



Pilot Operating Guide and Reference

Digital Flight Control System
S-TEC 3100 Digital and Analog

Doc No 87325

This pilot guide must be carried in the aircraft and available to the pilot at all times. It can only be used in conjunction with the Federal Aviation Administration (FAA) approved Aircraft Flight Manual (AFM) or Aircraft Flight Manual Supplement (AFMS). Refer to the applicable AFM or AFMS for aircraft specific information, such as unique ground tests, limitations, and emergency procedures.

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Section 1 Overview

1.1. DOCUMENT ORGANIZATION

Section 1 Overview

Section 2 Pre-Flight Procedures

Section 3 In-Flight Procedures

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Section 6 Glossary

1.2. PURPOSE

This pilot guide provides pre-flight and in-flight operating procedures for the S-TEC 3100 autopilot (3100) for both digital and analog interfaced systems.

NOTE:

The S-TEC 3100 is designed to assist pilots with cockpit workload management. The ability of the 3100 to provide optimum assistance and performance is directly proportional to the pilot's knowledge of its operating procedures. Therefore, it is highly recommended that the pilot develop a thorough understanding of the 3100, its modes, and operating procedures in visual meteorological conditions (VMC) prior to using it under instrument flight rules (IFR).

1.3. GENERAL CONTROL THEORY

The S-TEC 3100 is capable of being a two- or three-axis attitude-based digital flight control system. It is comprised of a computer/programmer, which performs input/output processing and control laws, and an integrated bezel/display for mode selection and display, including trim annunciations.

S-TEC servos are coupled to the control system:

Roll Servo: Coupled to the ailerons. The 3100 senses roll attitude, roll rate, heading error, and course deviation to control the roll servo.

Pitch Servo: Coupled to the elevator. The 3100 senses pitch attitude, pitch rate, pressure altitude, indicated airspeed (IAS), vertical speed (VS), vertical acceleration, and glideslope deviation to control the pitch servo.

Trim Servo: Coupled to the elevator trim. The 3100 senses an out of trim condition whenever the trim sensor in the pitch servo is activated. In response, the 3100 drives the trim servo in the proper direction until the aircraft is in trim.

Yaw Servo (optional): Coupled to the rudder. The 3100 senses yaw rate and acceleration to control the yaw servo.

The 3100 also includes an altitude pre-select function, if enabled.

1.4. LIMITATIONS

1.4.1. Altitude Pre-Select Limitations

The S-TEC 3100 relies on digital air data information for altitude pre-select. Some configurations may not have altitude pre-select if the baro-correction cannot be provided to the autopilot system.

1.4.2. Indicated Airspeed Mode (IAS) and Envelope Protection Limitations

The S-TEC 3100 relies on digital air data information for indicated air speed hold (IAS). Some configurations may not have IAS mode if indicated airspeed data is not provided to the autopilot system.

Overspeed and underspeed protection is not be available for systems without indicated airspeed.

1.4.3. Optional Yaw Damper (YD)

Some aircraft configurations do not have a yaw damper system installed. In these cases, the yaw damper button is blank and the YD LED does not illuminate under any circumstances.



Figure 1-1: S-TEC 3100 Without Optional Yaw Damper

1.5. AUTOPILOT MODES

Autopilot (AP) Mode: Engages autopilot servos

Flight Director (FD) Mode: Drives steering command bars (flight director or electronic flight instrument system (EFIS) required)

Yaw Damper (YD) Mode: Dampens excessive adverse yaw and coordinates turns (if installed)

Roll Attitude (ROLL) Mode: Holds roll attitude

Pitch Attitude (PITCH) Mode: Holds pitch attitude

Heading (HDG) Mode: Turns onto a selected heading and holds it

Navigation (NAV) Mode: Intercepts and tracks a VOR course

Approach (APR) Mode: Intercepts and tracks a LOC front course or GPS approach inbound

Glideslope (GS) Mode: Intercepts and tracks glideslope

Level (LVL) Mode: Returns aircraft to level flight and a configured pitch angle for the aircraft (refer to AFMS for pitch angle value)

Indicated Airspeed (IAS) Mode: Holds indicated airspeed

Vertical Speed (VS) Mode: Holds vertical speed

Altitude Hold (ALT HOLD) Mode: Holds altitude

GPS Steering (GPSS) Mode: Laterally steers along a flight plan course defined by GPS/FMS

GPS Lateral Navigation (GPSL) Mode: Laterally steers along an approach course defined by GPS/FMS approach

GPS Vertical Navigation (GPSV) Mode: Vertically steers along a glidepath defined by a GPS/FMS approach

Reverse (REV) Mode: Intercepts and tracks a LOC back course (BC) inbound or tracks a LOC front course outbound

Control Wheel Steering (CWS) Mode: Used to temporarily disengage servos and manually maneuver the aircraft or set new targets

Go-Around Mode (GA) Mode: Disengages AP and/or engages FD in pitch hold mode with a pre-set nose-up command

Half Bank (HB) Mode: Reduces commands in HDG and GPS/FMS steering by half (if installed)

Automatic Trim Mode: Automatically drives pitch trim servo.

