GARMIN®

GFC™ 600 Pilot's Guide

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WARNING: *Perform a thorough preflight control check to verify that there is no excessive friction, binding, or other anomalies that prevent smooth movement throughout the intended range of motion in pitch, roll, and yaw axis. Any discrepancies must be resolved prior to continued operation.*

WARNING: *For safety reasons, system operational procedures must be learned on the ground.*

WARNING: *The Garmin system, as installed in this aircraft, has a very high degree of functional integrity. However, the pilot must recognize that providing monitoring and/or self-test capability for all conceivable system failures is not practical.*

WARNING: *To reduce the risk of unsafe operation, carefully review and understand all aspects of the system, Pilot's Guide documentation, and the pertinent manuals. Thoroughly practice basic operation prior to actual use. During flight operations, carefully compare the Flight Director commands and autopilot response to all available navigation indications, attitude displays, and air data information. For safety purposes, always resolve any discrepancies before continued operation.*

CAUTION: *The system does not contain any user-serviceable parts. Repairs should only be made by an authorized Garmin service center. Unauthorized repairs or modifications could void both the warranty and the pilot's authority to operate this device under FAA/FCC regulations.*

NOTE: *All visual depictions contained within this document, including screen images of the panel and displays, are subject to change and may not reflect the most current system and aviation databases. Depictions of equipment may differ slightly from the actual equipment.*

NOTE: *This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.*

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Part Number	Change Summary
190-01488-00	Initial release

Rev	Date	Description
A	June, 2017	Production Release
B	July, 2017	Removed software version number
C	August, 2018	Added Enroute Vertical Navigation
D	July, 2019	Added GTA 28 Trim Adapter Added Emergency Decent Mode (EDM) Added Low Bank Mode Added Yaw Autotrim Added Roll Autotrim Updated Autotrim to Pitch Autotrim Added Reversionary GPS Track Mode
E	September, 2020	Added Smart Rudder Bias
F	October, 2020	Corrected Clerical Error
G	August, 2021	Updated ESP Low Speed Equipment Requirements Added Smart Glide functionality
H	September, 2021	Corrected Clerical Error

SECTION 1 SYSTEM OVERVIEW

The Garmin GFC 600 is a high-performance, attitude-based, Automatic Flight Control System (AFCS) that supports an extensive set of operating modes and safety features. The system design offers the flexibility to interface with a wide variety of avionics equipment commonly found in general aviation aircraft. The specific functions supported by the GFC 600 vary by installation. Refer to Appendix A for more information.

CAUTION: *This manual covers all functions and modes the GFC 600 supports, however it is the responsibility of the user to become familiar with the capabilities and limitations of a specific aircraft (per the Airplane Flight Manual Supplement) which may not support all the features described here.*

1.1 BASIC FUNCTIONS

The GFC 600 AFCS provides the following main operating functions:

- **Flight Director (FD)** — The Flight Director function provides pitch and roll commands needed to guide the aircraft toward the active reference selected by the pilot. If a compatible Primary Flight Display (PFD) is installed these pitch and rolls commands are displayed on the PFD as Command Bars. When the Flight Director is active the pitch and roll commands can be hand-flown by the pilot. When the Autopilot is engaged the autopilot servos drive the flight controls to follow the commands issued by the Flight Director.
- **Autopilot (AP)** — The Autopilot function is provided by servo actuators which move the flight control surfaces in response to Flight Director steering commands, aircraft attitude, and airspeed. The optional pitch auto-trim function serves to relieve any sustained effort required by the pitch servo to keep the aircraft in trim.
- **Yaw Damper (YD)** — The optional Yaw Damper function provides Dutch Roll damping, assists in turn coordination, and provides a steady force to help maintain directional trim. If installed the YD comes on when the autopilot is engaged. It can be turned on/off independent of the autopilot and may be used during normal hand-flying maneuvers.

- **Manual Electric Trim (MET)** — The optional Manual Electric Trim uses the same servo or trim adapter as the auto-trim function and allows the pilot to command trim via a trim switch when the autopilot is not engaged. The MET function does not preclude the use of the aircraft's basic mechanical trim system.
- **Electronic Stability & Protection (ESP)** — The ESP function provides a soft barrier to keep the aircraft within the desired operating envelope when the autopilot is not engaged. When the GFC 600 senses the aircraft is near the defined operating limit in pitch attitude, roll attitude, high airspeed, or low airspeed, the ESP function will automatically engage one or more servos to nudge it back to the nominal operating envelope. While ESP utilizes the same sensors, processors, and actuators as the GFC 600 autopilot it is a separate mutually exclusive function. ESP can be easily overpowered by the pilot and can be disabled using the **AP DISC / TRIM INT** button.
- **Autotrim** (Optional) — The optional autotrim function for pitch, roll, or yaw utilizes either a GSA 87 servo for mechanical trim systems or a GTA 82 trim adapter for existing electric trim systems. Autotrim automatically adjusts the trim systems.

1.2 AFCS EQUIPMENT

The basic GFC 600 system is comprised of the following equipment:

GMC 605 MODE CONTROLLER

The panel-mounted GMC 605 serves as the primary user interface for the GFC 600. The GMC provides autopilot and Flight Director mode selection buttons and a wheel for convenient adjustment of the pitch, airspeed, and vertical speed references. A backlit monochrome LCD displays active and armed modes, reference values, alerts, and messages.

The GMC 605 contains internal sensors which calculate the aircraft attitude, allowing the GFC 600 to operate without relying on any external source of attitude. Flight Director mode logic as well as some autopilot management functions are performed within the GMC 605 main processor.

The GMC 605 has extensive I/O capabilities that support interfaces to a large variety of equipment including Primary Flight Displays, Air Data Computers, GPS navigators, VHF Nav radios, Audio Panels, HSIs, and Directional Gyros (DGs). The GMC requires airspeed and altitude information, therefore if it does not have an interface to an Air Data Computer, a small Air Data Module must be attached to the back of the GMC's mounting tray to provide basic air data information to the AFCS.

The GMC 605 features a covered USB port on the front face of the unit, allowing a convenient means of updating software and downloading diagnostics information to aid in troubleshooting.

CAUTION: *The USB port is not designed to provide power or data to external consumer devices such as smart phones, cameras, or tablet computers and should not be used in flight.*

GMC 605

GSA 87 SERVO

The GSA 87 servos provide control surface actuation as part of the autopilot, yaw damper, electric trim, and ESP functions. The GSA 87 is a 'smart' servo which performs most of the autopilot processing functions and offers many inherent safety features. The brushless motor and electronic torque and speed sensing capabilities provide smooth, reliable operation. The GSA 87 design incorporates an internal engagement solenoid and a gear train that allows the motor to be backdriven by the pilot in case the solenoid fails to disengage. This eliminates the need for a mechanical slip clutch along with the associated performance limitations and maintenance requirements.

GSA 87

GSA 80/81 SERVO AND GSM 86 SERVO MOUNT

The GSA 80/81 servos are used for automatic control of the aircraft flight control surfaces. Each servo moves its respective aircraft control surface in response to commands generated by internal servo calculations. The GSA 80/81 requires a GSM 86 to interface to the aircraft control system. The GSM 86 is mounted to the aircraft structure and is responsible for transferring the output torque of the GSA 80/81 to the mechanical flight control surface linkage.

GSA 80/81

GTA 82 TRIM ADAPTER

The GTA 82 Trim Adapter is a remote-mounted device that is used to allow the GFC 600 to drive an existing electric trim system.

GTA 82

GI 285 ANNUNCIATOR PANEL

The GI 285 Annunciator Panel provides basic AFCS status and mode annunciation for GFC 600 installations where the GMC 605 cannot be mounted within the pilot's primary field of view and there is no PFD capable of providing the annunciations.

GI 285

1.3 INTERFACING EQUIPMENT

The GFC 600 is capable of interfacing with a wide variety of equipment including the following:

G500/G600 INTEGRATED GLASS PANEL SYSTEM

The GDU 620 Primary Flight Display (part of the G500/G600 Glass Cockpit system) can provide AFCS mode annunciation and alerts, Flight Director command bar display, Altitude Preselect (ALTS) capability, Heading (HDG) reference selection, and bank limit indications for the ESP function. The PFD displays AFCS reference values and bugs for Vertical Speed (VS) and Indicated Airspeed (IAS) modes. Nav source selection can be performed on the PFD and the GFC 600 will couple to the selected source for guidance. The G500/G600 systems include an Air Data Computer which provides airspeed and baro-corrected altitude to the AFCS. This is particularly beneficial when operating in Altitude Hold (ALT) mode because the autopilot will automatically synchronize to small changes resulting from an updated altimeter setting.

GDU 620

Reference the latest G500/G600 Pilot's Guide for more detail about features related to AFCS.

G500/G600 TXI INTEGRATED GLASS PANEL SYSTEM

The G500/G600 TXi is a display and sensor system available in the following three display options:

- GDU 1060 - 10" display
- GDU 700P - 7" portrait display
- GDU 700L - 7" landscape display

The GDU 1060 or 700P Primary Flight Display can provide AFCS mode annunciation and alerts, Flight Director command bar display, Altitude Preselect (ALTS) capability, Heading (HDG) reference selection, and bank limit indications for the ESP function. The PFD displays AFCS reference values and bugs for Vertical Speed (VS) and Indicated Airspeed (IAS) modes. Nav source selection can be performed on the PFD and the GFC 600 will couple to the selected source for guidance. The G500/G600 TXi systems include an Air Data Computer which provides airspeed and baro-corrected altitude to the AFCS. This is particularly beneficial when operating in Altitude Hold (ALT) mode because the autopilot will automatically synchronize to small changes resulting from an updated altimeter setting.

The GDU 700L is a dedicated Engine Indicating System (EIS) display.

G500/G600 TXi

Reference the latest G500/G600 TXi Pilot's Guide for more detail about features related to AFCS.

For systems with dual ADC (Air Data Computer) sources connected to the G500/G600 TXi Primary Flight Display, the GFC 600 will utilize the same Air Data Computer that is selected for use on the pilot's Primary Flight Display.

For systems with dual AHRS sources connected to the G500/G600 TXi Primary Flight Display, the GFC 600 will utilize the same magnetic heading information from the selected AHRS source on the pilot's Primary Flight Display.

ASPEN EFD1000

The Aspen EFD1000 can provide Flight Director command bar display, Heading (HDG) reference selection, and Nav source selection functions. The GFC 600 will couple to the selected nav source for guidance including when the EFD1000 is operated in GPSS mode.

Reference the Aspen EFD1000 Pilot's Guide for operational details about features related to autopilot interfaces.

GPS NAVIGATORS

The GFC 600 can accept guidance from a variety of panel mount GPS navigators including those that provide Roll Steering and Glidepath commands and older models that provide only basic lateral course deviation for guidance. The WAAS-enabled Garmin GNS and GTN series navigators also provide an interface to the GMC 605 that supports improved aircraft attitude computation, thereby enhancing AFCS performance and increasing the availability of basic modes in the event of an air data failure.

The GTN 650 is an example of a compatible GPS Navigator:

GTN 650

Reference the applicable Pilot's Guide for more information about operating the GPS navigation equipment installed in an aircraft.

NOTE: *If there is more than one navigation source (GPS and/or VHF Nav) installed it is the responsibility of the user to understand the nav source selection mechanism and ensure the GFC 600 is coupled to the intended source guidance.*

VHF NAV RADIOS

The GFC 600 can accept VOR/Localizer and Glideslope guidance from a variety of VHF Nav receivers including stand-alone radios and those that are included as part of a Nav-Com or GPS-Nav-Com integrated navigator.

The GNC 255 is an example of a compatible VHF Nav receiver:

GNC 255

Reference the applicable Pilot's Guide for more information about operating the VHF Nav equipment installed in an aircraft.

HORIZONTAL SITUATION INDICATORS (HSI)

The GFC 600 can accept Heading commands and Course inputs from a variety of HSIs including mechanical instruments such as the Bendix King KI 525A and Century NSD360A and electronic HSI displays such as the Sandel SN3500/4500.

DIRECTIONAL GYROS (DG)

If GFC 600 is installed in an aircraft without an HSI, the system can accept Heading commands from a variety of popular DGs that have a compatible interface. These installations do not provide a Course input to the GFC 600, therefore whenever the user selects a NAV or APR mode on the GMC 605 the Heading bug must be manually set to align with the Course pointer on the CDI.

AUDIO PANEL

The GFC 600 can interface to a wide variety of audio panels to provide aural alerts including the AP Disconnect tone and low Airspeed warning. The AFCS aural alerts cannot be muted or deselected via the audio panel controls. For audio panels that do not have a failsafe audio path for the autopilot disconnect tone, a Sonalert aural tone generator must be included to ensure the AP Disconnect aural is heard by the pilot if the audio panel fails or suffers a loss of power.

