure.

Setting the Selected Altitude:

Turn the **ALT** Knob to set the Selected Altitude (large knob for 1000-ft increments, small knob for 100-ft increments).

If set, the Minimum Descent Altitude/Decision Height (MDA/DH) value is also available for the Selected Altitude.

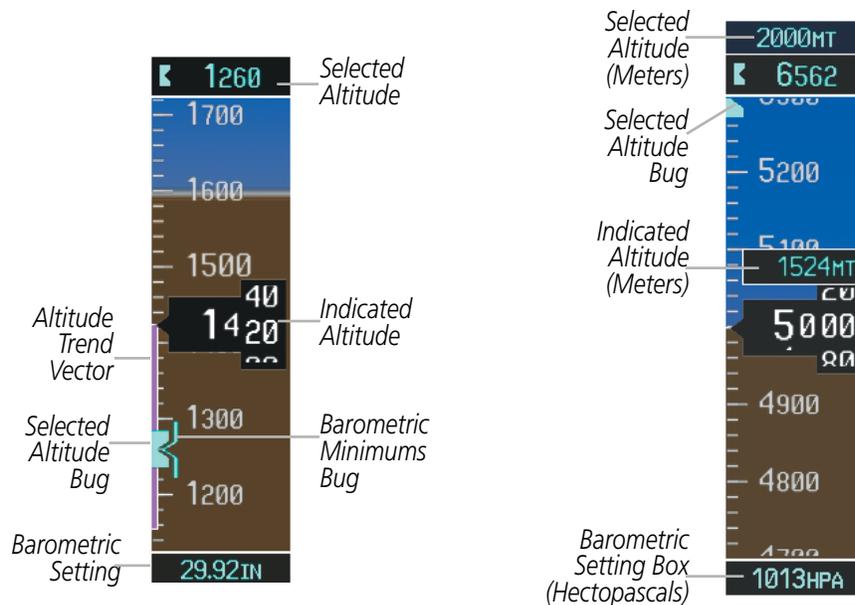


Figure 2-8 Altimeter Settings, In Hg and Metric

Altitudes can also be displayed in meters. Note that the altitude tape does not change scale.

Displaying altitude in meters:

- 1) Press the **PFD** Softkey to display the second-level softkeys.
- 2) Press the **ALT UNIT** Softkey.
- 3) Press the **METERS** Softkey to turn on metric altitude readouts.
- 4) Press the **BACK** Softkey to return to the top-level softkeys.

The barometric pressure setting is displayed below the Altimeter in inches of mercury (in Hg) or hectopascals (hPa) when metric units are selected. Adjusting the altimeter barometric pressure setting creates discontinuities in VNV vertical navigation, moving the descent path. For large adjustments, it may take several minutes for the aircraft to re-establish on the descent patch. If the change is made while nearing a waypoint with a VNV Target Altitude, the aircraft may not re-establish on the descent path in time to meet the vertical constraint.

Selecting the altimeter barometric pressure setting:

Turn the **BARO** Knob to select the desired setting.

Selecting standard barometric pressure:

- 1) Press the **PFD** Softkey to display the second-level softkeys..
- 2) Press the **STD BARO** Softkey; STD BARO is displayed in barometric setting box (Figure 2-9).



Figure 2-9 Standard Barometric Altimeter Setting

Changing altimeter barometric pressure setting units:

- 1) Press the **PFD** Softkey to display the second-level softkeys.
- 2) Press the **ALT UNIT** Softkey.
- 3) Press the **IN** Softkey to display the barometric pressure setting in inches of mercury (in Hg).
Or: Press the **HPA** Softkey to display the barometric pressure setting in hectopascals (hPa).
- 4) Press the **BACK** Softkey to return to the top-level softkeys.

A Baro Transition Alert is provided to notify the pilot to change the barometric pressure setting when crossing the baro transition altitude. If the aircraft is at least 500 feet below the transition altitude and then climbs through this altitude and the **STD BARO** Softkey has not been pressed, the barometric pressure setting flashes in light blue until the pressure setting is changed. If the aircraft is at least 500 feet above the transition altitude and then descends through this altitude and the barometric pressure setting has not been changed from STD BARO, the setting flashes in light blue until it is changed (Figure 2-10).

Setting the Baro Transition Alert:

- 1) Use the **FMS** Knob to select the AUX - System Setup Page.
- 2) Press the **FMS** Knob to activate the cursor.
- 3) Turn the large **FMS** Knob to highlight 'OFF or ON' in the 'BARO TRANSITION ALERT' box.
- 4) Turn the small **FMS** Knob to turn the alert OFF or ON and press the **ENT** Key.
- 5) With the altitude field highlighted, turn the small **FMS** Knob to select the desired altitude and press the **ENT** Key.
- 6) To cancel the selection, press the **FMS** Knob.



Pressure setting flashes during climb above transition altitude if the STD BARO Softkey has not been pressed.



Pressure setting flashes during descent below transition altitude to indicate setting has not been changed from STD BARO.



Figure 2-10 Baro Transition Alert (AUX - System Setup Page)

VERTICAL SPEED INDICATOR (VSI)

The Vertical Speed Indicator (VSI) displays the aircraft vertical speed on a fixed scale with labels at 1000 and 2000 fpm and minor tick marks every 500 fpm (Figure 2-11). Digits appear in the pointer when the climb or descent rate is greater than 100 fpm. If the rate of ascent/descent exceeds 2000 fpm, the pointer appears at the edge of the tape and the rate appears inside the pointer.

A magenta chevron is displayed as the Required Vertical Speed Indication (RVSI) for reaching a VNV Target Altitude once the “TOD [Top of Descent] within 1 minute” alert has been generated. See the Flight Management and AFCS sections for details on VNV features, and refer to Section 2.2, Supplemental Flight Data, for more information about VNV indications on the PFD.

VERTICAL DEVIATION



NOTE: The Glidepath Indicator is only shown for aircraft with GIA 63W Integrated Avionics Units when SBAS is available.

The Vertical Deviation Indicator (VDI) is a magenta chevron indicating the baro-VNV vertical deviation when Vertical Navigation (VNV) is being used. The VDI appears in conjunction with the “TOD within 1 minute” alert. The VDI is removed from the display if vertical deviation becomes invalid. See the Flight Management Section for details on VNV features, and refer to Section 2.2, Supplemental Flight Data, for more information about VNV indications on the PFD.

The Glideslope Indicator appears to the left of the Altimeter whenever an ILS frequency is tuned in the active NAV field and the aircraft heading and selected course are within 107°. A green diamond acts as the Glideslope Indicator, like a glideslope needle on a conventional indicator. If a localizer frequency is tuned and there is no glideslope, “NO GS” is displayed in place of the diamond.

The glidepath is analogous to the glideslope for GPS approaches supporting SBAS vertical guidance (LNAV+V, L/VNAV, LPV). When an approach of this type is loaded into the flight plan and GPS is the selected navigation source, the Glidepath Indicator appears as a magenta diamond during the approach. If the approach type downgrades past the final approach fix (FAF), “NO GP” is displayed in place of the diamond.

Full-scale deflection of two dots is 1000 feet.