1.6. SYSTEM COMPONENTS

1.6.1. S-TEC 3100 Flight Guidance Computer (FGC)

The S-TEC 3100 FGC is the main processing unit for the autopilot system. It controls all of the input/output processing, control law calculation, and drives up to four servos (pitch, roll, yaw and pitch trim).



Figure 1-2: S-TEC 3100 Flight Guidance Computer (FGC)

The FGC requires navigational and target data to provide the correct servo drive signals. Mode selection may be controlled through the front panel.

The S-TEC 3100 has an on-board MEMS device that calculates attitude angles and rates in the pitch, roll, and yaw axis. This may be configured to act as the primary or single source of attitude on certain interface configurations.

NOTE:

Each S-TEC 3100 is loaded with a single configuration file, which contains aircraft and interface configuration data to match the installation. Any future avionic upgrades on equipment interfaced to the autopilot may require a new configuration file to be uploaded.

1.6.2. Aircraft Configuration

The aircraft configuration contains specific gains and servo drive values to match the aircraft flight characteristics. Gain values are specifically setup during STC flight testing and are calculated for the optimum flight performance of each aircraft model/type.

1.6.3. Interface Configuration

The S-TEC 3100 has been designed to interface to both modern digital EFIS systems and older analog navigation and heading systems. The interface configuration ensures the 3100 maximizes performance by utilizing any available data from both digital and analog sources.

1.6.4. Servo Assemblies



The S-TEC 3100 servos are used to move the aircraft control surfaces. They are driven by the FGC using pulse width modulated (PWM) signal. The pulse width modulation allows the FGC greater control over the speed of servo during fluctuations in aircraft voltage.

Figure 1-3: S-TEC 3100 Servos

1.6.5. Sandia Air Data Computer



The Sandia SAC7-35 is installed on non-EFIS installations that do not have a digital source of air data. The ADC provides essential airspeed and altitude data required for the 3100 internal attitude source to calculate attitude angles and rates.

Figure 1-4: Sandia SAC7-35

1.6.6. GPS 1/2 Selector Switch

Some installations with dual GPS navigators may have a GPS 1/2 selector switch located in the panel with an associated LED. Position of the switch determines from which GPS source the 3100 is receiving navigation data.

- 1) With the LED extinguished the 3100 is following to GPS/NAV 1
- 2) With the LED illuminated the 3100 is following to GPS/NAV 2

If there is no GPS 1/2 selector switch installed, the 3100 is automatically switched by the interfacing EFIS or only a single GPS navigation source is available.

NOTE:

The autopilot always follows the source selected by the GPS 1/2 selector switch regardless of the source displayed on the PFD. Always ensure the GPS 1/2 selector switch position matches the navigation source displayed on the PFD.

1.7. INTERFACED AVIONICS

The S-TEC 3100 may be setup to integrate with both analog and digital systems, which includes (but not limited to) the following.

1.7.1. Garmin G500/G600/TXi EFIS

All mode annunciation is displayed on the 3100 bezel, but the G500/600/TXi does not display 3100 AFCS mode annunciations.

Altitude pre-select is available and the 3100 reads VS, IAS and ALT targets set on the EFIS display (§ 3.8.5).

If a target is set using the 3100 bezel directly, this supersedes any existing targets from the EFIS and the new target is displayed as the altitude annunciation.

Flight director command bars are displayed on the EFIS.

NOTE:

The G500/600/TXi does not update the EFIS displayed targets set on the 3100 bezel directly.

1.7.2. Aspen EFD 500/1000/MAX

All mode annunciations are displayed on the 3100 bezel, but the EFD1000 does not display 3100 AFCS mode annunciations.

Indicated airspeed data is not provided from the Aspen EFD1000. Therefore, some installations may not have IAS mode or envelope protection unless supplemented with additional air data equipment.

This interface uses the 3100 internal altitude pre-select. VS, IAS, and ALT targets cannot be set using the PFD bugs (§ 3.8.5).

For dual GPS navigators, a GPS 1/2 selector switch is required. See § 1.6.6 for function details.

Flight director interface box (ST-670/ST-645) required to display flight director command bars on the EFIS.

1.7.3. Avidyne EXP5000 and Meggitt EFIS

All mode annunciations are displayed on the 3100 bezel, but the EFIS does not display 3100 AFCS mode annunciations.

This interface uses the 3100 internal altitude pre-select. VS, IAS, and ALT targets cannot be set using the PFD bug (§ 3.8.5).

For dual GPS navigators, a GPS 1/2 selector switch is required. See § 1.6.6 for function details.

Flight director command bars are displayed on the EFIS.

1.7.4. Analog DG/HSI

All mode annunciations are displayed on the 3100 bezel. Providing baro-correction to the 3100 enables the 3100 internal altitude pre-select (§ 3.8.5).

This interface is also compatible with the S-TEC ST-360 altitude selector/alerter (§ 3.8.5).

For dual GPS navigators a GPS 1/2 selector switch is required. See § 1.6.6 for function details.

External flight director indicator required to display flight director command bars.

NOTE:

Installations that do not provide baro-corrected data or have an ST-360 installed do not have altitude pre-select and will need to perform a manual altitude capture for climbs and descents (§ 3.8.5.1).