The GMA 345 is an example of a compatible audio panel:

GMA 345

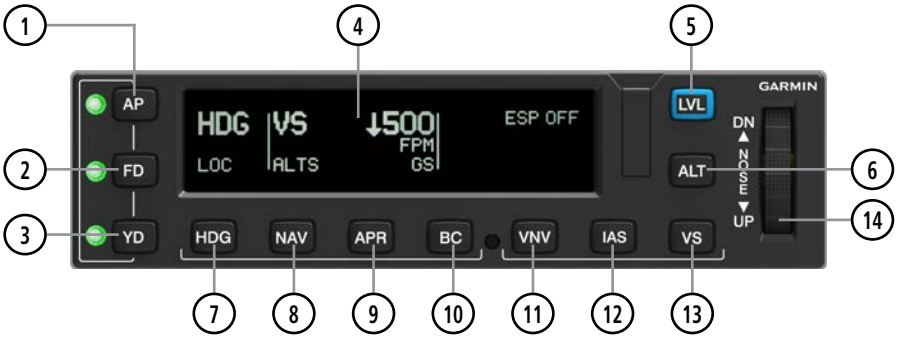
GTX 335/345(R) WITH GPS OPTION

The GTX 335/345(R) transponders with GPS Option can provide an interface to the GMC 605 that supports improved aircraft attitude computation, thereby enhancing AFCS performance and increasing the availability of basic modes in the event of an air data failure.

GTX 345

1.4 AFCS CONTROLS

GMC 605



GMC 605 AFCS Mode Controller

(1) **AP Key**	Engages/disengages the autopilot
(2) **FD Key**	Activates/deactivates the Flight Director only. Pressing once turns on the Flight Director in the default vertical and lateral modes. Pressing again deactivates the Flight Director and removes the Command Bars. If the autopilot is engaged, the key is disabled.
(3) **YD Key**	Engages/disengages the yaw damper (if installed).
(4) **LCD Display**	Displays AFCS modes, references, and annunciations.
(5) **LVL Key**	Engages the autopilot in Level Mode (or selects Level Mode if autopilot is already engaged).
(6) **ALT Key**	Selects/deselects Altitude Hold Mode
(7) **HDG Key**	Selects/deselects Heading Select Mode

(8) **NAV Key**	Selects/deselects Navigation Mode. Cancels GS Mode if LOC Mode is either active or armed. Cancels GP Mode if GPS Mode is either active or armed.
(9) **APR Key**	Selects/deselects Approach Mode
(10) **BC Key**	Selects/deselects Backcourse Mode
(11) **VNV Key**	Selects/deselects Vertical Path Tracking Mode for Vertical Navigation flight control
(12) **IAS Key**	Selects/deselects Indicated Airspeed Mode
(13) **VS Key**	Selects/deselects Vertical Speed Mode
(14) **NOSE UP/DN Wheel**	Adjusts the vertical mode reference in Pitch Hold, Vertical Speed, Indicated Airspeed, and Altitude Hold modes

EXTERNAL CONTROLS

These controls are used for important Flight Director and autopilot functions but are not found on the GMC 605.

Control	Common Name	Typical Location	Purpose
AP DISC/ TRIM INT button	Autopilot Disconnect	Pilot control yoke/stick	Disengages the autopilot, yaw damper, and interrupts pitch trim operation; or, acknowledges an autopilot disconnect alert and mutes the associated tone. Holding the **AP DISC / TRIM INT** button down for 10 seconds will also disable Electronic Stability & Protection.
GA button	Go Around	Power lever or instrument panel	Selects Go Around mode.

Control	Common Name	Typical Location	Purpose
MET switch	Manual Electric Trim	Pilot control yoke/stick	Commands manual electric pitch trim.
CWS switch	Control Wheel Steering	Pilot control yoke/stick	Temporarily disengages the pitch and roll servos. Upon releasing CWS the servos re-engage and may be synchronized to a new reference (depending on mode).
EDM switch	Emergency Decent Mode	Instrument Panel	Manually activates Emergency Decent Mode (if configured). *
Low Bank switch	Low Bank Mode	Instrument Panel	Manually toggles Low Bank Mode.**
Rudder Bias / **Off** switch	Rudder Bias	Instrument Panel	2-position switch. When "RUDDER BIAS" is selected, Smart Rudder Bias is armed and will activate under specified conditions. When "OFF" is selected, Smart Rudder Bias is disabled and unable to arm/ activate.**
Dimmer knob (optional)	Panel Lighting Dimmer	Instrument Panel	Adjusts the brightness of the GMC 605 LCD backlight, keypad, and LED annunciators. If dimmer is not connected the GMC lighting will be adjusted automatically using its photocell.

* Requires installation of a GTN and G500/G600 TXi Primary Flight Display, and is only available in specific aircraft models. Refer to the pertinent manual for availability of Emergency Descent Mode.

** Only available in specific aircraft models. Refer to the pertinent manual for availability of Low Bank Mode.

External Controls

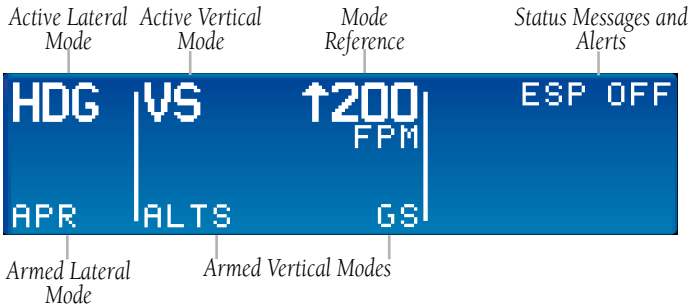
1.5 SYSTEM INDICATIONS

GMC 605

The GMC 605 provides indications to the pilot via a monochrome LCD combined with three color LEDs that are located adjacent to the **AP**, **FD**, and **YD** keys.

The left side of the LCD displays lateral Flight Director modes, the center portion of the display provides vertical modes and references, and the right side of the display serves as a message area for status and alerts. Active modes and references are depicted in large letters along the upper portion of the display, with armed modes in a smaller font along the lower portion. The message area can display up to four messages simultaneously.

Text can be flashed alternating between normal display and inverse video when needed to get the pilot's attention.



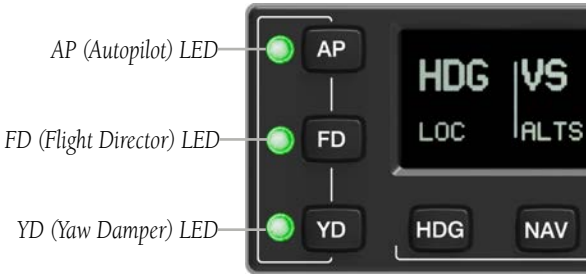
GMC 605 LCD Display

The LEDs adjacent the **AP**, **FD**, and **YD** keys are illuminated in conjunction with other information on the LCD to provide status and alert information.

The **AP**, **FD**, and **YD** LEDs are illuminated in green to indicate that they are engaged. Manual autopilot and yaw damper disconnect is indicated with flashing yellow **AP** and **YD** annunciations, and red is used to indicate an abnormal disconnect or failure condition.

The **FD** LED flashes yellow to indicate when an active mode is dropped automatically by the AFCS.

The **AP** LED is illuminated in yellow when a trim failure has occurred or when a mistrim condition has developed.



GMC 605 LEDs

Refer to section 3.1 for more information about specific GMC 605 messages and LED annunciations.

GI 285 INDICATIONS

The GI 285 Mode Annunciator is required in installations where the GMC 605 is located outside of the pilot's primary field of view and there is no Garmin PFD to provide mode annunciations and alerts. The left side of the GI 285 displays lateral Flight Director modes, the center portion of the display provides status information for the autopilot, yaw damper, and trim system, and the right side displays vertical modes.

The GI 285 can illuminate indications in multiple colors and also supports flashing annunciations when needed to get the pilot's attention. Active modes are depicted in green and armed modes in white. Yellow is used to indicate when an active mode is dropped automatically by the AFCS.

The AP and YD annunciations are illuminated in green to indicate that they are engaged. Manual autopilot and yaw damper disconnect is indicated with flashing yellow AP and YD annunciations, and red is used to indicate an abnormal disconnect or failure condition.

The TRIM annunciation is illuminated in yellow when a trim failure has occurred or when a mistrim condition has developed.

The pilot should reference the GMC 605 message area for more information regarding failures and mistrim conditions.

GI 285 Annunciator

Refer to section 3.1 for more information about specific AP, YD, and TRIM annunciations on the GI 285.

GARMIN PFD AFCS INDICATIONS

A Garmin PFD (if installed) can display Flight Director command bars, active and armed mode annunciations, references, autopilot and yaw damper engagement status, AFCS alerts, and Low Bank mode. Bugs are displayed along with digital references for Selected Heading, Vertical Speed, Selected Altitude, and Indicated Airspeed (when GFC 600 is in IAS mode).

Refer to the G500/G600 or G500/G600 TXi Pilot's Guide for more detailed information on PFD AFCS indications.

EMERGENCY DESCENT MODE (EDM)

Depending on configuration, the system may provide an Emergency Descent Mode (EDM) that assists pilots of pressurized aircraft in the event of cabin depressurization.

For detailed information on Emergency Descent Mode refer to the G500/G600 TXi Pilot's Guide.

EMERGENCY DESCENT MODE (EDM) PFD INDICATIONS

State	PFD Annunciation	Description	PFD System Message
Armed		Aircraft is above 15,000 ft with the autopilot engaged.	
Engaged	Delay Timer	Once engaged, the Delay Timer is displayed with a 10 to 60 second delay before EDM activation. *	Emergency decent will begin in XX seconds.

State	PFD Annunciation	Description	PFD System Message
Activated	**EDM**	EDM is activated when the Delay Timer expires.	EDM active. To deactivate, press **AP** key or **AP DISC**.
Inhibited	**EDM**	Inhibits EDM activation for five minutes.	EDM automatic activation inhibited for 5 minutes.
Overridden	**EDM**	Press the **AP** key or **AP DISC / TRIM INT** to override EDM.	EDM overridden.Re-pressurize cabin and cycle autopilot.

*Press the EDM switch twice (if configured) to bypass the delay timer and activate EDM.

EDM PFD Indications

For EDM to arm the aircraft must be above 15,000 ft with the autopilot engaged.

GMC 605 Annunciating Emergency Decent Mode (Armed)

Once armed, there are two ways to engage EDM:

- Manually, if configured with an EDM switch.
- Automatically, if configured to detect cabin pressure.

EDM Activation Delay Timer

After EDM is engaged, the EDM Activation Delay Timer window is displayed with a 10 to 60 second delay before EDM activation. Press the EDM switch (if configured) to bypass the delay timer and activate EDM.

EDM Activation Delay Timer Window

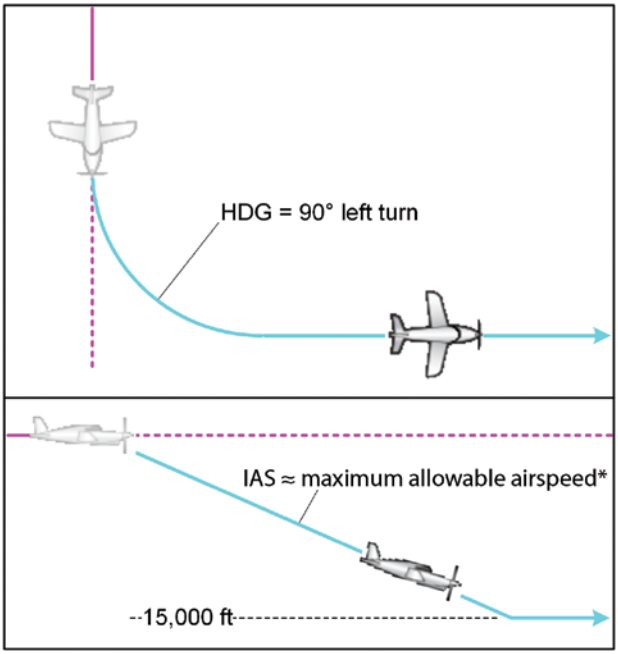
EDM Activation

Once the EDM Activation Delay Timer expires the following EDM activation settings are initiated:

Action	Mode/Indicator Bug	State/Setting
❶	EDM	Active
❷	HDG Mode	Active
❸	Heading Bug	90° Left
❹*	IAS Mode	Active
	Airspeed Bug	Approximately the maximum allowable airspeed **
	Altitude Preselect Bug	15,000 ft

*Action ❹ settings take place simultaneously.
** EDM will change the descent airspeed reference to a value configured per specific airframe.

EDM Activation Settings

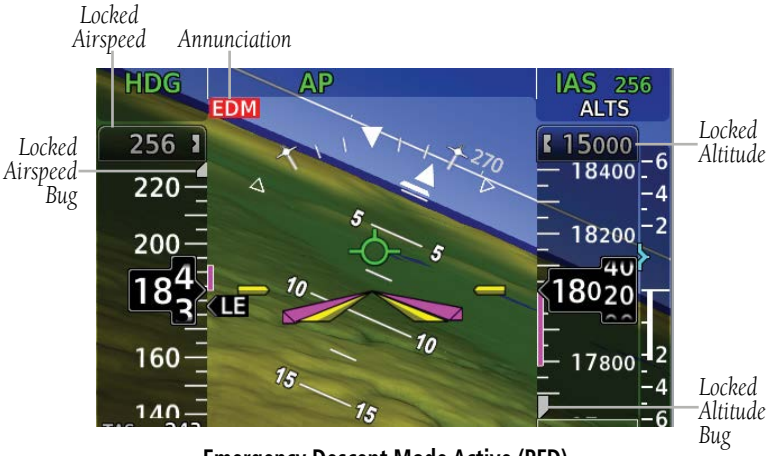


*EDM will change the descent reference to a value configured per specific airframe.