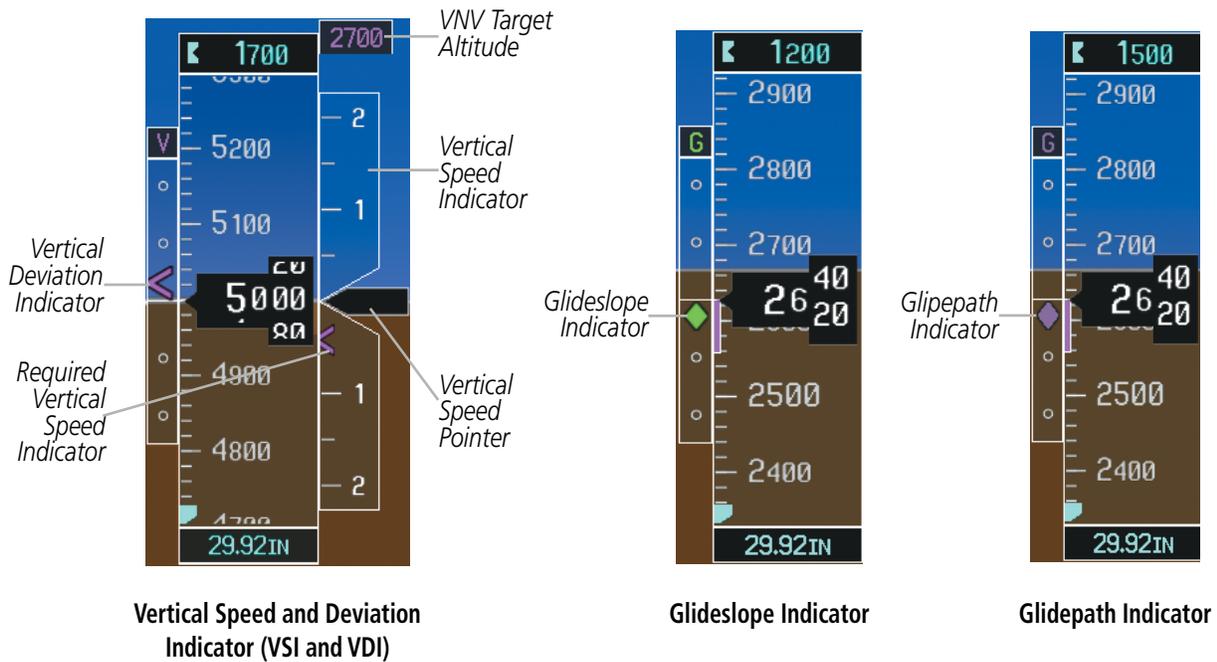


Figure 2-11 Vertical Speed and Vertical Deviation Indications

HORIZONTAL SITUATION INDICATOR (HSI)

The Horizontal Situation Indicator (HSI) displays a rotating compass card in a heading-up orientation. Letters indicate the cardinal points with numeric labels every 30°. Major tick marks are at 10° intervals and minor tick marks are at 5° intervals. A digital reading of the current heading appears on top of the HSI, and the current track is represented on the HSI by a magenta diamond. The HSI also presents turn rate, course deviation, bearing, and navigation source information. The HSI is available in two formats, a 360° compass rose and a 140° arc.

Changing the HSI display format:

- 1) Press the **PFD Softkey**
- 2) Press the **HSI FRMT Softkey**.
- 3) Press the **360 HSI** or **ARC HSI** Softkey.

The 360° HSI contains a Course Deviation Indicator (CDI), with a Course Pointer, To/From Indicator, and a sliding deviation bar and scale. The course pointer is a single line arrow (GPS, VOR1, and LOC1) or a double line arrow (VOR2 and LOC2) which points in the direction of the set course. The To/From arrow rotates with the course pointer and is displayed when the active NAVAID is received.

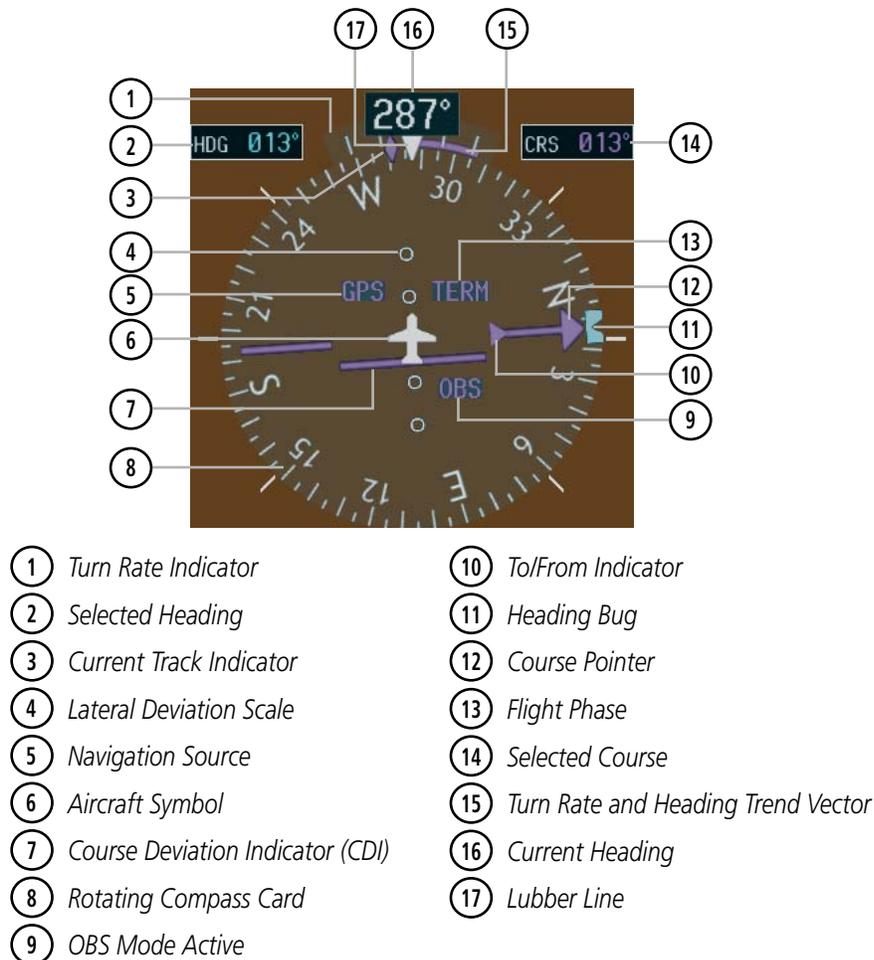


Figure 2-12 Horizontal Situation Indicator (360° HSI)

The Arc HSI is a 140° expanded section of the compass rose. The Arc HSI contains a Course Pointer, combined To/From Indicator and a sliding deviation indicator, and a deviation scale. Upon station passage, the To/From Indicator flips and points to the tail of the aircraft, just like a conventional To/From flag. Depending on the navigation source, the CDI on the Arc HSI can appear in two different ways, an arrowhead (GPS, VOR, OBS) or a diamond (LOC).

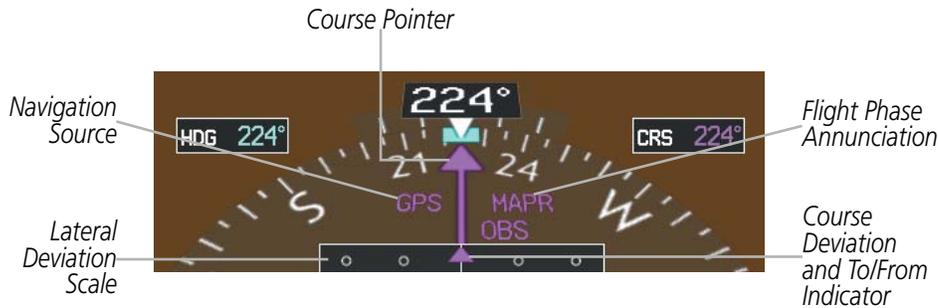


Figure 2-13 Arc HSI

The selected heading is shown to the upper left of the HSI and is displayed in light blue. The light blue heading bug on the compass rose corresponds to the selected heading.

Adjusting the selected heading:

Turn the **HDG** Knob to set the selected heading.

Press the **HDG** Knob to synchronize the bug to the current heading.

The Selected Course is shown to the upper right of the HSI. The color of the Selected Course corresponds to the selected navigation source: magenta for GPS or green for NAV (VOR, LOC).

Adjusting the Selected Course:

Turn the **CRS** Knob to set the Selected Course.

Press the **CRS** Knob to re-center the CDI and return the course pointer to the bearing of the active waypoint or navigation station (see OBS Mode for adjusting a GPS course).



Figure 2-14 Heading and Course Indications (Magnetic)

SYSTEM OVERVIEW

FLIGHT INSTRUMENTS

EIS

AUDIO PANEL & CNS

FLIGHT MANAGEMENT

HAZARD AVOIDANCE

AFCS

ADDITIONAL FEATURES

APPENDICES

INDEX

Navigation angles (track, heading, course, bearing) are corrected to the computed magnetic variation (Mag Var) or referenced to true north (T), set on the AUX - System Setup Page. When an approach referenced to true north has been loaded into the flight plan, the system generates a message to change the navigation angle setting to True at the appropriate time.