Emergency Descent Mode Active

GMC 605 Annunciating Emergency Decent Mode (Active)

The aircraft decends near the maximum allowable airspeed and the autopilot captures Altitude Hold mode at 15,000 ft. While EDM is active, the airspeed and altitude bugs are locked and unchangeable. An active Emergency Descent Mode is indicated by a red '**EDM**' annunciation on the PFD.



Emergency Descent Mode Active (PFD)

EDM Inhibit

To inhibit automatic activation of EDM when the delay timer expires, the pilot may touch **Inhibit EDM** on the Activation Delay Timer window. This inhibits automatic activation of EDM for five minutes and is indicated by a white '**EDM**' annunciation and advisory message.

EDM Inhibit Annunciation and Message

After the five minute inhibit timer expires, and the activation conditions are still present, EDM automatically triggers again. If the pilot loses consciousness after inhibiting automatic activation, EDM automatically activates again to bring the aircraft to a safe altitude.

EDM Override

The pilot can deactivate EDM by disengaging the autopilot. This may be done by pressing the **AP** key on the GMC 605, pressing **AP DISC / TRIM INT**, or from the PFD home screen (**Menu** > **System** > **PFD Setup** > **Auto EDM**). The activation of the autopilot results in overriding EDM and returning the autopilot to normal operation. Once EDM is overridden it will not automatically activate until arming conditions have cleared. EDM override is indicated by a white '**EDM**' annunciation and advisory message.

EDM Override

SECTION 2 AUTOMATIC FLIGHT CONTROL SYSTEM

NOTE: *The approved pertinent manual always supersedes the information in this Pilot's Guide.*

NOTE: *Refer to the pertinent manual for GFC 600 specific emergency procedures.*

2.1 AFCS OPERATION

AFCS PRE-FLIGHT

The pilot is expected to perform a standard pre-flight control check by moving the flight controls through their full range of motion in pitch, roll, and yaw axis to verify smooth and unrestricted operation. Any discrepancies must be resolved before flight.

When applying system power, the GFC 600 will automatically perform a Pre Flight Test (PFT) to check internal GMC 605 functions, interfaces, and servo status. While the test is in progress the GMC displays the message PFT. The GMC's three LEDs are illuminated in yellow for 1 second and then in red for 1 second. The GI 285 (if installed) will illuminate all lateral mode annunciations in yellow for 1 second, followed by the AP YD/TRIM annunciations in yellow for 1 second, then the vertical modes in yellow for 1 second, and finally the AP/YD/TRIM annunciations in red for 1 second. Any failed LED annunciators on the GMC 605 or GI 285 should be noted and addressed by the operator.

When PFT is complete the AP Disconnect aural is played through the audio panel. If everything passed the PFT message is removed from the GMC display. If there are any failures detected the GMC displays PFT FAIL and illuminates the AP LED in red. The AP annunciation on the GI 285 will also be illuminated red.

ENGAGING THE AUTOPILOT

The autopilot is engaged by pressing the **AP** key on the GMC 605. If the Flight Director is already on the autopilot will begin following the active Flight Director commands. If the Flight Director is not on when the **AP** key is pressed, the Flight Director will come on with autopilot engagement in the default PIT and ROL modes.

Another way to engage the autopilot is by selecting the **LVL** key. This will engage the autopilot in Level mode.

The aircraft must be within the GFC 600 engagement limits (+/-50 degrees pitch and +/- 75 degrees roll attitude) in order to engage the autopilot.

FLIGHT DIRECTOR MODES

Flight Director modes are normally selected independently for the pitch and roll axes using the keys on the GMC 605 bezel. Unless otherwise specified, all mode keys are alternate action (i.e., press on, press off). In the absence of specific mode selection, the Flight Director reverts to the default pitch and/or roll modes.

Active modes are annunciated on the GMC 605's screen in large text. Armed modes are annunciated in smaller text below the active modes and are queued to take effect as soon as capture criteria is met. Automatic transition from armed to active mode is indicated by the armed mode annunciation moving up to the active mode field and flashing for 10 seconds.

If the information required to compute an active Flight Director mode (such as air data or navigation data) becomes invalid or unavailable, the Flight Director automatically reverts to the default mode for that axis. The affected mode annunciation on the GMC 605 flashes in conjunction with the FD LED in yellow. The affected GI 285 annunciation also flashes in yellow. When such a loss occurs, the system automatically begins to roll the wings level (enters Roll Hold mode) or maintain the pitch angle (enters Pitch Hold mode), depending on the affected axis. The flashing annunciation stops when the affected mode key is pressed or another mode for the axis is selected. If after 10 seconds no action is taken, the flashing annunciation stops.

The Flight Director is automatically disabled if the attitude information required to compute the default Flight Director modes becomes invalid or unavailable.

DISENGAGING THE AUTOPILOT

The Autopilot is manually disengaged by pressing the **AP** key on the GMC 605 or by pressing the **AP DISC / TRIM INT** button or MET switch on the control stick or yoke. Manual disengagement is indicated by an aural alert and the AP LED on the GMC 605 flashing yellow for five seconds. The AP indication on the GI 285 also flashes yellow. The aural alert and flashing annunciations can be canceled by an additional press of the **AP DISC / TRIM INT** button.

Automatic disengagement is indicated by an aural alert and the AP LED on the GMC 605 flashing red. The AP indication on the GI 285 also flashes red. The aural alert and flashing annunciations continue until acknowledged by pressing the **AP** key or the **AP DISC / TRIM INT** button. Automatic disengagement may occur due to a failure within the GFC 600 system, loss of both GPS and air data inputs, strong turbulence, or exceeding the engagement attitude limits.

2.2 BASIC AUTOPILOT FEATURES

FLIGHT DIRECTOR

NOTE: *Flight Director command bars may be displayed on a Garmin PFD, Garmin G5, or an Aspen EFD 1000.*

The Flight Director function provides pitch and roll commands to the autopilot and displays them on the PFD. With the Flight Director active, the aircraft can be hand-flown to follow the path shown by the command bars or the autopilot can be engaged to follow the commands.

ACTIVATING THE FLIGHT DIRECTOR

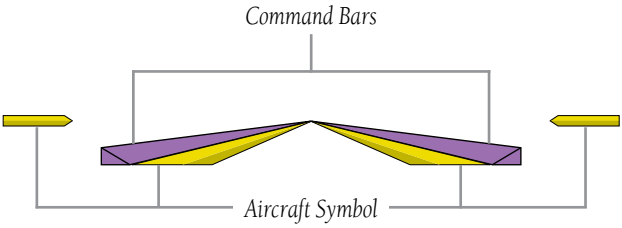
NOTE: *In an installation that does not support display of command bars, pressing the FD Key will result in a DISABLD KEY message and all active and armed mode annunciations will be removed upon autopilot disconnect.*

An initial press of the **FD** key on the GMC 605 or the **GA** button activates the Flight Director and adds the command bars to the PFD. If the autopilot is disengaged, an additional press of the **FD** key will turn off the Flight Director and remove the command bars from the PFD.

NOTE: *The FD Key is disabled when the autopilot is engaged.*

COMMAND BARS ON GARMIN PFD

Upon activation of the Flight Director, Command Bars are displayed in magenta on the PFD. The Command Bars do not override the Aircraft Symbol. The Command Bars move together vertically to indicate pitch commands and bank left or right to indicate roll commands.



Command Bars

FLIGHT DIRECTOR LIMITATIONS

The maximum commanded pitch and roll attitudes are limited to values established during AFCS certification. Maximum commanded pitch and roll rates are also limited. Reference the pertinent manual for Flight Director command limits in a specific aircraft.

CONTROL WHEEL STEERING

During autopilot operation, the aircraft may be hand-flown without disengaging the autopilot. Pressing and holding the **CWS** button (if installed) disengages the pitch and roll servos from the flight control surfaces and allows the aircraft to be hand flown. Releasing the **CWS** button reengages the servos. Depending on the active mode the Flight Director may be synchronized to a new reference upon CWS release. Refer to the descriptions of vertical and lateral modes for specific CWS behavior in each mode.

Control Wheel Steering is annunciated on the GMC 605 with a **CWS ON** message and the AP LED flashing green. On the GI 285, the AP annunciation changes from green to white while CWS is active.

GMC 605 Annunciating Control Wheel Steering

GI 285 Annunciating Control Wheel Steering

YAW DAMPER

NOTE: *Yaw Damper is available in aircraft that have an autopilot servo installed on the yaw axis.*

The Yaw Damper reduces Dutch roll tendencies, coordinates turns, and provides a steady force to help maintain directional trim. It can operate independently of the autopilot and may be used during normal hand-flown maneuvers.

The Yaw Damper is engaged by pressing the **YD** key. It will also be engaged by pressing the **AP** key to turn on the autopilot. If the autopilot is disengaged using the **AP** key or the PITCH or ROLL **MET** switch the Yaw Damper will remain engaged and can be separately turned off by pressing the **YD** key or YAW **MET** switch. If the autopilot is disengaged using the **AP DISC / TRIM INT** button on the control yoke/stick the Yaw Damper will also be disengaged.

NOTE: *In an installation that does not have a Yaw Damper servo, pressing the YD Key will result in a DISABLED KEY message on the GMC 605.*

When the Yaw Damper is engaged it is annunciated on the GMC 605 with the YD LED illuminated in green. On the GI 285 the YD annunciation is illuminated green.

GMC 605 Yaw Damper Indication

GI 285 Yaw Damper Indication

When the Yaw Damper is disengaged it is annunciated by the YD LED on the GMC 605 and the YD annunciation on the GI 285 flashing yellow for five seconds and then extinguished.

MANUAL TRIM

Aircraft that do not have a trim servo must be manually trimmed by the pilot. Manual trim may also be required in the event of trim servo failure. Mistrim indication is provided when the autopilot is engaged to inform the pilot when manual trim is needed.

On the GMC 605 a mistrim condition is indicated by the AP LED flashing yellow for five seconds and then steady illumination. A message is displayed indicating the trim axis and the direction. ELE TRM UP indicates the pitch servo is holding excessive nose up force and the pilot must manually trim the aircraft in the nose up direction to alleviate the load and restore the aircraft to an in-trim condition. Once the aircraft is in-trim the yellow AP LED is extinguished and the message is removed.

The GI 285 indicates a mistrim condition by flashing the TRIM annunciation in yellow for five seconds and then steady. The TRIM annunciation is extinguished once the mistrim condition is resolved.

NOTE: *The GI 285 does not provide any indication of mistrim axis or direction. The pilot must look at the GMC 605 message for this information.*

GMC 605 Mistrim Indication

GI 285 Mistrim Indication

MANUAL ELECTRIC TRIM

NOTE: *Manual Electric Trim (MET) is available in aircraft that have an autopilot servo connected to the trim system or a trim adapter connected to the previously installed electric trim system. The same servo or trim adapter provides both the MET and Autotrim functions.*

NOTE: *When the autopilot is engaged, moving the pitch or roll MET Switch will disengage the AP.*

When the autopilot is not engaged, the pitch trim servo or trim adapter may be used to provide manual electric trim (MET). This allows the aircraft to be trimmed using the control wheel or stick-mounted switch. The MET switch is split into two adjacent parts which must be moved together to arm and activate the trim command.

PITCH AND ROLL AUTOTRIM

NOTE: *Autotrim is available in aircraft that have an autopilot servo connected to the trim system or a trim adapter connected to the previously installed electric trim system. The same servo or trim adapter provides both the MET and Autotrim functions.*

Pitch and Roll Autotrim will automatically adjust the trim to keep the aircraft trimmed while the autopilot is engaged. Autotrim can be disabled by pressing the **AP DISC / TRIM INT** or **CWS** button.

If pitch or roll trim fails while the autopilot is engaged (as indicated by P TRIM FAIL message and AP LED illuminated yellow) the pilot can continue to use the autopilot and manually trim the aircraft in response to any mistrim messages.

NOTE: *After disengaging the autopilot it cannot be re-engaged until a pitch trim failure condition is corrected. The autopilot may be re-engaged with a roll trim failure condition.*

YAW AUTOTRIM

NOTE: *Yaw Autotrim is available in aircraft that have either an autopilot servo connected to the rudder trim system or a trim adapter connected to the existing electric rudder trim system.*

Yaw Autotrim will automatically adjust the rudder trim to keep the aircraft trimmed while the Yaw Damper is engaged. Yaw Autotrim can be disabled by pressing the **AP DISC / TRIM INT**, **CWS**, **YD**, or **Manual Electric Rudder Trim** (if installed) button.

If rudder trim fails while the autopilot is engaged (as indicated by Y TRIM FAIL message and AP LED illuminated yellow) the pilot can continue to use the autopilot and manually trim the aircraft in response to any mistrim messages.