Figure 2-15 Heading and Course Indications (True)

Changing the navigation angle true/magnetic setting:

- 1) Use the **FMS** Knob to select the AUX - System Setup Page on the MFD.
- 2) Press the **FMS** Knob to activate the cursor.
- 3) Turn the large **FMS** Knob to highlight Nav Angle in the Display Units box.
- 4) Turn the small **FMS** Knob to highlight the desired setting and press the **ENT** Key.
 - TRUE - References angles to true north (T)
 - MAGNETIC - Angles corrected to the computed magnetic variation (Mag Var)



Figure 2-16 Navigation Angle Settings (AUX - System Setup Page)

TURN RATE INDICATOR

The Turn Rate Indicator is located directly above the rotating compass card. Tick marks to the left and right of the lubber line denote half-standard and standard turn rates. A magenta Turn Rate Trend Vector shows the current turn rate. The end of the trend vector gives the heading predicted in 6 seconds, based on the present turn rate. A standard-rate turn is shown on the indicator by the trend vector stopping at the standard turn rate tick mark, corresponding to a predicted heading of 18° from the current heading. At rates greater than 4 deg/sec, an arrowhead appears at the end of the magenta trend vector and the prediction is no longer valid.



Figure 2-17 Turn Rate Indicator and Trend Vector

BEARING POINTERS AND INFORMATION WINDOWS

Two bearing pointers and associated information can be displayed on the HSI for NAV, GPS, and ADF sources by pressing the **PFD** Softkey then a **BRG** or **DME** Softkey. The bearing pointers are light blue and are single-line (BRG1) or double-line (BRG2). A pointer symbol is shown in the information windows to indicate the navigation source. The bearing pointers never override the CDI and are visually separated from the CDI by a white ring. Bearing pointers may be selected but not necessarily visible due to data unavailability. When the Arc HSI is displayed, the Bearing Information windows and pointers are disabled.

NOTE: ADF radio installation is optional.

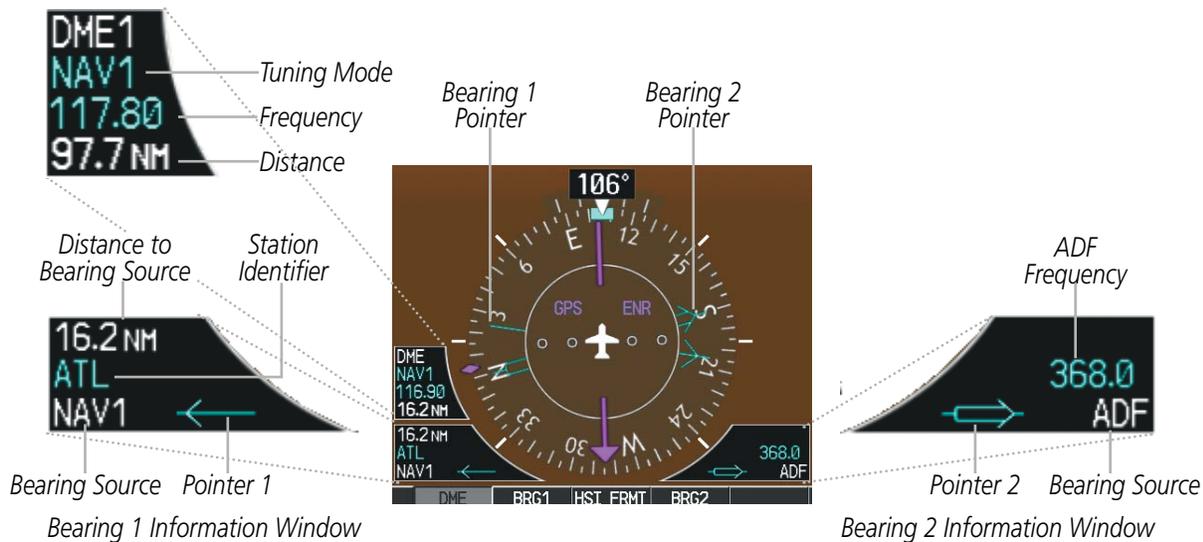


Figure 2-18 HSI with Bearing and Distance Information

When a bearing pointer is displayed, the associated information window is also displayed. The Bearing Information Windows (Figure 2-18) are displayed at the lower sides of the HSI and give the following information:

- Bearing source (NAV, GPS, ADF)
- Pointer icon (BRG1 = single line, BRG2 = double line)
- Frequency (NAV, ADF)
- Station/waypoint identifier (NAV, GPS)
- GPS-derived great circle distance to bearing source

When the NAV radio is tuned to an ILS frequency the bearing source and the bearing pointer is removed from the HSI. When NAV1 or NAV2 is the selected bearing source, the frequency is replaced by the station identifier when the station is within range. If GPS is the bearing source, the active waypoint identifier is displayed instead of a frequency.

The bearing pointer is removed from the HSI and NO DATA is displayed in the information window if the NAV radio is not receiving a VOR station or if GPS is the bearing source and an active waypoint is not selected.

Selecting bearing display and changing sources:

- 1) Press the **PFD** Softkey.
- 2) Press a **BRG** Softkey to display the desired bearing pointer and information window with a NAV source.
- 3) Press the **BRG** Softkey again to change the bearing source to GPS.
- 4) To remove the bearing pointer and information window, press the **BRG** Softkey again.

DME INFORMATION WINDOW

The DME Information Window is displayed above the BRG1 Information Window on the 360° HSI and in a box above and along side the Arc HSI. It shows the DME label, tuning mode (NAV1, NAV2, or HOLD), frequency, and distance. When a signal is invalid, the distance is replaced by –. – NM Refer to the Audio Panel and CNS Section for information on tuning the DME.



NOTE: DME installation is optional.

Displaying the DME Information Window:

- 1) Press the **PFD** Softkey.
- 2) Press the **DME** Softkey to display the DME Information Window.
- 3) To remove the DME Information Window, press the **DME** Softkey again.

COURSE DEVIATION INDICATOR (CDI)

NOTE: During a heading change of greater than 105° with respect to the course, the CDI on the Arc HSI switches to the opposite side of the deviation scale and displays reverse sensing.

The Course Deviation Indicator (CDI) moves left or right from the course pointer along a lateral deviation scale to display aircraft position relative to the course. If the course deviation data is not valid, the CDI is not displayed.

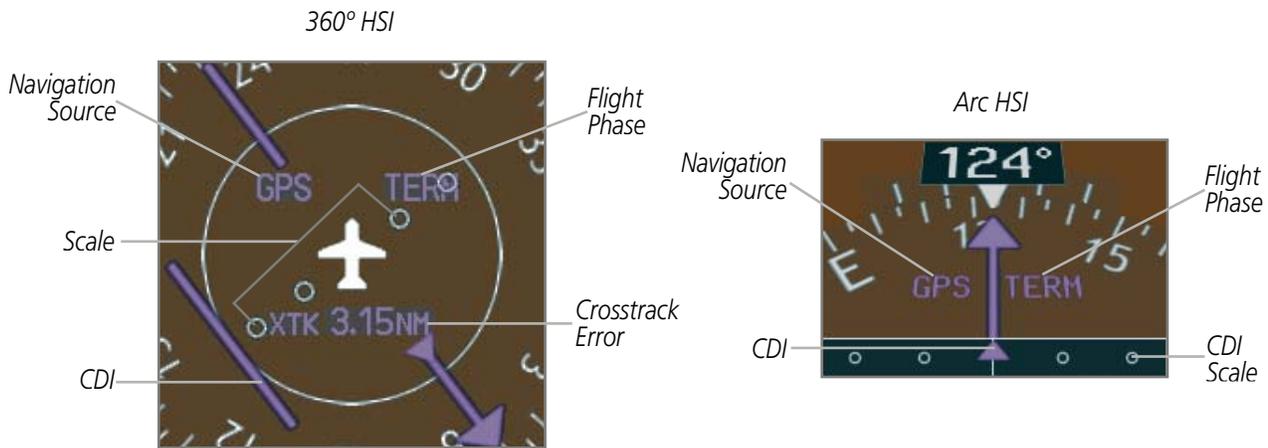


Figure 2-19 Course Deviation Indicator

The CDI can display two sources of navigation, GPS or VOR/LOC. The color indicates the current navigation source, magenta for GPS and green for VOR and LOC. The full scale limits for the CDI are defined by a GPS-derived distance when navigating GPS. When navigating using a VOR or localizer (LOC), the CDI uses the same angular deviation as a mechanical CDI. If the CDI exceeds the maximum deviation on the scale (two dots) while navigating with GPS, the crosstrack error (XTK) is displayed below the white aircraft symbol.

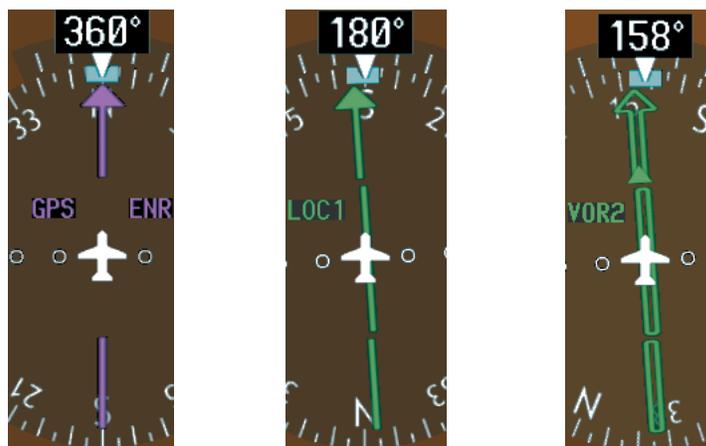


Figure 2-20 Navigation Sources

Changing navigation sources:

- 1) Press the **CDI** Softkey to change from GPS to VOR1 or LOC1. This places the light blue tuning box over the NAV1 standby frequency in the upper left corner of the PFD.
- 2) Press the **CDI** Softkey again to change from VOR1 or LOC1 to VOR2 or LOC2. This places the light blue tuning box over the NAV2 standby frequency.
- 3) Press the **CDI** Softkey a third time to return to GPS.

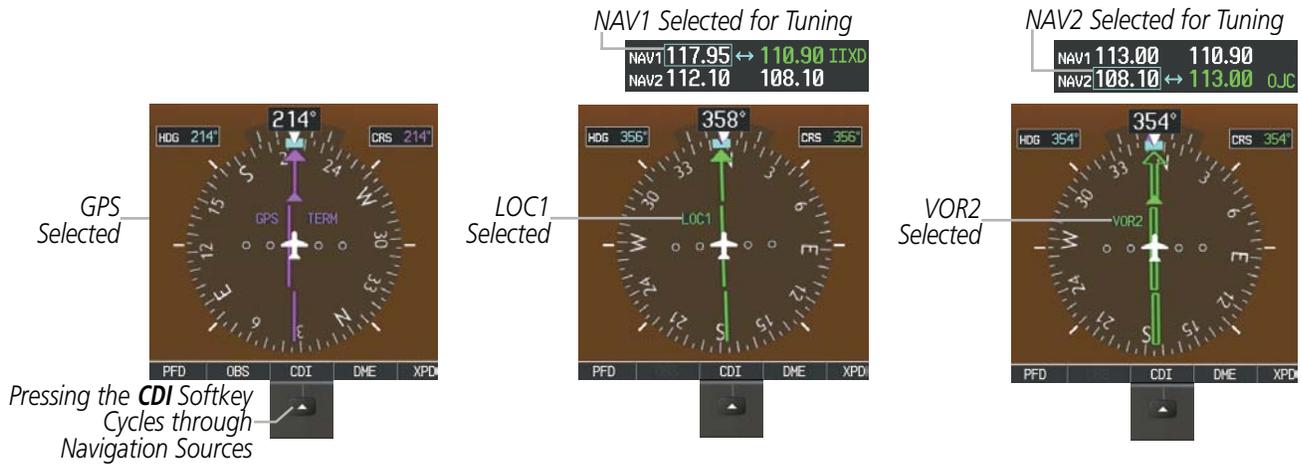


Figure 2-21 Selecting a Navigation Source

The system automatically switches from GPS to LOC navigation source and changes the CDI scaling accordingly when all of the following occur:

- A localizer or ILS approach has been loaded into the active flight plan
- The final approach fix (FAF) is the active leg, the FAF is less than 15 nm away, and the aircraft is moving toward the FAF
- A valid localizer frequency has been tuned
- The GPS CDI deviation is less than 1.2 times full-scale deflection

GPS steering guidance is still provided after the CDI automatically switches to LOC until LOC capture, up to the Final Approach Fix (FAF) for an ILS approach, or until GPS information becomes invalid. Activating a Vector-to-Final (VTF) also causes the CDI to switch to LOC navigation source. GPS steering guidance is not provided after the switch.

GPS CDI SCALING

When GPS is the selected navigation source, the flight plan legs are sequenced automatically and annunciations appear on the HSI for the flight phase. Flight phase annunciations are normally shown in magenta, but when cautionary conditions exist the color changes to yellow. If the current leg in the flight plan is a heading leg, HDG LEG is annunciated in magenta beneath the aircraft symbol.

The current GPS CDI scale setting is displayed as System CDI on the AUX - System Setup Page and the full-scale deflection setting may also be changed (2.0 nm, 1.0 nm, 0.3 nm, or Auto) from this page. If the selected scaling is smaller than the automatic setting for enroute and terminal phases, the CDI is scaled accordingly and the selected setting is displayed rather than the flight phase annunciation.

Changing the selected GPS CDI setting:

- 1) Use the **FMS** Knob to select the AUX - System Setup Page on the MFD.
- 2) Press the **FMS** Knob to activate the cursor.
- 3) Turn the large **FMS** Knob to highlight Selected in the GPS CDI box.
- 4) Turn the small **FMS** Knob to highlight the desired setting and press the **ENT** Key.
- 5) To cancel the selection, press the **FMS** Knob or the **CLR** Key.



Figure 2-22 GPS CDI Settings (AUX - System Setup Page)

When set to Auto (default), the GPS CDI scale automatically adjusts to the desired limits based upon the current phase of flight (Figure 2-23, Table 2-1).