OVERSPEED PROTECTION

NOTE: *Overspeed protection is not active in Altitude Hold (ALT), Glideslope (GS), Glidepath (GP), or Go Around (GA) modes.*

While Pitch Hold, Vertical Speed, Indicated Airspeed, or Selected Altitude Capture mode is active, airspeed is monitored by the Flight Director. Overspeed protection is provided in situations where the Flight Director cannot acquire and maintain the mode reference for the selected vertical mode without exceeding the certified maximum autopilot airspeed.

When an overspeed condition occurs, the Flight Director will deviate from the active vertical reference and produce a pitch up command to slow the aircraft. Engine power should be reduced and/or the **NOSE UP/DN** wheel moved in the UP direction to adjust the PIT or VS reference.

When Overspeed Protection becomes active, the GMC 605 displays a MAXSPEED message, the active vertical mode annunciation changes automatically to IAS, and the previously active vertical mode becomes armed. The GI 285 displays IAS in green and the previously active mode changes to white.

When the overspeed condition is resolved the MAXSPEED message is removed and the armed vertical mode becomes active again.

NOTE: *When the autopilot is outside normal operating limits, it uses more aggressive commands to return to normal limits.*

GMC 605 Overspeed Indication

GI 285 Overspeed Indication

UNDERSPEED PROTECTION

NOTE: *While underspeed protection is active, the aircraft will deviate from the selected reference.*

Underspeed Protection is designed to discourage aircraft operation below minimum established airspeeds and is available when the autopilot is on.

When the aircraft is decelerating to within six seconds of reaching a predetermined minimum airspeed (specified in the pertinent manual), the AIRSPEED aural will sound to alert the pilot of the impending underspeed condition.

If the aircraft continues to decelerate, Underspeed Protection functionality will vary depending on the airframe (refer to the applicable manual for the type of functionality installed). For some airframes, Underspeed Protection engages once the stall warning system is activated, regardless of the vertical mode selected. For other airframes, Underspeed Protection fuctionality depends on the vertical mode selected. For the purpose of this discussion, the vertical modes can be divided into two categories: Those in which it is important to maintain altitude for as long as possible (altitude-critical modes), and those in which maintaining altitude is less crucial (non-altitude critical modes).

ALTITUDE-CRITICAL MODES (ALT, GS, GP, GA)

If the aircraft decelerates to stall warning for at least one second, the vertical and lateral modes will change from active to armed. IAS and ROL will become the active vertical and lateral modes and flash for five seconds, and the autopilot will provide input causing the aircraft to pitch down and wings to level.

The AIRSPEED aural will sound every five seconds and a MINSPEED annunciation will be displayed on the GMC 605.

GMC 605 Underspeed Indication
(Altitude Critical Mode)

GI 285 Underspeed Indication
(Altitude Critical Mode)

The pilot must add power to increase airspeed. If the aircraft was in GA mode prior to entering Underspeed Protection and full power has already been applied, the pilot can move the **NOSE UP/DN** wheel in the DN direction to reduce the pitch attitude reference. Moving the wheel will cause the vertical mode to revert to PIT mode after exiting Underspeed Protection.

When airspeed increases to 5 KIAS above the minimum speed, the AIRSPEED aural and MINSPEED message will be turned off, and the armed vertical and lateral Flight Director modes will change back to active. The autopilot will resume tracking the previously selected vertical and lateral references.

NON-ALTITUDE CRITICAL MODES (VS, LVL, PIT, IAS, ALTS, VNAV)

If the aircraft decelerates to an IAS below the minimum commandable autopilot airspeed, the vertical Flight Director mode will change from active to armed and IAS will become the active vertical mode and flash for five seconds. MINSPEED will be displayed on the GMC 605. The autopilot will cause the aircraft to pitch down.

GMC 605 Underspeed Indication (Non-Altitude Critical Mode)

GI 285 Underspeed Indication (Non-Altitude Critical Mode)

The pilot must add power to increase airspeed. If the aircraft was in PIT or VS mode prior to entering Underspeed Protection and full power has already been applied, the pilot can move the **NOSE UP/DN** wheel in the DN direction to reduce the pitch attitude or vertical speed reference.

When airspeed increases to 5 KIAS above the minimum speed, the MINSPEED message will be removed and the armed vertical Flight Director mode will change back to active. The autopilot will resume tracking the previously selected vertical reference.

NOTE: *When the AFCS is outside normal operating limits, it uses more aggressive commands to return to normal limits.*

2.3 VERTICAL MODES

VERTICAL MODE CONTROLS AND ANNUNCIATIONS

The table below lists the vertical modes with their corresponding controls and annunciations. The mode reference is displayed next to the active mode annunciation on the GMC 605 for Altitude Hold, Vertical Speed, and Indicated Airspeed modes. The **NOSE UP/DN** wheel can be used to change the vertical mode reference while operating in Pitch Hold, Vertical Speed, Indicated Airspeed, or Altitude Hold modes. Increments of change and acceptable ranges of values for each of these references using the **NOSE UP/DN** wheel are also listed in the table.

Vertical Mode	Description	Control	Annunciation		Reference Change Increment	Ref Range
Pitch Hold	Holds the current aircraft pitch attitude; may be used to climb/ descend to the Selected Altitude	(default)	PIT		0.5°	Varies by aircraft type, see pertinent manual
Level Mode	Commands a pitch attitude necessary to establish a vertical speed of 0 fpm and also commands wings level (zero bank angle)	LVL	LVL			
Go Around	Commands a constant nose-up pitch attitude and also commands zero bank angle	**GA** Button	GA			Varies by aircraft type, see pertinent manual
Altitude Hold	Holds the current Altitude	ALT	ALT	nnnnn FT	10 ft	± 150 ft

Vertical Mode	Description	Control	Annunciation		Reference Change Increment	Ref Range
Selected Altitude Capture	Captures the Selected Altitude	*	ALTS			
Vertical Path Constraint Altitude Capture	Captures the Vertical Path Constraint Altitude	**	ALTV			
Vertical Speed	Maintains the current aircraft vertical speed; may be used to climb/descend to the Selected Altitude	VS	VS	nnnn FPM	100 fpm	Varies by aircraft type, see pertinent manual
Vertical Path Tracking (VNAV)	Captures and tracks descent legs of an active vertical profile	VNV	VPTH			
Indicated Airspeed (IAS)	Maintains the current aircraft airspeed; may be used to climb/descend to the Selected Altitude	IAS	IAS	nnn KT	1 kt	Varies by aircraft type, see pertinent manual
Glidepath	Captures and tracks the SBAS GPS glidepath on approach	APR	GP			
Glideslope	Captures and tracks the ILS glideslope on approach		GS			

* *When the GFC 600 is receiving a Selected Altitude value from a Garmin PFD, ALTS is armed automatically when PIT, VS, IAS, or GA modes are active.*

** *ALTV arms automatically when VPTH is armed or active and the aircraft is descending towards the Vertical Path Constraint Altitude.*

Autopilot Vertical Mode Summary

PITCH HOLD MODE (PIT)

When the autopilot or Flight Director is activated (**AP** or **FD** key is pressed), Pitch Hold mode is selected by default. This mode may be used for climb or descent to the Selected Altitude, since Selected Altitude Capture mode (with Garmin PFD) is automatically armed when Pitch Hold mode is activated.

In Pitch Hold mode, the AFCS maintains a constant pitch attitude. The pitch reference is set to the aircraft pitch attitude at the moment of mode selection, and can be adjusted by using the **NOSE UP/DN** wheel. The wheel adjusts pitch attitude in increments of 0.5 deg per click within the range defined in the pertinent manual. The pitch reference can also be adjusted by pressing the **CWS** button, hand-flying the aircraft to establish a new pitch reference, and then releasing the **CWS** button. If the aircraft pitch attitude exceeds the autopilot pitch command limitations, the Flight Director commands a pitch angle equal to the nose-up/down limit.

GMC 605 AND GI 285 ANNUNCIATIONS

Both the GMC 605 and GI 285 show the 'PIT' annunciation in their active vertical mode sections. If the Selected Altitude Capture mode is available, the GMC 605 also shows the 'ALTS' annunciation in the armed vertical mode section.

GMC 605 Annunciating Pitch Mode

GI 285 Annunciating Pitch Mode

LEVEL MODE (LVL)

Level mode is a coupled pitch and roll mode and is annunciated as both the vertical and lateral modes when active. Pressing the **LVL** key engages the autopilot (if the autopilot is disengaged) in level vertical and lateral modes. Level mode does not track altitude or heading but instead uses a vertical reference of zero feet per minute and a lateral reference of zero bank angle. When the **LVL** key is pressed all armed and active modes are cancelled and the AFCS reverts to LVL mode for pitch and roll. While in level mode, all other modes are available by pressing the corresponding button.

NOTE: *The Level Mode may be helpful if the aircraft encounters strong turbulence making it impractical to maintain normal references such as Altitude Hold.*

GMC 605 AND GI 285 ANNUNCIATIONS

The GMC 605 and GI 285 annunciate 'LVL' in both the vertical and lateral sections.

GMC 605 Annunciating Level Mode

GI 285 Annunciating Level Mode

GO AROUND MODE (GA)

Go Around mode is a coupled pitch and roll mode and is annunciated as both the vertical and lateral modes when active. The **GA** button installed in the cockpit is used to activate Go Around mode.

Go Around mode can also be activated while the aircraft is on the ground and used to establish an attitude reference to follow immediately after takeoff.

WARNING: *When GA mode is activated for takeoff the autopilot should not be engaged until the aircraft has reached the Minimum Use Height (MUH) specified in the pertinent manual.*

Pressing the **GA** button while in the air allows the execution of a missed approach or a go around without disconnecting the autopilot (i.e. Coupled Go Around). Go Around mode arms Selected Altitude Capture mode automatically, and any attempts to modify the aircraft attitude (i.e., with the **CWS** button or the **NOSE UP/DN** wheel) result in reversion to Pitch and Roll Hold modes.

GMC 605 AND GI 285 ANNUNCIATIONS

The GMC 605 and GI 285 annunciate 'GA' in both vertical and lateral sections. If the Selected Altitude Capture mode is available, the GMC 605 also shows the 'ALTS' annunciation in the armed vertical mode section.

GMC 605 Annunciating Go Around Mode

GI 285 Annunciating Go Around Mode

ALTITUDE HOLD MODE (ALT)

Altitude Hold mode can be activated by pressing the **ALT** key; the AFCS maintains the current aircraft altitude (to the nearest 10 feet) as the Altitude Reference.

With Garmin PFD:

Altitude Hold mode is automatically armed when in Selected Altitude Capture mode. Selected Altitude Capture mode automatically transitions to Altitude Hold mode when within 50 feet of the Selected Altitude. In this case, the Selected Altitude becomes the Altitude Reference. The Altitude Reference is displayed on the GMC and the autopilot will automatically compensate for small altitude changes introduced when the altimeter setting is updated on the PFD.

When operating in Altitude Hold mode, the displayed altitude reference can be adjusted by using the **NOSE UP/DN** wheel. The reference altitude can only be moved a maximum of 200 ft from the current aircraft altitude; each click changes the reference altitude by 10 ft. The altitude hold reference can also be adjusted by pressing the **CWS** button, hand-flying the aircraft to a different altitude, and then releasing the **CWS** button.

Without Garmin PFD:

When there is no Garmin PFD installed, the Altitude Reference is not displayed on the GMC 605 and the autopilot cannot automatically compensate for small altitude changes introduced when the altimeter setting is updated. The **NOSE UP/DN** wheel may be used to adjust the Altitude Reference in increments of 10 ft per click up to +/- 200 ft from the current altitude.

When the wheel is moved the GMC will display the total adjustment the pilot has selected. For example, clicking the wheel four times in the NOSE UP direction will result in a display of ALT +40 FT. Three seconds after the last click, the adjustment value will disappear and only ALT will be displayed. The autopilot will begin tracking the new reference (in the example it would climb 40 feet). If the wheel is moved again before the aircraft has reached the new reference altitude, the Altitude Reference will synch to the current aircraft altitude and calculate a new adjustment from that altitude.

The altitude hold reference can also be adjusted by pressing the **CWS** button, hand-flying the aircraft to a different altitude, and then releasing the **CWS** button.

GMC 605 AND GI 285 ANNUNCIATIONS

The GMC 605 and the GI 285 annunciate 'ALT' for Altitude Hold mode. If a Garmin PFD is installed, the GMC also shows the reference altitude in the mode reference section.

GMC 605 Annunciating Alt Hold Mode

GI 285 Annunciating Alt Hold Mode

SELECTED ALTITUDE CAPTURE MODE (ALTS)

NOTE: *Selected Altitude Capture Mode is available in aircraft with a Garmin PFD.*

Selected Altitude Capture mode is a transitional mode used in conjunction with other vertical modes. It is not directly selectable by the GMC 605 panel or other equipment. Instead, Selected Altitude Capture (when supported by a GDU interface) is automatically armed with activation of the following modes:

- Pitch Hold
- Vertical Speed
- Indicated Airspeed
- Go Around

The Altitude Preselect function on a Garmin PFD allows the pilot to adjust the altitude bug to a target Selected Altitude for the AFCS to intercept, capture, and subsequently track in Altitude Hold mode.