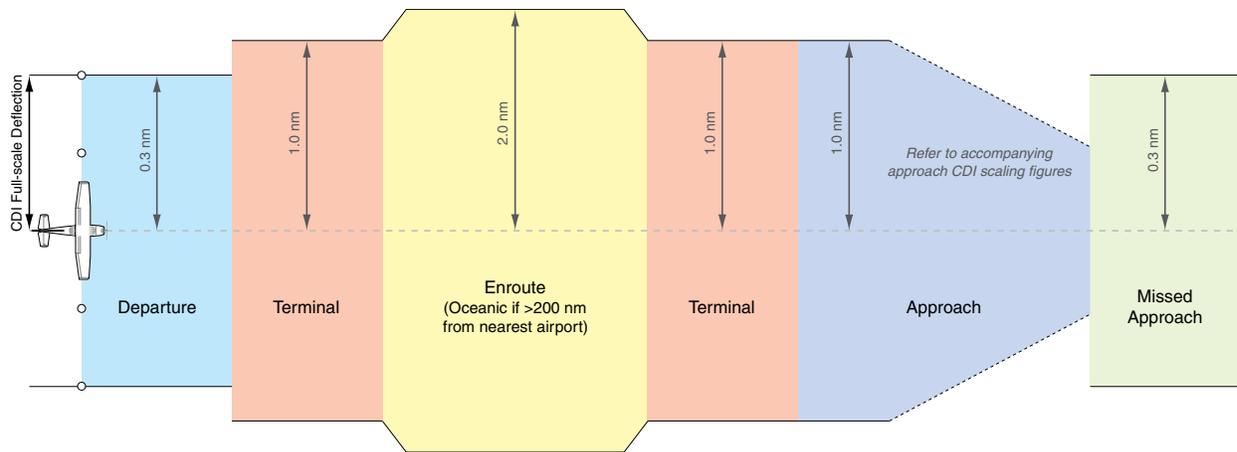


Figure 2-23 Automatic CDI Scaling

- Once a departure procedure is activated, the CDI is scaled for **departure** (0.3 nm).
- The system switches from departure to **terminal** CDI scaling (1.0 nm) under the following conditions:
 - The next leg in the departure procedure is not aligned with the departure runway
 - The next leg in the departure procedure is not a CA, CD, CF, CI, CR, DF, FA, FC, FD, FM, IF, or TF (see Glossary for leg type definitions)
 - After any leg in the departure procedure that is not a CA or FA
- At 30 nm from the departure airport, the **enroute** phase of flight is automatically entered and CDI scaling changes to 2.0 nm over a distance of 1.0 nm, except under the following conditions:
 - When navigating with an active departure procedure, the flight phase and CDI scale does not change until the aircraft arrives at the last departure waypoint (if more than 30 nm from the departure airport) or the leg after the last departure waypoint has been activated or a direct-to waypoint is activated.
- If after completing the departure procedure the nearest airport is more than 200 nm away from the aircraft and the approach procedure has not yet commenced, the CDI is scaled for **oceanic** flight (2.0 nm).
- Within 31 nm of the destination airport (**terminal** area), the CDI scale gradually ramps down from 2.0 nm to 1.0 nm over a distance of 1.0 nm; except under the following conditions:
 - Upon reaching the first waypoint of an arrival route that is more than 31 nm from the destination airport, the flight phase changes to terminal and the CDI scale begins to transition down from 2.0 nm to 1.0 nm over a distance of 1.0 nm.
- During **approach**, the CDI scale ramps down even further (Figures 2-24 and 2-25). This transition normally occurs within 2.0 nm of the final approach fix (FAF). The CDI switches to approach scaling automatically once the approach procedure is activated or if Vectors-To-Final (VTF) are selected.
 - If the active waypoint is the FAF, the ground track and the bearing to the FAF must be within 45° of the final approach segment course.
 - If the active waypoint is part of the missed approach procedure, the active leg and the preceding missed approach legs must be aligned with the final approach segment course and the aircraft must not have passed the turn initiation point.

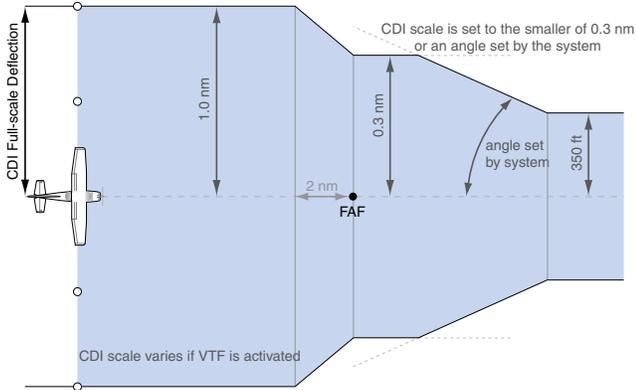


Figure 2-24 Typical LNAV and LNAV+V Approach CDI Scaling

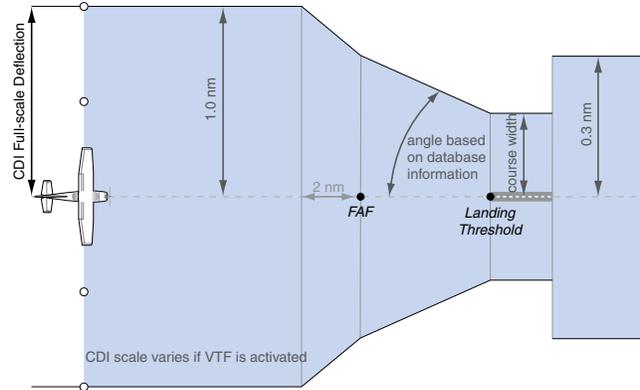


Figure 2-25 Typical LNAV/VNAV and LPV Approach CDI Scaling

- When a **missed approach** is activated, the CDI scale changes to 0.3 nm.
- The system automatically switches back to **terminal** mode under the following conditions:
 - The next leg in the missed approach procedure is not aligned with the final approach path
 - The next leg in the missed approach procedure is not a CA, CD, CF, CI, CR, DF, FA, FC, FD, FM, IF, or TF
 - After any leg in the missed approach procedure that is not a CA or FA

Flight Phase	Annunciation*	Automatic CDI Full-scale Deflection
Departure	DPRT	0.3 nm
Terminal	TERM	1.0 nm
Enroute	ENR	2.0 nm
Oceanic	OCN	2.0 nm
Approach (Non-precision)	LNAV	1.0 nm decreasing to 350 feet depending on variables (Figure 2-24)
Approach (Non-precision with Vertical Guidance)	LNAV + V	
Approach (LNAV/VNAV)	L/VNAV	1.0 nm decreasing to a specified course width, then 0.3 nm, depending on variables (Figure 2-25)
Approach (LPV)	LPV	
Missed Approach	MAPR	0.3 nm

* Flight phase annunciations are normally shown in magenta, but when cautionary conditions exist the color changes to yellow.

Table 2-1 Automatic GPS CDI Scaling

OBS MODE



NOTE: VNV is inhibited while automatic waypoint sequencing has been suspended.

Enabling Omni-bearing Selector (OBS) Mode suspends the automatic sequencing of waypoints in a GPS flight plan (GPS must be the selected navigation source), but retains the current Active-to waypoint as the navigation reference even after passing the waypoint. OBS is annunciated to the lower right of the aircraft symbol on the moving map when OBS Mode is selected.

While OBS is enabled, a course line is drawn through the active-to waypoint on the moving map. If desired, the course to/from the waypoint can now be adjusted. When OBS Mode is disabled, the GPS flight plan returns to normal operation, with automatic sequencing of waypoints, following the course set in OBS Mode. The flight plan on the moving map retains the modified course line.

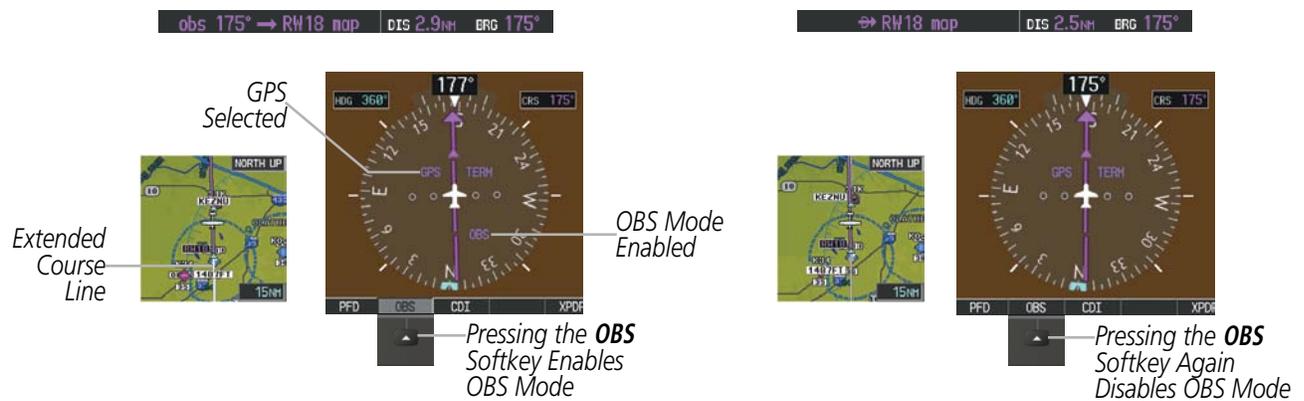


Figure 2-26 Omni-bearing Selector (OBS) Mode

Enabling/disabling OBS Mode while navigating a GPS flight plan:

- 1) Press the **OBS** Softkey to select OBS Mode.
- 2) Turn the **CRS** Knob to select the desired course to/from the waypoint. Press the **CRS** Knob to synchronize the Selected Course with the bearing to the next waypoint.
- 3) Press the **OBS** Softkey again to return to automatic waypoint sequencing.

As the aircraft crosses the missed approach point (MAP), automatic approach waypoint sequencing is suspended. **SUSP** appears on the HSI at the lower right of the aircraft symbol. The **OBS** Softkey label changes to indicate the suspension is active as shown in Figure 2-27. Pressing the **SUSP** Softkey, deactivates the suspension and resumes automatic sequencing of approach waypoints.