The GMC 605 will annunciate 'ALTS' as the armed vertical mode while the active vertical mode is PIT, VS, IAS, or GA.

As the aircraft nears the Selected Altitude, the AFCS automatically transitions to Selected Altitude Capture mode with Altitude Hold mode armed. This automatic transition is indicated by the 'ALTS' annunciation flashing for up to 10 seconds and the appearance of the 'ALT' annunciation. The Selected Altitude is shown as the Altitude Reference.

At 50 feet from the Selected Altitude, the AFCS automatically transitions from Selected Altitude Capture to Altitude Hold mode and holds the reference altitude. As Altitude Hold mode becomes active, the 'ALT' annunciation moves to the active vertical mode field and flashes for 10 seconds to indicate the automatic transition.

GMC 605 Annunciating Selected Altitude Capture Mode

Changing the Selected Altitude on the PFD while Selected Altitude Capture mode is active causes the AFCS to revert to Pitch Hold mode with Selected Altitude Capture mode armed for the new Selected Altitude.

VERTICAL SPEED MODE (VS)

Vertical Speed mode is selected by pressing the **VS** key. This mode acquires and maintains a Vertical Speed Reference. The Vertical Speed Reference may be changed by using the **NOSE UP/DN** wheel. The vertical speed reference can also be adjusted by pressing the **CWS** button, hand-flying the aircraft to establish a new vertical speed, and then releasing the **CWS** button. If the Selected Altitude Capture mode is available in this aircraft, this mode may be used for climb or descent to the Selected Altitude since Selected Altitude Capture mode is automatically armed when Vertical Speed mode is selected.

GMC 605 AND GI 285 ANNUNCIATIONS

The GMC 605 and GI 285 annunciate 'VS' for Vertical Speed mode. Additionally, the GMC 605 annunciates the Vertical Speed Reference in the mode reference section.

GMC 605 Annunciating Vertical Speed Mode

GI 285 Annunciating Vertical Speed Mode

INDICATED AIRSPEED MODE (IAS)

Indicated Airspeed mode is selected by pressing the **IAS** key. This mode acquires and maintains the Airspeed Reference (IAS). The Airspeed Reference is set to the current airspeed upon mode activation. The IAS reference can be changed using the **NOSE UP/DN** wheel. Moving the knob in the NOSE UP direction decreases the reference by 1 knot per click, and the NOSE DN direction increases the reference by 1 knot per click. The airspeed reference can also be adjusted by pressing the **CWS** button, hand-flying the aircraft to establish a new airspeed, and then releasing the **CWS** button.

Engine power must be adjusted to allow the autopilot to fly the aircraft at a pitch attitude corresponding to the desired flight profile (climb or descent) while maintaining the Airspeed Reference.

GMC 605 AND GI 285 ANNUNCIATIONS

The GMC 605 and GI 285 annunciate 'IAS' for Indicated Airspeed mode. Additionally, the GMC 605 displays the Airspeed Reference value in the mode reference section.

GMC 605 Annunciating Indicated Airspeed Mode

GI 285 Annunciating Indicated Airspeed Mode

SMART GLIDE

If the GFC 600 is interfaced with a GTN Xi that supports Smart Glide, IAS mode will be modified on the GFC so that the initial IAS target airspeed is set to the Best Glide Speed (configured on the GTN Xi) instead of the current airspeed. No pilot action is required to initiate this change as it is available if and only if Smart Glide is active on the GTN Xi. 'Glide' is annunciated on the GMC 605 and optionally interfaced G500/G600 TXi to alert the pilot that IAS mode is targeting Best Glide Speed. IAS mode will still function normally and the pilot may change the target airspeed as desired. If the mode is changed and IAS mode is re-enabled while Smart Glide is active, the airspeed reference will again be set to Best Glide Speed. Refer to the GTN Xi Series Pilot's Guide for detailed information on Smart Glide.

GMC 605 Annunciating IAS - Glide

GLIDEPATH MODE (GP)

NOTE: *Glidepath mode is available in aircraft with an SBAS GPS-enabled navigator. The GMC 605 may annunciate GP as an armed vertical mode when the APR Key is selected even when interfaced to a GPS navigator that is not capable of calculating a glidepath. In that case GP will never become the active vertical mode.*

Glidepath mode is used to track a glidepath generated by a GPS navigator with WAAS or other Satellite Based Augmentation System (SBAS) capability.

Selecting Glidepath Mode:

1) EXTERNAL NAVIGATOR: Ensure a GPS approach with vertical guidance (LPV, LNAV/VNAV, LNAV+V, LP+V) is loaded into the active flight plan. The active waypoint must be part of the flight plan (cannot be a direct-to a waypoint not in the flight plan).

2) Ensure that GPS is the selected navigation source.

3) GMC 605: Press the **APR** key. The AFCS maintains the current mode but arms Glidepath mode.

4) Upon reaching the glidepath, the AFCS vertical mode transitions to Glidepath Mode and begins to capture and track the glidepath.

NOTE: *Some RNAV (GPS) approaches provide a vertical descent angle as an aid in flying a stabilized approach. These approaches are NOT considered Approaches with Vertical Guidance (APV). Approaches that are annunciated on the HSI as LNAV or LNAV+V are considered Nonprecision Approaches (NPA) and are flown to an MDA even though vertical glidepath (GP) information may be provided.*

WARNING: *When flying an LNAV approach (with vertical descent angle) with the autopilot coupled, the aircraft will not level off at the MDA even if the MDA is set in the altitude preselect.*

Once the following conditions have been met, the glidepath can be captured:

- GPS must be the active lateral mode.
- Vertical deviation is valid.
- The CDI is at less than full-scale deviation.
- Automatic sequencing of waypoints has not been suspended (no 'SUSP' annunciation on the HSI).

NOTE: *Pressing the CWS button while Glidepath mode is active does not cancel the mode. Upon release of the CWS button the autopilot will guide the aircraft back to the glidepath.*

GMC 605 AND GI 285 ANNUNCIATIONS

The GMC 605 and GI 285 annunciate 'GP' for Glidepath mode. Since Glidepath mode relies on GPS positioning, the 'GPS' lateral mode is also annunciated.

GMC 605 Annunciating Glidepath Mode

GI 285 Annunciating Glidepath Mode

GLIDESLOPE MODE (GS)

NOTE: *Glideslope Mode is available in aircraft with a VHF Nav radio that includes a glideslope receiver.*

Glideslope mode is available for ILS approaches to capture and track the glideslope. When Glideslope mode is armed, LOC Approach mode is armed as the lateral AFCS mode.

Selecting Glideslope Mode:

1) EXTERNAL NAVIGATOR: Tune and activate the desired localizer frequency.

2) Ensure that LOC is the selected navigation source.

3) GMC 605: Press the **APR** key. This simultaneously arms LOC and GS (Glideslope) modes.

Once the localizer has been captured (LOC is annunciated as the active lateral mode), the glideslope can also be captured.

NOTE: *Pressing the CWS button while Glideslope mode is active does not cancel the mode. Upon release of the CWS button the autopilot will guide the aircraft back to the glideslope.*

GMC 605 AND GI 285 ANNUNCIATIONS

The GMC 605 and GI 285 annunciate 'GS' for Glideslope mode. Since Glideslope mode relies on LOC positioning, the 'LOC' lateral mode is also annunciated.

GMC 605 Annunciating Glideslope Mode

GI 285 Annunciating Glideslope Mode

2.4 ENROUTE VERTICAL NAVIGATION

Enroute Vertical Navigation allows pilots to customize descent profiles along flight plans and provides vertical descent-only guidance to a digital Vertical Deviation Indicator (VDI) on an interfacing GDU 620, TXi, or G5. The GDU 620, TXi, or G5 must be interfaced to a GTN 6XX or 7XX to support Enroute Vertical Navigation. Enroute Vertical Navigation uses barometric input to the navigator and computes a vertical descent path based on the parameters in the flight plan. The flight plan parameters may be pulled from the navigation database or manually entered (i.e. crossing restrictions). Supported waypoints in a flight plan can be assigned an altitude, and can provide vertical guidance to meet those restrictions. The selected altitude must be at least 75 feet below the present altitude to begin the VNAV descent and below the lowest constraint altitude to descend all of the way to the bottom of the VNAV profile.

The Enroute Vertical Navigation feature uses altitude constraints. Refer to the GTN 620 or TXi Pilot's Guide for more information on altitude constraints.

The pilot can choose to manually descend along the displayed vertical path, or couple the descent navigation with the GFC 600. Coupling VNAV with the GFC 600 allows the autopilot to command the descent along the VNAV path to include intermediate level-offs.

Selecting VNAV Mode:

1) EXTERNAL NAVIGATOR: Ensure a GPS flight plan with vertical altitude constraints is loaded.

2) EXTERNAL NAVIGATOR: Ensure that GPS is the selected navigation source.

3) Verify selected altitude is set to the lowest desired descent altitude (must be more than 75 feet below the aircraft's current altitude).

4) GMC 605: Press the **VNV** key.

At Top-Of-Descent (TOD), the autopilot captures VNAV (VPTH is annunciated as the active vertical mode).

GMC 605 AND GI 285 ANNUNCIATIONS

The GMC 605 annunciates 'ALTV' for automatic altitude constraint capture mode, and 'VPTH' for vertical path (VPTH) mode.

NOTE: *Under certain display screen area limitations 'VPTH' and 'GP or GS' armed modes are combined together into a single 'GP/V' or 'GS/V' annunciation.*

GMC 605 Annunciating VPTH/GP Mode

NOTE: *'ALT' on the GI 285 is equivalent to 'ALTV' on the GMC 605.*

GI 285 Annunciating VNAV/GP Mode

AUTOSWITCHING

When VNAV is active and ILS approach is armed, the GFC 600 will automatically switch to localizer and glideslope between the FAF and the waypoint preceding the FAF, if connected to a GTN 6XX/7XX that has auto switching enabled.

Similarly, when VNAV is active and GPS approach is armed, the GFC 600 will automatically switch to glidepath between the FAF and the waypoint preceding the FAF, if connected to a GTN 6XX/7XX that has auto switching enabled.

Selecting the VNAV Autoswitching Feature (VNAV to GPS Approach):

NOTE: *Vectors to final are not supported by VNAV.*

1) EXTERNAL NAVIGATOR: Ensure a GPS approach with vertical guidance (LPV, LNAV/VNAV, LNAV+V, LP+V) is loaded into the active flight plan. The active waypoint must be part of the flight plan (can be a direct-to a waypoint not in the flight plan).
2) Ensure that GPS is the selected navigation source.
3) Set the pre-selected altitude to the lowest desired or cleared altitude.
4) GMC 605: Press the **VNV** key. The AFCS maintains the current mode but arms Vertical Path mode.
5) GMC 605: Press the **APR** key. The AFCS arms the GP mode.
6) Upon reaching the vertical descent path, the AFCS captures and tracks the vertical path, automatically leveling off at intermediate altitudes.
7) Upon reaching the glidepath, the AFCS vertical mode transitions to Glidepath Mode and begins to capture and track the glidepath.

Selecting the VNAV Autoswitching Feature (VNAV to LOC/GS):

NOTE: *Vectors to final are not supported by VNAV.*

1) EXTERNAL NAVIGATOR: Ensure a ILS approach is loaded into the active flight plan.
2) Ensure that LOC is the selected navigation source.
3) Set the pre-selected altitude to the lowest desired or cleared altitude.
4) GMC 605: Press the **VNV** key. The AFCS maintains the current mode but arms Vertical Path mode.
5) GMC 605: Press the **APR** key. The AFCS arms the LOC and GS modes.
6) Upon reaching the vertical descent path, the AFCS captures and tracks the vertical path, automatically leveling off at intermediate altitudes.
7) Upon reaching the localizer and glideslope, the AFCS transitions to Localizer and Glideslope Mode and begins to capture and track the localizer and glideslope.

2.5 LATERAL MODES

LATERAL MODE CONTROLS AND ANNUNCIATIONS

The table below lists the lateral modes with their corresponding controls and annunciations. Refer to the Vertical modes section for a detailed description of Level mode and Go Around mode.

Lateral Mode	Description	Control	Annunciation
Roll Hold	Holds the current aircraft roll attitude or rolls the wings level, depending on the bank angle at the time of Roll mode activation	(default)	ROL
Level Mode	Commands wings level (zero bank angle) and also commands a pitch attitude necessary to establish a vertical speed of 0 fpm	LVL	LVL
Go Around	Commands zero bank angle and also commands a constant nose-up pitch attitude.	**GA** Button	GA
Heading Select	Captures and tracks the Selected Heading	HDG	HDG
Navigation, GPS	Captures and tracks the selected navigation source (GPS, VOR, LOC)	NAV	GPS
Navigation, VOR Enroute Capture/ Track			VOR
Navigation, LOC Capture/Track (No Glideslope)			LOC
Navigation, Backcourse Capture/ Track	Captures and tracks a localizer signal for backcourse approaches	BC	BC

Lateral Mode	Description	Control	Annunciation
Approach, GPS Capture/Track (Glidepath mode automatically armed)	Captures and tracks the selected approach navigation source (GPS, VOR, LOC)	APR	GPS
Approach, VOR Capture/Track			VAPP*
Approach, LOC Capture/Track (Glideslope mode automatically armed)			LOC

The AFCS limits turn rate to 3 degrees per second (standard rate turn).

* *The GMC 605 displays 'VAPP' for VOR Approach mode, however the GI 285 will display only 'VOR'.*

Autopilot Lateral Mode Summary

The **CWS** button does not change lateral references for Selected Heading, Navigation, Backcourse, or Approach modes. The autopilot guides the aircraft back to the Selected Heading/Course upon release of the **CWS** button.

ROLL HOLD MODE (ROL)

NOTE: *If Roll Hold Mode is activated as a result of a mode reversion, the Flight Director commands a wings level flight attitude.*

When the Flight Director is activated Roll Hold mode is selected by default. The current aircraft bank angle at the time of activation is held as the reference unless the bank angle is greater than 20 deg or less than 6 deg as defined in the following table:

Bank Angle	Flight Director Response
< 6°	Rolls wings level
6 to 20°	Maintains current aircraft roll attitude
>20°	Limits bank to 20°

Roll Hold Mode Responses

When operating in Roll Hold mode, the roll reference can be adjusted in the following ways:

- If the bank angle is less than 6°, the AFCS will roll the aircraft wings level.
- Hold the **CWS** button, establish the desired bank angle, then release the **CWS** button.

GMC 605 AND GI 285 ANNUNCIATIONS

The GMC 605 and the GI 285 display the ROL annunciation when Roll Hold mode is active.

GMC 605 Annunciating Roll Hold Mode

GI 285 Annunciating Roll Hold Mode

HEADING SELECT MODE (HDG)

NOTE: *Heading Select Mode is available in aircraft with a Garmin PFD, an Aspen EFD 1000 display unit, a compatible Horizontal Situation Indicator, or a compatible Directional Gyro.*

Heading Select mode is activated by pressing the **HDG** key. Heading Select mode acquires and maintains the Selected Heading. Turn the HDG Knob on the HSI or DG to set the Selected Heading.

When using a Garmin PFD, turns are commanded in the same direction as Selected Heading Bug movement, even if the Bug is turned more than 180° from the present heading (e.g., a 270° turn to the right). However, Selected Heading changes of more than 330° at a time result in turn reversals.

For non-Garmin HSI or Directional Gyro interfaces, the turn is commanded in the shortest direction toward the bug.

NOTE: *For installations using a non-Garmin HSI or DG, rapid changes in Selected Heading where the bug crosses the current aircraft heading or 180 deg to the current heading may result in the autopilot not turning in the expected direction.*

Holding the **CWS** button and hand-flying the aircraft does not change the Selected Heading. The autopilot guides the aircraft back to the Selected Heading upon release of the **CWS** button.

GMC 605 AND GI 285 ANNUNCIATIONS

The GMC 605 and the GI 285 display the HDG annunciation when Heading Select mode is active.

GMC 605 Annunciating Heading Mode

GI 285 Annunciating Heading Mode

REVERSIONARY GPS TRACK MODE

For aircraft interfaced to a G500/G600 TXi Primary Flight Display, loss of magnetic heading will result in the GFC 600 reverting to GPS track mode. When Reversionary GPS Track mode is active, 'TRK MODE' will be displayed on the GMC 605 and the GFC 600 will fly a GPS track based on the currently selected heading. No pilot action is required to activate or disable Reversionary GPS Track mode.

GMC 605 Annunciating Reversionary GPS Track Mode

NAVIGATION MODES (GPS, VOR, LOC)

NOTE: *Availability of Navigation Modes depends on the installed navigation equipment capabilities and interfaces.*

NOTE: *The selected navigation receiver must have a valid VOR or LOC signal or active GPS course for the Flight Director to enter Navigation Mode.*

Pressing the **NAV** key selects Navigation mode. Navigation mode acquires and tracks the selected navigation source (GPS, VOR, LOC) as provided by a GPS navigator or VHF Nav radio.

When GPS is the selected navigation source the Flight Director will follow GPS Roll Steering commands when available. Some older GPS navigators do not provide Roll Steering commands to the AFCS in which case the Flight Director creates steering commands using course and deviation inputs.

When the navigation source is VOR or LOC, the Flight Director creates roll steering commands from the Selected Course and deviation. Navigation mode can also be used to fly non-precision GPS and LOC approaches where vertical guidance is not required.

If the Course Deviation Indicator (CDI) shows greater than half scale when the **NAV** key is pressed, the selected mode is armed.

GMC 605 Annunciating GPS Navigation Mode Armed

If the CDI is less than half scale, Navigation mode is automatically captured.

When the AFCS is interfaced to a Directional Gyro (as opposed to an HSI), Navigation mode cannot be armed. The pilot must align the aircraft to be on course with the CDI displaying less than half scale of deviation and then press the **NAV** key to force capture in Navigation mode. The GMC 605 will display a message 'SET HDG=CRS' while any Navigation mode is active.

NOTE: *When the AFCS is interfaced to a DG, set the Selected Heading on the DG to the same value as the Selected Course when a Navigation Mode is active.*

Some navigators that combine both GPS and VHF Nav functions are capable of automatically switching the CDI source from GPS to VOR/LOC when programmed to transition from a GPS flight plan to a Localizer approach. The AFCS does not support automatic transition from a Navigation mode to an Approach mode and will revert to ROL mode if it senses the navigation source has changed. This is not the case for installations that support autoswitching. Refer to the pertinent manual for autoswitching capability.

CAUTION: *Navigators or PFDs with automatic CDI source switching capability should be configured with automatic switching disabled if not allowed by the specification installation. Refer to the pertinent manual for limitations.*

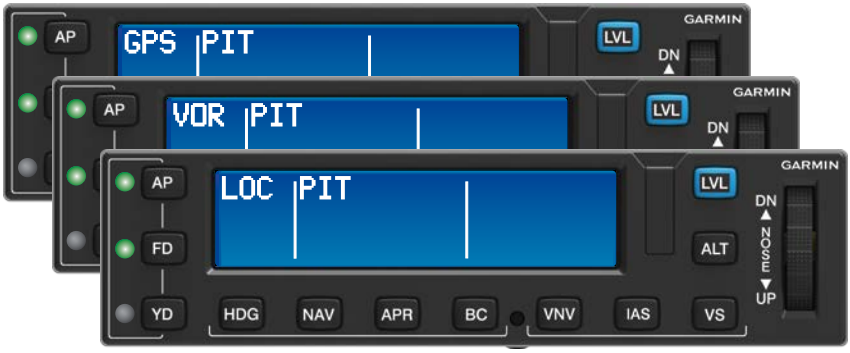
If Navigation mode is active and any of the following occur, the AFCS reverts to Roll Hold mode (wings rolled level):

- Different VHF Nav frequency tuned while in VOR or LOC Navigation mode (note that in some installations Navigation mode may remain engaged if there is still valid deviation after the frequency changes from VOR to VOR, or from LOC to LOC)
- Navigation source switched (e.g. GPS to VOR/LOC, or VOR to LOC)
- Navigation signal of a VOR is lost for more than 5 seconds while crossing over the VOR station.

Pressing the **CWS** button and hand-flying the aircraft does not change the selected course while in Navigation mode. Upon release of the **CWS** button the autopilot will guide the aircraft back to the selected course (or GPS flight plan).

GMC 605 AND GI 285 ANNUNCIATIONS

The GMC 605 and GI 285 will annunciate the appropriate lateral mode as GPS, VOR, or LOC depending on the selected navigation source when the **NAV** key was pressed.



GMC 605 Annunciating Various NAV Modes

GI 285 Annunciating Various Nav Modes

APPROACH MODES (GPS, VOR, LOC)

NOTE: *Availability of Approach Modes depends on the installed navigation equipment capabilities and interfaces.*

NOTE: *The selected navigation receiver must have a valid VOR or LOC signal or active GPS course for the Flight Director to enter Approach Mode.*

Approach mode is selected by pressing the **APR** key. Approach mode acquires and tracks the selected navigation source (GPS, VOR, or LOC), depending on approach loaded in the navigator. This mode uses the selected navigation receiver deviation and desired course inputs to fly the approach. Pressing the **APR** key when the CDI deflection is greater than half scale arms the selected approach mode.

GMC 605 Annunciating GPS Approach Mode Armed

If the CDI deflection is less than half scale, the approach is automatically captured when the **APR** key is pressed.

When the AFCS is interfaced to a Directional Gyro (as opposed to an HSI), Approach mode cannot be armed. The pilot must align the aircraft to be on course with the CDI displaying less than half scale of deviation and then press the **APR** key to force capture in Approach mode. The GMC 605 will display a message 'SET HDG=CRS' while any Approach mode is active.

NOTE: *When the AFCS is interfaced to a DG, set the Selected Heading on the DG to the same value as the Selected Course when an Approach mode is active.*

Some navigators that combine both GPS and VHF Nav functions are capable of automatically switching the CDI source from GPS to VOR/LOC when programmed to transition from a GPS flight plan to an ILS approach. The AFCS does not support automatic transition from a Navigation mode to an Approach mode and will revert to ROL mode if it senses the navigation source has changed. This is not the case for installations that support autoswitching. Refer to the pertinent manual for autoswitching capability.

CAUTION: *Navigators or PFDs with automatic CDI source switching capability should be configured with automatic switching disabled if not allowed by the specification installation. Refer to the pertinent manual for limitations.*

When GPS Approach mode is armed, Glidepath mode is also armed.

Selecting GPS Approach Mode:

1) EXTERNAL NAVIGATOR: Ensure a GPS approach is loaded into the active flight plan. The active waypoint must be part of the flight plan (cannot be a direct-to a waypoint not in the flight plan).

2) EXTERNAL NAVIGATOR: Ensure that GPS is the selected navigation source.

3) GMC 605: Press the **APR** key.

VOR Approach mode (VAPP) provides greater sensitivity for signal tracking than VOR Navigation mode.

Selecting VOR Approach Mode:

1) EXTERNAL NAVIGATOR: Ensure a valid VOR frequency is tuned

2) EXTERNAL NAVIGATOR: Ensure that VOR is the selected navigation source.

3) GMC 605: Press the **APR** key.

LOC Approach mode allows the autopilot to fly an ILS approach with a glideslope. When LOC Approach mode is armed, Glideslope mode is also armed automatically. LOC captures are inhibited if the difference between aircraft heading and localizer course exceeds 105°.

Selecting LOC Approach Mode:

1) EXTERNAL NAVIGATOR: Ensure a valid localizer frequency is tuned.

2) EXTERNAL NAVIGATOR: Ensure that LOC is the selected navigation source.

3) GMC 605: Press the **APR** key.

If Approach mode is active and any of the following occur, the AFCS reverts to Roll Hold mode (wings rolled level):

- Different VHF Nav frequency tuned while in VOR or LOC Approach mode (note that in some installations Approach mode may remain engaged if there is still valid deviation after the frequency changes from VOR to VOR, or from LOC to LOC).
- Navigation source switched (e.g. GPS to VOR/LOC, or VOR to LOC).

Pressing the **CWS** button and hand-flying the aircraft does not change the selected course while in Approach mode. Upon release of the **CWS** button the autopilot will guide the aircraft back to the selected course (or GPS flight plan).

GMC 605 AND GI 285 ANNUNCIATIONS

The GMC 605 will annunciate VOR Approach mode as VAPP, LOC Approach mode as LOC and GS, and GPS Approach mode as GPS and GP. The annunciation displayed is based on the selected navigation source when the **APR** key is pressed.

The GI 285 provides the same annunciations as the GMC 605 with the exception of VOR Approach mode which is annunciated VOR instead of VAPP.

GMC 605 Annunciating Various Approach Modes

GI 285 Annunciating Various Approach Modes

FLYING A DME ARC WITH A GPS NAVIGATOR

The AFCS will intercept and track a DME arc that is part of the active flight plan provided that GPS Navigation mode is engaged, GPS is the active navigation source on the CDI, and the DME arc segment is the active flight plan leg. It is important to note that automatic navigation of DME arcs is based on GPS. If the final approach segment will be flown as a VOR or Localizer approach the pilot must manually change the navigation source from GPS to VOR/LOC when the arc segment is completed. The Flight Director will revert to ROL mode and the pilot must press the **APR** key to capture and track the VOR or Localizer approach.

If the pilot decides to intercept the arc at a location other than the published IAF (i.e. ATC provides vectors to intercept the arc) and subsequently selects Heading mode or Roll mode, the AFCS will not automatically intercept or track the arc unless the pilot activates the arc leg of the flight plan and arms GPS Navigation mode. If at any point while established on the DME arc the pilot deselects GPS Navigation mode, the AFCS will no longer track the arc.

BACKCOURSE MODE (BC)

Pressing the **BC** key selects Backcourse mode. Backcourse mode captures and tracks a localizer signal in the backcourse direction.