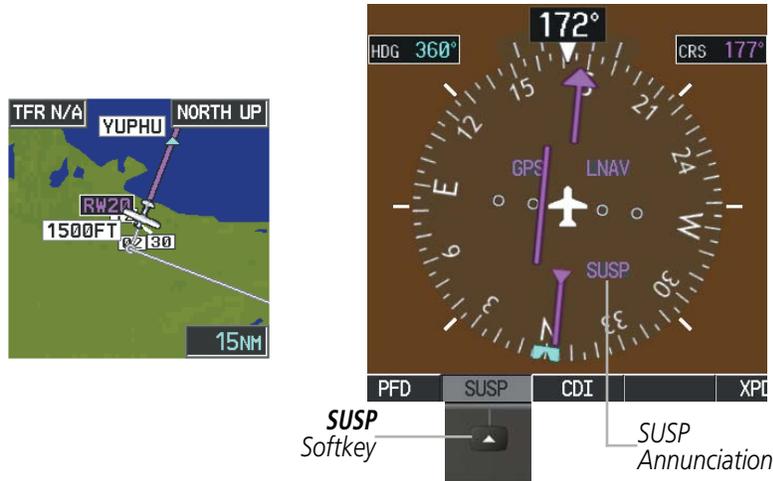


Figure 2-27 Suspending Automatic Waypoint Sequencing

- SYSTEM OVERVIEW
- FLIGHT INSTRUMENTS
- EIS
- AUDIO PANEL & CNS
- FLIGHT MANAGEMENT
- HAZARD AVOIDANCE
- AFCS
- ADDITIONAL FEATURES
- APPENDICES
- INDEX

2.2 SUPPLEMENTAL FLIGHT DATA



NOTE: Pressing the *DFLTS* Softkey turns off metric Altimeter display, the Inset Map and wind data display.

In addition to the flight instruments, the PFD also displays various supplemental information, including temperatures, wind data, and Vertical Navigation (VNV) indications.

OUTSIDE AIR TEMPERATURE

The Outside Air Temperature (OAT) is displayed in degrees Celsius (°C) or Fahrenheit (°F) as selected by the pilot, in the lower left of the PFD under normal display conditions. Temperature is displayed below the true airspeed in reversionary mode.

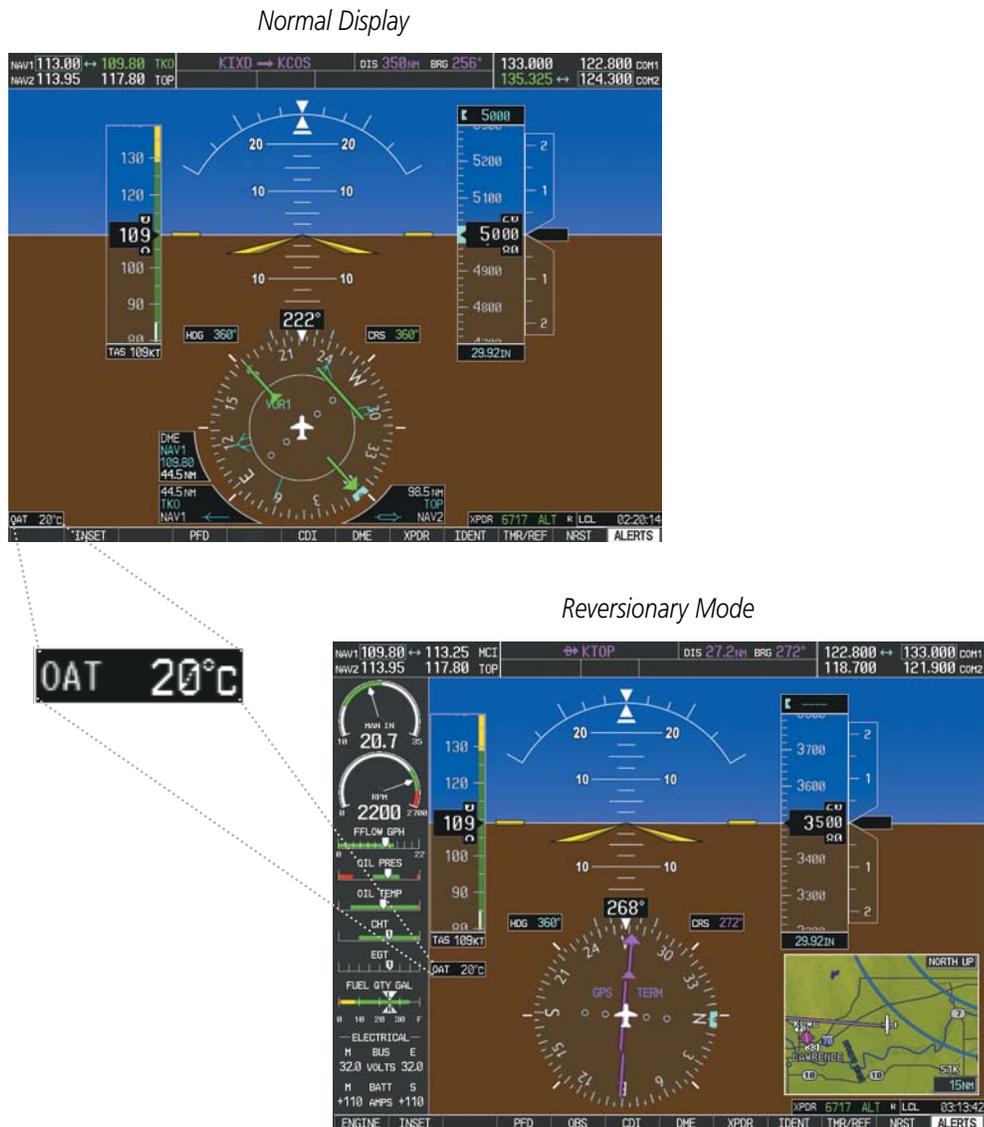


Figure 2-28 Outside Air Temperature

SYSTEM OVERVIEW

FLIGHT INSTRUMENTS

EIS

AUDIO PANEL & CNS

FLIGHT MANAGEMENT

HAZARD AVOIDANCE

AFCS

ADDITIONAL FEATURES

APPENDICES

INDEX

Changing temperature display units:

- 1) Select the AUX - System Setup Page on the MFD using the **FMS** Knob.
- 2) Press the **FMS** Knob to activate the cursor.
- 3) Turn the large **FMS** Knob to highlight the TEMP field in the Display Units box.
- 4) Turn the small **FMS** Knob to highlight either CELSIUS or FAHRENHEIT and press the **ENT** Key to confirm the selection.
- 5) To cancel the selection, press the **FMS** Knob or the **CLR** Key.



Figure 2-29 Temperature Selection (AUX - System Setup Page)

WIND DATA

Wind direction and speed in knots can be displayed relative to the aircraft in a window to the upper left of the HSI. When the window is selected for display, but wind information is invalid or unavailable, the window displays NO WIND DATA. Wind data can be displayed in three different ways.

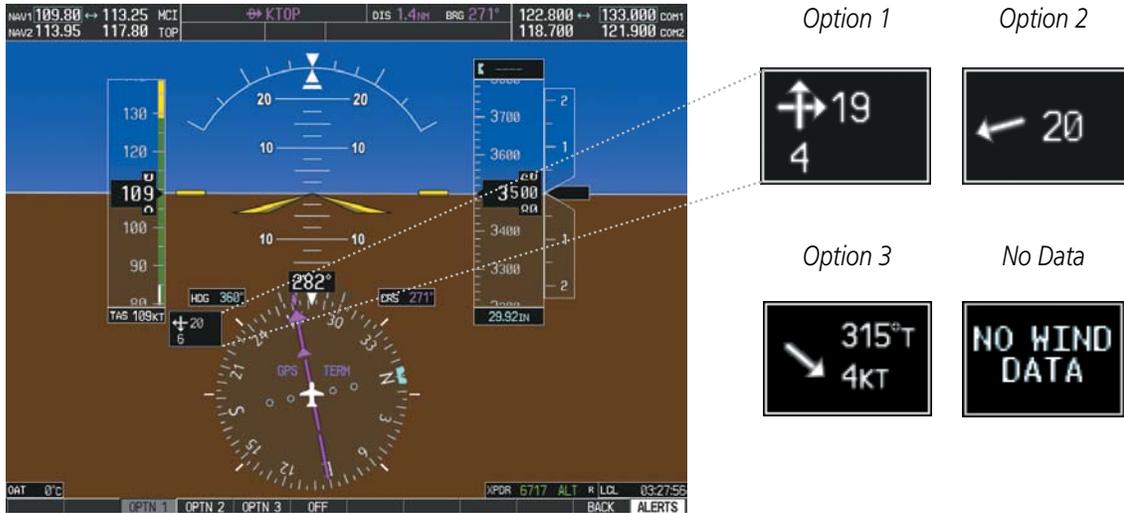


Figure 2-30 Wind Data

Displaying wind data:

- 1) Press the **PFD** Softkey.
- 2) Press the **WIND** Softkey to display wind data below the selected heading.
- 3) Press one of the **OPTN** softkeys to change how wind data is displayed:
 - **OPTN 1**: Wind direction arrows with headwind/tailwind and crosswind components
 - **OPTN 2**: Wind direction arrow and numeric speed
 - **OPTN 3**: Wind direction arrow with numeric True direction and numeric speed
- 4) To remove the window, press the **OFF** Softkey.