NOTE: *When making a backcourse approach, set the Selected Course to the localizer front course.*

The Flight Director creates roll steering commands from the Selected Course and deviation when in Backcourse mode. If the Course Deviation Indicator (CDI) shows greater than half scale when the **BC** key is pressed, the mode is armed. If the CDI is less than half scale, Backcourse mode is automatically captured.

NOTE: *When the AFCS is interfaced to a DG, Backcourse mode cannot be armed. Set the Selected Heading on the DG to the same value as the Selected Course when Backcourse mode is active.*

GMC 605 AND GI 285 ANNUNCIATIONS

The GMC 605 and GI 285 will annunciate 'BC' for Backcourse mode.

GMC 605 Annunciating Backcourse Mode

GI 285 Annunciating Backcourse Mode

2.6 ELECTRONIC STABILITY & PROTECTION (ESP™)

WARNING: *Do not assume ESP will provide stability protection in all circumstances. There are in-flight situations that can exceed the capabilities of ESP technology.*

The Electronic Stability and Protection (ESP) feature is intended to monitor the aircraft and provide control input feedback when necessary to discourage operating the aircraft at potentially unsafe attitudes and/or airspeeds. This feature will only function when the aircraft is above 200 feet AGL and the autopilot is not engaged.

CAUTION: *In aircraft that do not have a Garmin PFD or a GTN 6XX/7XX series navigator with a valid terrain database, Low Speed ESP is not supported and all other ESP modes are functional at any altitude.*

ESP engages automatically when the aircraft approaches or exceeds one or more predetermined airspeed or attitude limitations. Stability protection for each flight axis is provided by the autopilot servos, which apply force to the appropriate control surface(s) to discourage pilot control inputs that would cause the aircraft to exceed the normal or "protected" flight envelope. This is perceived by the pilot as resistance to control movement in the undesired direction when the aircraft approaches a steep attitude, and/or the airspeed is below the minimum or above the maximum configured airspeed.

As the aircraft deviates further from the normal attitude and/or airspeed, the force increases proportionally (up to an established maximum) to encourage control movement in the direction necessary to return to the normal attitude and/or airspeed range.

When ESP has been engaged for more than ten seconds (cumulative; not necessarily consecutive seconds) of a 20-second interval, the autopilot will automatically engage with the Flight Director in Level mode, bringing the aircraft into level flight. An aural "Engaging Autopilot" alert is played and the Flight Director mode annunciation will indicate 'LVL' for vertical and lateral modes.

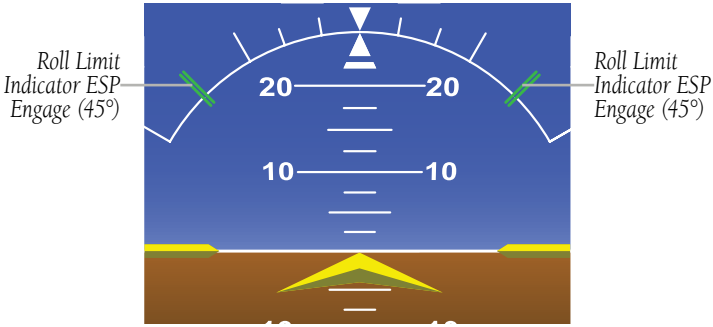
The pilot can interrupt ESP by pressing and holding the **AP DISC / TRIM INT** button. If the **AP DISC / TRIM INT** button is held down for 5 seconds or more, ESP will be disabled. ESP will be re-enabled when either of the **AP** or **FD** keys are selected on or power is cycled on the GMC 605. ESP is always enabled by default when applying system power. If ESP has been disabled the GMC 605 will display the message "ESP OFF" and the Roll Limit Indicators will be removed from the Garmin PFD (if installed).

The servo torque limit is configured such that when ESP is active the pilot can always overpower the servo and hand-fly the aircraft.

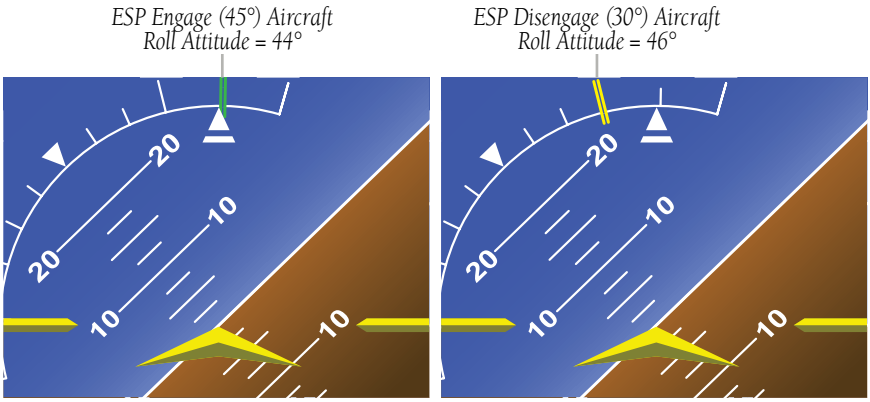
ROLL ENGAGEMENT

NOTE: *This section describes ESP indications displayed on a Garmin PFD. If a Garmin PFD is not installed, the AFCS will still provide the same Roll ESP function but without any displayed indications or annunciations.*

Roll Limit Indicators are displayed on the roll scale of a Garmin PFD at 45 deg to indicate where ESP will engage. As roll attitude exceeds the limit, ESP will engage and the Roll Limit Indicator will move in to 30 deg to indicate where ESP will disengage as roll attitude decreases.



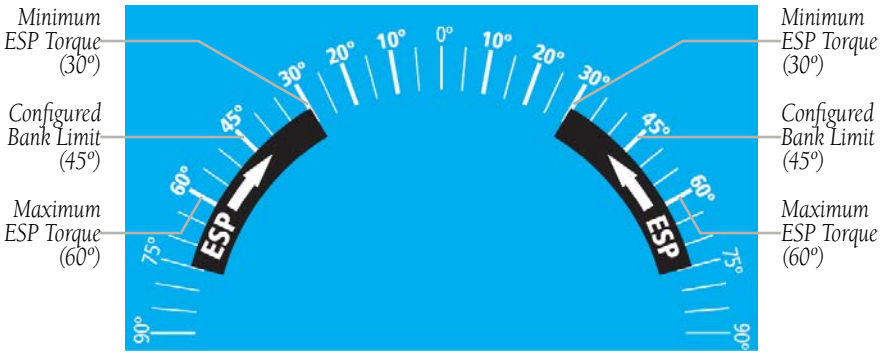
ESP Roll Engagement Indication (ESP NOT Engaged)



Before ESP Engage **After ESP Engage**

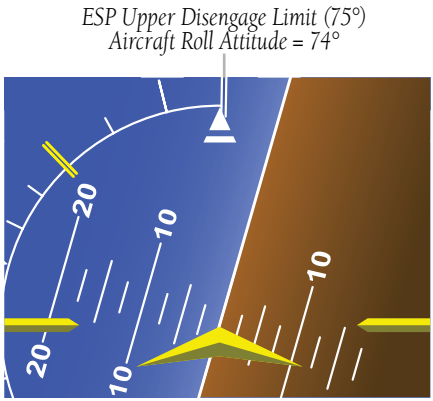
Roll Increasing to ESP Engagement

Once engaged, ESP force will be applied between bank angles of 30° and 75°. The force increases as roll attitude increases and decreases as roll attitude decreases. The applied force is intended to encourage pilot input that returns the airplane to a more normal roll attitude. As roll attitude decreases, ESP will disengage at 30°.



ESP Roll Operating Range When Engaged
(Force Increases as Roll Increases & Decreases as Roll Decreases)

ESP™ is automatically disengaged if the aircraft reaches the autopilot roll engagement attitude limit of 75°.



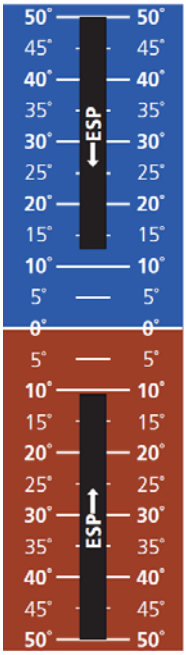
Roll Attitude Autopilot Engagement Limit (ESP Engaged)

PITCH ENGAGEMENT

ESP pitch engagement thresholds are configured for each airframe type. Thresholds are established for both nose-up and nose-down attitudes. Most aircraft are configured such that torque applied by ESP increases to its maximum value when pitch attitude has exceeded the configured nose-up or nose-down pitch limits by 5°. The opposing force increases or decreases depending on the pitch angle and the direction of pitch travel. This force is intended to encourage movement in the pitch axis in the direction of the normal pitch attitude range for the aircraft. As the pitch attitude moves back toward the normal envelope the ESP force ramps down to zero and disengages when pitch is 5° less than the configured nose-up and nose-down pitch limits.

ESP will disengage if the aircraft exceeds the ESP engagement limits of 50 degrees nose-up or nose-down.

There are no indications marking the pitch ESP™ engage and disengage limits in these nose-up/nose-down conditions.



ESP Pitch Operating Range When Engaged
(Force Increases as Pitch Increases & Decreases as Pitch Decreases)

NOTE: *The Pitch ESP operating range may vary for each airframe type. The specific values depicted in the figure above are only to illustrate the Pitch ESP function. Reference the pertinent manual for the Pitch ESP limits for a specific aircraft.*

AIRSPEED PROTECTION

LOW SPEED PROTECTION

When the stall warning system determines a stall condition is imminent, ESP will engage and apply a force in the nose down direction. After stall warning becomes inactive, the force will smoothly be reduced to zero and ESP will disengage.

Low Speed Protection is inhibited when the aircraft is below 200' above ground level. If the AFCS is not receiving height above ground information from a compatible Garmin GPS, Low Speed Protection is not available.

HIGH AIRSPEED PROTECTION

Exceeding the airspeed limit (configured for each airframe type and usually set just above Vne) will result in ESP™ applying force to raise the nose of the aircraft. When the high airspeed condition is remedied, ESP™ force is no longer applied.

Reference the pertinent manual for the High Airspeed ESP limits for a specific aircraft.

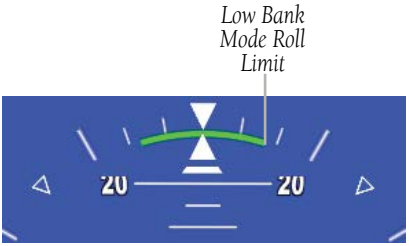
2.7 LOW BANK MODE

NOTE: *Manual Low Bank Mode is also supported on some airframes. A switch mounted on the control panel toggles Low Bank Mode on/off at any altitude.*

Low Bank Mode is intended for aircraft that operate at high altitudes. When crossing the altitude threshold the system automatically enters Low Bank Mode and the PFD displays a green arc on the roll scale, indicating the roll limits.

GMC 605 Annunciating Low Bank Mode

Roll Scale (Normal)



Roll Scale (Low Bank Mode)

2.8 SMART RUDDER BIAS

Smart Rudder Bias is a function intended to assist the pilot in maintaining control of a light twin engine airplane in the event of a single engine failure. Smart Rudder Bias addresses the following three major concerns during a one engine inoperative (OEI) event:

- Large yawing moment in the direction of the failed engine
- Loss of wing lift on the side of the failed engine
- Critical loss of airspeed due to sideslip and increased drag

Smart Rudder Bias determines an engine-out condition by comparing percent power measurements from the two engines and detecting when the difference has exceeded a predetermined configurable threshold. When an engine-out condition has been detected, the function aids the pilot with the following:

- **Rudder Bias**: Assists the pilot in controlling sideslip by driving the rudder in the direction opposite of the failed engine.
- **ESP (Electronic Stability Protection):**

  Roll: Assists the pilot in maintaining bank control by lowering the Roll Attitude ESP thresholds in the direction of the failed engine.

  Pitch: Assists the pilot in maintaining pitch control by lowering the Pitch Attitude ESP thresholds.

  Low Airpeed: Assists the pilot in maintaining an adequate V_{mc} margin by enabling the Low Airspeed ESP function.

CONTROLS AND ANNUNCIATIONS

Smart Rudder Bias consists of PFD annunciations, GMC annunciations, and the Rudder Bias switch. Smart Rudder Bias is a feature that is normally armed and automatically activated during an engine-out situation. Smart Rudder Bias may be OFF (disabled), ARMED (enabled), or ACTIVE. Because it is normally armed, there will only be an alert annunciation when it is either OFF or ACTIVE.

Control	Function
AP DISC	Holding the **AP DISC** button down, disconnects Smart Rudder Bias while the button is held. Holding the **AP DISC** button down for longer than 10 seconds will also disable Electronic Stability & Protection.
RUDDER BIAS / OFF	2-position switch. When "RUDDER BIAS" is selected, Smart Rudder Bias is armed and will activate under specified conditions. When "OFF" is selected, Smart Rudder Bias is disabled and unable to arm/activate.

Smart Rudder Bias Controls

SMART RUDDER BIAS ANNUNCIATIONS (GMC 605)

Smart Rudder Bias has two GMC annunciations to alert the pilot when Smart Rudder Bias will not function. These annunciations may be the result of the pilot intentionally turning off the feature ("RB OFF") or the result of a failure ("RB FAIL").

The following Smart Rudder Bias (not armed) annunciations are displayed on the GMC 605.

Annunciation	Description
RB OFF	Smart Rudder Bias has been manually disabled by the pilot.
RB FAIL	Smart Rudder Bias is automatically disabled due to an internal or external system failure.

Smart Rudder Bias (Not Armed) Annunciations (GMC 605)

GMC 605 Annunciating Smart Rudder Bias Off (RB OFF)

GMC 605 Annunciating Smart Rudder Bias Fail (RB FAIL)

When Smart Rudder Bias is activated the GMC 605 displays an RB ACTIVE annunciation in the CAS area of the display (if the AFCS preflight test in the GMC 605 has completed and passed).

If Yaw Damper (YD) is active when Smart Rudder Bias activates, YD will disengage. The 'YD' LED on the GMC 605 bezel will flash yellow for 10 seconds before disengaging.

Annunciation	Description
RB ACTIVE	Smart Rudder Bias is active and driving the yaw servo.

Smart Rudder Bias Active Annunciation (GMC 605)

GMC 605 Annunciating Smart Rudder Bias Active

SMART RUDDER BIAS ANNUNCIATIONS (PFD)

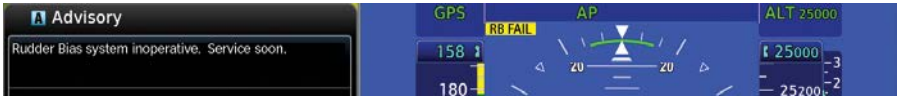
Smart Rudder Bias has two PFD annunciations to alert the pilot when Smart Rudder Bias will not function. These annunciations may be the result of the pilot intentionally turning off the feature ("RB OFF") or the result of a failure ("RB FAIL").

The following Smart Rudder Bias annunciations are displayed on the PFD, once the AFCS preflight test has completed and PASSED.

Annunciation	Description
RB OFF	Smart Rudder Bias has been manually disabled by the pilot.
RB FAIL	Smart Rudder Bias is disabled due to an internal or external system failure.

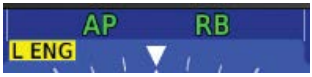
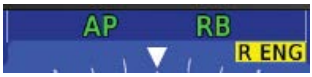
Smart Rudder Bias PFD Annunciations

Smart Rudder Bias OFF PFD Annunciation and Message



Smart Rudder Bias Fail PFD Annunciation and Message

The following Smart Rudder Bias (Active) annunciations are displayed on the PFD:

Annunciation	Description
	Upon activation of Smart Rudder Bias. 'RB' flashes green inverse video for 5 seconds.
	While Smart Rudder Bias is active, 'RB' is green and the engine determined to have low power is displayed in yellow.
	

Smart Rudder Bias Active Annunciations (PFD)

SECTION 3 ANNUNCIATIONS & ALERTS

3.1 VISUAL ANNUNCIATIONS AND ALERTS

The GFC 600 provides visual annunciations and alerts to notify the pilot of system status, failures, degraded operation, and conditions requiring specific pilot action. The table below summarizes the messages that may appear on the GMC 605's display along with any associated LED illumination, GI 285 indications, and a brief description. Refer to other parts of this Pilot's Guide for more information about the functions and modes associated with the annunciations and alerts.

NOTE: *A Garmin PFD (when installed with GFC 600) will provide similar annunciations and alerts to those listed below. Refer to the Garmin PFD's Pilot's Guide for a description of the PFD indications related to AFCS.*

GMC 605 Message	GMC 605 LED	GI 285 Indication	Description
PFT			Preflight Test is in progress
PFT FAIL	●	AP	Preflight Test has failed
AP FAIL	●	AP	Autopilot has failed
YD FAIL	●	YD	Yaw Damper has failed (on some aircraft annunciation may be red)
P TRIM FAIL	●	TRIM	Pitch Trim has failed. Autopilot may remain engaged, but after disengagement it cannot be re-engaged until problem is resolved.
R TRIM FAIL	●	TRIM	Roll Trim has failed. Autopilot may remain engaged and can be disengaged/re-engaged without limitation.
Y TRIM FAIL	●	TRIM	Yaw Trim has failed. Yaw Damper may remain engaged and can be disengaged/re-engaged without limitation.

GMC 605 Message	GMC 605 LED	GI 285 Indication	Description
ELE TRM UP	●	TRIM	Mistrim condition requiring Nose Up Elevator trim
ELE TRM DN	●	TRIM	Mistrim condition requiring Nose Down Elevator trim
AIL TRM LF	●	TRIM	Mistrim condition requiring Roll trim to the Left
AIL TRM RT	●	TRIM	Mistrim condition requiring Roll trim to the Right
RUD TRM LF	●	TRIM	Mistrim condition requiring Rudder trim to the Left
RUD TRM RT	●	TRIM	Mistrim condition requiring Rudder trim to the Right
MAXSPEED			Overspeed Protection is active
MINSPEED			Underspeed Protection is active
AIRDAT FAIL			Air Data inputs to the GMC 605 have failed. Functions dependent on air data (IAS, VS, VPTH, and ALT modes; Overspeed & Underspeed Protection; and High Speed ESP) may not be supported and AFCS performance may be degraded.
ESP OFF			Electronic Stability & Protection (ESP) has been turned Off
ESP FAIL			Electronic Stability & Protection (ESP) function has failed
RB ACTIVE			Smart Rudder Bias is active and driving the yaw servo
RB OFF			Smart Rudder Bias has been manually disabled by the pilot
RB FAIL			Smart Rudder Bias is disabled due to an internal or external system failure
CWS ON	●	AP	Control Wheel Steering is active (the GMC 605's AP LED flashes green continuously during CWS)

GMC 605 Message	GMC 605 LED	GI 285 Indication	Description
SET HDG=CRS			Pilot action required to set the Selected Heading on the DG to the same value as the Selected Course pointer on the CDI. Message displayed continuously when NAV or APR modes are active in a DG-equipped aircraft.
DISABLD KEY			The GMC 605 key selected by the user is disabled because the associated function is not supported in a particular installation
AP KEY STK			The **AP** key on the GMC 605 is stuck in the active state
FD KEY STK			The **FD** key on the GMC 605 is stuck in the active state
YD KEY STK			The **YD** key on the GMC 605 is stuck in the active state
HDG KEY STK			The **HDG** key on the GMC 605 is stuck in the active state
NAV KEY STK			The **NAV** key on the GMC 605 is stuck in the active state
APR KEY STK			The **APR** key on the GMC 605 is stuck in the active state
BC KEY STK			The **BC** key on the GMC 605 is stuck in the active state
VNV KEY STK			The **VNV** key on the GMC 605 is stuck in the active state
IAS KEY STK			The **IAS** key on the GMC 605 is stuck in the active state
VS KEY STK			The **VS** key on the GMC 605 is stuck in the active state
ALT KEY STK			The **ALT** key on the GMC 605 is stuck in the active state
LVL KEY STK			The **LVL** key on the GMC 605 is stuck in the active state

Visual Annunciations and Alerts

3.2 AURAL ALERTS

The GFC 600 outputs aural annunciations and alerts to provide enhanced awareness to the pilot of several key AFCS conditions.

VOICE ALERTS

Voice alerts are played through the aircraft audio panel and are heard through the headset and/or cockpit speaker depending on installation and audio panel selections. The alerts cannot be muted. The voice alerts include:

- AIRSPEED - The AIRSPEED aural announces a low indicated airspeed condition and is played in conjunction with the Underspeed Protection function.
- ENGAGING AUTOPILOT - When ESP has been active for 50% of a 20-second time period, the autopilot engages automatically in Level Mode and the ENGAGING AUTOPILOT aural is played.

AUTOPILOT DISCONNECT ALERT

Autopilot disengagement is accompanied by an aural 'bee-boop' alert tone which is played through the audio panel and also through a separate Sonalert device (when installed). The Sonalert is a small speaker that plays a tone heard in the cockpit above the ambient noise.

Manual autopilot disengagement plays the alert two times. After it is played once the pilot may elect to press the **AP DISC / TRIM INT** button again to silence the alert. Abnormal (automatic) disengagement results in the alert being played continuously until silenced by the **AP DISC / TRIM INT** button.

The alert is also played at the end of Preflight Test to notify the pilot that PFT is complete. The alert is played regardless of whether PFT passes or fails.

SECTION 4 ABNORMAL OPERATION

4.1 SUSPECTED AUTOPILOT MALFUNCTION

If an autopilot failure or trim failure is suspected to have occurred, perform the following steps:

1) Firmly grasp the control wheel.
2) Press and hold the **AP DISC / TRIM INT** button. The autopilot will disconnect and power is removed from the trim motor. Power is also removed from all primary servo motors and engaged solenoids. Note the visual and aural alerting indicating autopilot disconnect.
3) Retrim the aircraft as needed. Substantial trim adjustment may be needed.
4) Pull the appropriate circuit breaker(s) to remove electrical power from the GMC 605 and servos. The GMC 605 display may remain active for up to 10 seconds after power is removed.
5) Release the **AP DISC / TRIM INT** button.

4.2 OVERPOWERING AUTOPILOT SERVOS

In the context of this discussion, "overpowering" refers to any pressure or force applied to the controls when the autopilot is engaged. In an emergency the pilot can forcibly overpower the servos and move the controls throughout their full range of motion without disengaging the autopilot, however even a small amount of pressure or force applied by the pilot in the pitch axis may cause the automatic trim to run. If the action is prolonged this will result in an out-of-trim condition and significant control forces upon autopilot disengagement. Therefore, any application of pressure or force to the controls should be avoided when the autopilot is engaged.

NOTE: *It is acceptable to engage the autopilot on the ground and overpower the servos to verify proper operation and experience the forces required to move the controls while backdriving the servo motors.*

APPENDICES

APPENDIX A: FEATURE/EQUIPMENT MATRIX

	Basic GMC 605 Function	WAAS GPS Nav	Garmin PFD	Aspen EFD 1000	HSI	DG	Garmin EIS	VHF Nav	Add'l GSA 87 Servo	GTA 82
Basic Autopilot Features										
Flight Director Command Bar Display			● OR	●						
Control Wheel Steering	●									
Yaw Damper									●[1]	
Manual Electric Trim									●[2] OR	●[2]
Pitch Autotrim									●[2] OR	●[2]
Roll Autotrim									●[2] OR	●[2]
Yaw Autotrim									●[2] OR	●[2]
Overspeed Protection	●[4]									
Underspeed Protection	●[4]									
Emergency Descent Mode (EDM)[13]		●[10]	●[11]							

	Basic GMC 605 Function	WAAS GPS Nav	Garmin PFD	Aspen EFD 1000	HSI	DG	Garmin EIS	VHF Nav	Add'l GSA 87 Servo	GTA 82
Electronic Stability and Protection (ESP) Features										
Pitch/Roll Engagement	●									
High Speed Protection	●[4]									
Low Speed Protection		●[5] OR	●[5]							
Smart Rudder Bias			●				●		●[1]	
Vertical Autopilot Modes										
Level Hold	●[4]									
Go Around	●[3]									
Pitch Hold	●									
Altitude Hold	●[4]									
Vertical Speed	●[4]									
Selected Altitude Capture			●[4]							
Indicated Airspeed	●[4]									
Glidepath		●								
Glideslope								●[7]		
Vertical Navigation Feature										
VNAV		●[8]	●[9]							

	Basic GMC 605 Function	WAAS GPS Nav	Garmin PFD	Aspen EFD 1000	HSI	DG	Garmin EIS	VHF Nav	Add'l GSA 87 Servo	GTA 82
Lateral Autopilot Modes										
Roll Hold	●									
Heading			●[12] OR	● OR	● OR	●				
GPS Navigation		●[6]								
VOR Navigation			● OR	● OR	● OR	●		●		
LOC Navigation			● OR	● OR	● OR	●		●		
BC Navigation			● OR	● OR	● OR	●		●		
GPS Approach		●								
VOR Approach			● OR	● OR	● OR	●		●		
LOC Approach			● OR	● OR	● OR	●		●		

1. Requires an additional Garmin GSA 87 servo installed on yaw axis.
2. Requires an additional GSA 87 servo or GTA 82 trim adapter to perform the MET and Autotrim functions.
3. Also requires external **GA** button.
4. Requires valid air data input to the GMC 605 via an Air Data Module or Air Data Computer.
5. Requires a Garmin GTN or PFD with a valid Terrain Database.
6. WAAS and Roll Steering not required for basic lateral GPS guidance.
7. Requires VHF Nav Radio that includes a glideslope receiver.
8. Specifically a GTN 6XX or GTN 7XX.
9. A Garmin G5 is also acceptable.
10. Requires a GTN with 6.61 or later.
11. Requires a G500/G600 TXi version 3.01 or later.
12. A Garmin G500/G600 TXi PFD with version 3.01 or later required for Reversionary Track Mode.
13. EDM is not available for every GFC 600 installation.

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Contact Garmin Product Support at **www.flygarmin.com**.

For warranty information refer to
https://fly.garmin.com/fly-garmin/support/warranty-information/

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