VERTICAL NAVIGATION (VNV) INDICATIONS

When a VNV flight plan has been activated, VNV indications (VNV Target Altitude, RVSI, VDI) appear on the PFD in conjunction with the “TOD within 1 minute” message and “Vertical track” voice alert. See the Flight Management and AFCS sections for details on VNV features. VNV indications are removed from the PFD according to the criteria listed in the Table 2-2.



Figure 2-31 Vertical Navigation Indications

Criteria	VNV Indication Removed		
	Required Vertical Speed (RVSI)	Vertical Deviation (VDI)	VNV Target Altitude*
Aircraft > 1 min before the next TOD due to flight plan change	X	X	X
VNV cancelled (CNCL VNV Softkey pressed on MFD)	X	X	X
Distance to active waypoint cannot be computed due to unsupported flight plan leg type (see Flight Management Section)	X	X	X
Aircraft > 250 feet below active VNV Target Altitude	X	X	X
Current crosstrack or track angle error has exceeded limit	X	X	X
Active altitude-constrained waypoint can not be reached within maximum allowed flight path angle and vertical speed	X	X	

Table 2-2 VNV Indication Removal Criteria

2.3 PFD ANNUNCIATIONS AND ALERTING FUNCTIONS

The following annunciations and alerting functions are displayed on the PFD. Refer to Appendix A for more information on alerts and annunciations.

SYSTEM ALERTING

Messages appear in the Alerts Window in the lower right corner of the PFD when a warning, caution, advisory alert, or system message advisory occurs. System alert messages are provided for awareness of system problems or status and may or may not require pilot action. The Alerts Window allows system alerts to be displayed simultaneously. The **FMS** Knob is used to scroll through the alert messages. The Alerts Window is enabled/disabled by pressing the **ALERTS** Softkey. If the window is already open when a new message is generated, pressing the **ALERTS** Softkey to acknowledge the message turns the softkey gray.

The **ALERTS** Softkey label changes to display the appropriate annunciation when an alert is issued. The annunciation flashes and the appropriate aural alert sounds until acknowledged by pressing the softkey. The softkey then reverts to the **ALERTS** Softkey label, and when pressed again opens the Alerts Window to display a descriptive message of the alert.

The Annunciation Window appears to the right of the Vertical Speed Indicator and displays abbreviated annunciation text for aircraft alerts. Warnings appear in red, cautions in yellow, advisory alerts in white, and safe operating annunciations in green. New alerts are displayed at the top of the Annunciation Window, regardless of priority. Once acknowledged, they are sequenced based on priority.

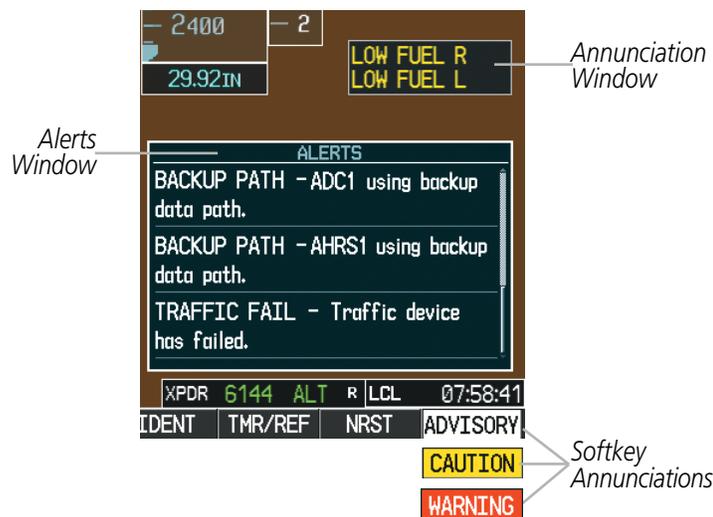


Figure 2-32 System Alerting

MARKER BEACON ANNUNCIATIONS

Marker Beacon Annunciations are displayed on the PFD to the left of the Selected Altitude. Outer marker reception is indicated in blue, middle in yellow, and inner in white. Refer to the Audio Panel and CNS Section for more information on Marker Beacon Annunciations.

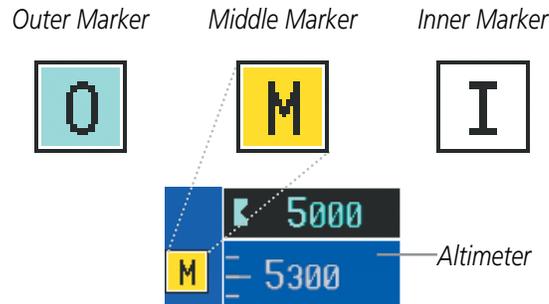


Figure 2-33 Marker Beacon Annunciations

TRAFFIC ANNUNCIATION

Traffic is displayed symbolically on the PFD Inset Map, the MFD Navigation Map Page, and various other MFD page maps. Refer to the Hazard Avoidance Section and the Appendix for more details about the Traffic Information Service (TIS) and optional Traffic Advisory Systems (TAS). When a traffic advisory (TA) is detected, the following automatically occur:

- The PFD Inset Map is enabled and displays traffic
- A flashing black-on-yellow TRAFFIC annunciation appears to the top left of the Attitude Indicator for five seconds and remains displayed until no TAs are detected in the area
- A single “TRAFFIC” aural alert is heard, unless an optional Traffic Advisory System (TAS) is installed. Refer to the applicable TAS documentation for alerts generated by TAS equipment.

If additional TAs appear, new aural and visual alerts are generated.

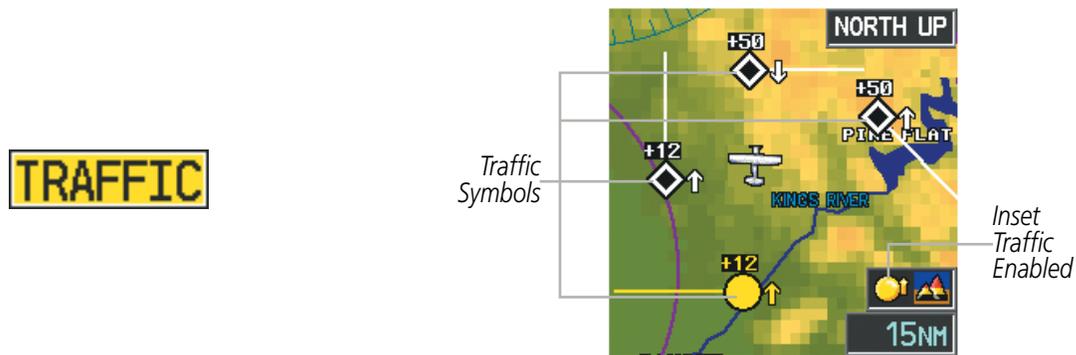


Figure 2-34 Traffic Annunciation and Inset Map with TIS Traffic Displayed

TAWS ANNUNCIATIONS

Terrain Awareness and Warning System (TAWS) annunciations appear on the PFD at the top left of the Altimeter. Refer to the Hazard Avoidance Section and Appendix A for information on TAWS alerts and annunciations.



Figure 2-35 Traffic and TAWS Annunciations

ALTITUDE ALERTING

Altitude Alerting provides the pilot with a visual alert when approaching the Selected Altitude. Whenever the Selected Altitude is changed, the Altitude Alerter is reset. Altitude alerting tones and visual alerts occur only if the GFC 700 is installed. The following occur when approaching the Selected Altitude:

- Upon passing through 1000 feet of the Selected Altitude an aural tone is heard. The Selected Altitude changes to black text on a light blue background and flashes for 5 seconds.
- When the aircraft passes within 200 feet of the Selected Altitude, the Selected Altitude changes to light blue text on a black background and flashes for 5 seconds.
- After reaching the Selected Altitude, if the pilot flies outside the deviation band (± 200 feet of the Selected Altitude) an aural tone is heard. The Selected Altitude changes to yellow text on a black background and flashes for 5 seconds.



Figure 2-36 Altitude Alerting Visual Annunciations

LOW ALTITUDE ANNUNCIATION



NOTE: A Low Altitude Annunciation is available only when SBAS is available. This annunciation is not shown for systems with TAWS, unless TAWS is inhibited.

When the Final Approach Fix (FAF) is the active waypoint in a GPS SBAS approach using vertical guidance, a Low Altitude Annunciation may appear if the current aircraft altitude is at least 164 feet below the prescribed altitude at the FAF. A black-on-yellow LOW ALT annunciation appears to the top left of the Altimeter, flashing for several seconds, then remaining displayed until the condition is resolved.



Figure 2-37 Low Altitude on GPS SBAS Approach

MINIMUM DESCENT ALTITUDE/DECISION HEIGHT ALERTING

For altitude awareness, a barometric Minimum Descent Altitude (MDA) or Decision Height (DH) can be set in the Timer/References Window and is reset when the power is cycled. When active, the altitude setting is displayed to the bottom left of the Altimeter. Once the altitude is within the range of the tape, a bug appears at the reference altitude on the Altimeter. The following visual annunciations occur when approaching the MDA/DH:

- When the aircraft altitude descends to within 2500 feet of the MDA/DH setting, the BARO MIN box appears with the altitude in light blue text. The bug appears on the altitude tape in light blue once in range.
- When the aircraft passes through 100 feet of the MDA/DH, the bug and text turn white.
- Once the aircraft reaches MDA/DH, the bug and text turn yellow and the aural alert, “Minimums. Minimums”, is heard.

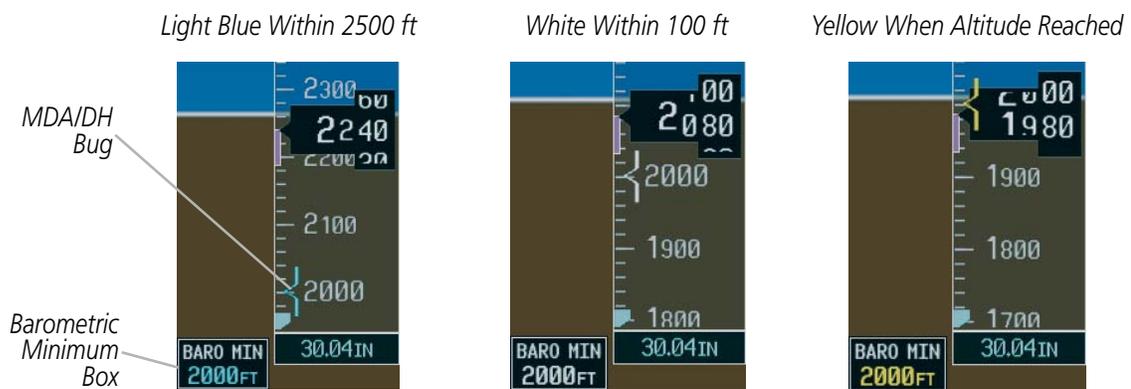


Figure 2-38 Barometric MDA/DH Alerting Visual Annunciations

Setting the barometric Minimum Descent Altitude/Decision Height and bug:

- 1) Press the **TMR/REF** Softkey.
- 2) Turn the large **FMS** Knob to highlight the Minimums field.
- 3) Turn the small **FMS** Knob to select BARO. Off is selected by default. Press the **ENT** Key or turn the large **FMS** Knob to highlight the next field.
- 4) Use the small **FMS** Knob to enter the desired altitude from zero to 16,000 feet.
- 5) To remove the window, press the **CLR** Key or the **TMR/REF** Softkey.



Figure 2-39 MDA/DH Setting (Timer/References Window)

Alerting is inhibited while the aircraft is on the ground and until the aircraft reaches 150 feet above the MDA/DH. If the aircraft proceeds to climb after having reached the MDA/DH, once it reaches 50 feet above the MDA/DH, alerting is disabled.

2.4 ABNORMAL OPERATIONS

ABNORMAL GPS CONDITIONS

The annunciations listed in Table 2-3 can appear on the HSI when abnormal GPS conditions occur. Refer to the Flight Management Section for more information on Dead Reckoning Mode.

Annunciation	Location	Description
LOI	Lower left of aircraft symbol	Loss of Integrity Monitoring—GPS integrity is insufficient for the current phase of flight
INTEG OK	Lower left of aircraft symbol	Integrity OK—GPS integrity has been restored to within normal limits (annunciation displayed for 5 seconds)
DR	Upper right of aircraft symbol	Dead Reckoning—System is using projected position rather than GPS position to compute navigation data and sequence active flight plan waypoints

Table 2-3 Abnormal GPS Conditions Annunciated on HSI



Figure 2-40 Example HSI Annunciations

Dead Reckoning (DR) Mode causes the following items on the PFD to be shown in yellow when GPS is the selected navigation source during Enroute (ENR) or Oceanic (OCN) phases of flight:

- CDI (removed after 20 minutes)
- Current Track Bug
- Wind Data
- Distances in the Bearing Information Windows
- GPS bearing pointers
- Ground Speed

It is important to note that estimated navigation data supplied by the G1000 in DR Mode may become increasingly unreliable and must not be used as a sole means of navigation. See the Flight Management section for more information about DR mode

SYSTEM OVERVIEW
 FLIGHT INSTRUMENTS
 EIS
 AUDIO PANEL & CNS
 FLIGHT MANAGEMENT
 HAZARD AVOIDANCE
 AFCS
 ADDITIONAL FEATURES
 APPENDICES
 INDEX

UNUSUAL ATTITUDES

When the aircraft enters an unusual pitch attitude, red chevrons pointing toward the horizon warn of extreme pitch. The chevrons are displayed on the Attitude Indicator, starting at 50° above and 30° below the horizon line.

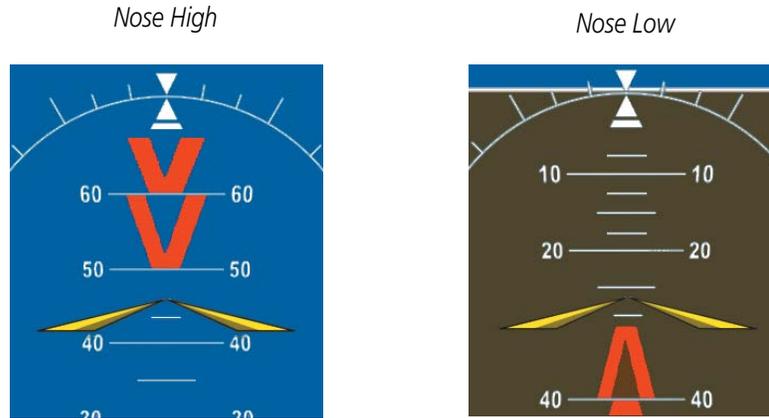


Figure 2-41 Pitch Attitude Warnings

If pitch exceeds +30°/-20° or bank exceeds 65°, some information displayed on the PFD is removed. The Altimeter and Airspeed, Attitude, Vertical Speed, and Horizontal Situation indicators remain on the display and the Bearing Information, Alerts, and Annunciation windows can be displayed during such situations. The following information is removed from the PFD and their softkeys are disabled when the aircraft experiences unusual attitudes:

- Traffic Annunciations
- AFCS Annunciations
- Flight Director Command Bars
- Inset Map
- Outside Air Temperature (OAT)
- Wind Data
- Selected Heading Readout
- Selected Course Readout
- PFD Setup Menu
- Windows displayed in the lower right corner of the PFD:
 - Timer/References
 - Nearest Airports
 - Flight Plan
 - Alerts
 - Procedures
 - Minimum Descent Altitude/ Decision Height Readout
- Vertical Deviation, Glideslope, and Glidepath Indicators
- Altimeter Barometric Setting
- Selected Altitude
- VNV Target Altitude
- System Time
- Transponder Status Box

SYSTEM
OVERVIEW

**FLIGHT
INSTRUMENTS**

EIS

AUDIO PANEL
& CNS

FLIGHT
MANAGEMENT

HAZARD
AVOIDANCE

AFCS

ADDITIONAL
FEATURES

APPENDICES

INDEX

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