1.8. DISPLAY LEGEND

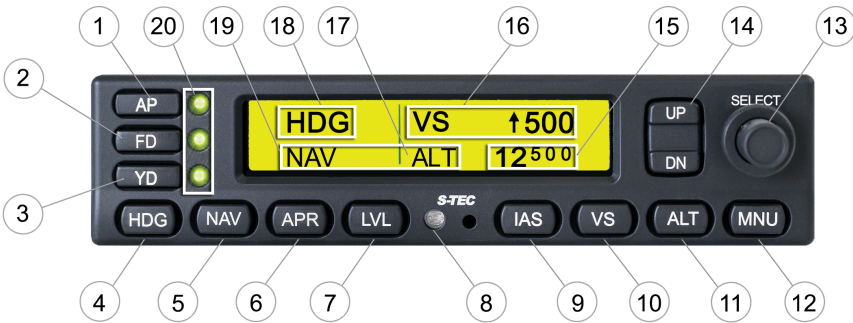


Figure 1-5: Display Legend

- 1) Autopilot (AP) Mode button
- 2) Flight Director (FD) Mode button
- 3) Yaw Damper (YD) Mode button (Optional) - (See Figure 1-1)
- 4) Heading (HDG) Mode button
- 5) Navigation (NAV) Mode button
- 6) Approach (APR) Mode button
- 7) Level (LVL) Mode button
- 8) Ambient light sensor
- 9) Indicated Airspeed (IAS) Mode button
- 10) Vertical Speed (VS) Mode button
- 11) Altitude Hold (ALT HOLD) Mode button
- 12) Menu (MNU) Mode button
- 13) Altitude Selector (SELECT) knobs
- 14) Up/Down (UP/DN) Modifier switch
- 15) Altitude Selector/Alerter annunciation
- 16) Engaged Pitch Mode annunciation
- 17) Armed Pitch Mode annunciation
- 18) Engaged Roll Mode annunciation
- 19) Armed Roll Mode annunciation
- 20) Light Emitting Diodes (LEDs)

Section 2 Pre-Flight Procedures

2.1. POWER-UP TEST

Perform the following actions during power-up.

- 1) Set battery master switch to ON position.
- 2) Set avionics master switch to ON position.
- 3) Set AP master switch to ON position.
- 4) Set trim master to ON position.

NOTE:

For proper manual electric trim function, both the AP master switch and trim master switch must be on during the 3100 self-test.

CAUTION:

DO NOT taxi until initialization is complete, and AP READY is displayed. Taxiing during the initialization process may result in a long initialization time.

The following occur in sequence:

ADAHRS INITIALIZING appears upon power-up to initialize the system and align the internal attitude sensor.

ADAHRS INITIALIZING

Self Test In Progress appears during 3100 self-test of the following:

Self Test in Progress

- 1) Memory and processor tests
- 2) Interface tests
- 3) Servo driver tests

AP READY indicates 3100 is ready for operation.

AP READY

The 3100 cannot be engaged if any of the following failure annunciations are displayed.

If the on-board attitude sensor fails to align, **ATTITUDE FAIL** appears.

A yellow rectangular box containing the text "ATTITUDE FAIL" in bold black capital letters.

If initial alignment is not valid after configured start-up time or data becomes invalid following the alignment, **AP FAIL** appears.

A yellow rectangular box containing the text "AP FAIL" in bold black capital letters, followed by four dashes "----" in black.

2.2. PRE-FLIGHT CHECKS

Preflight checks are detailed in the Aircraft Flight Manual Supplement (AFMS) and should be carried out before every flight. Any failures or unexpected behavior must be rectified before flight.

Section 3 In-Flight Procedures

3.1. ENGAGING THE AUTOPILOT

3.1.1. Roll Attitude (ROLL) Mode

With the 3100 in AP READY state, press **AP** to engage AP, FD, and YD (if applicable) simultaneously, as indicated by illuminated LED.

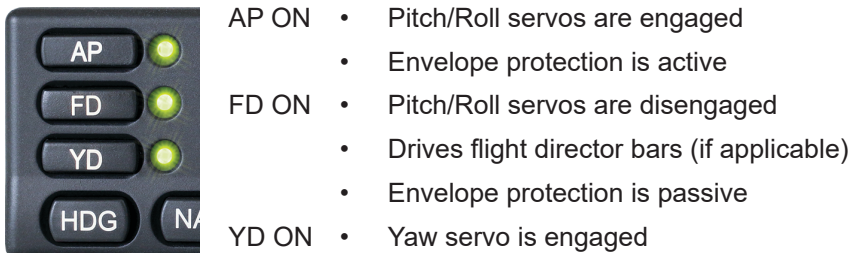


Figure 3-1: Roll Attitude (ROLL) Mode

During normal operation:

- 1) Pressing **AP** always engages FD simultaneously
- 2) FD may be toggled ON/OFF
- 3) YD may be toggled ON/OFF independently

3.2. DISCONNECTING THE AUTOPILOT

The 3100 may be disconnected by any of the following means:

- 1) Press remote AP DISC/TRIM INTR switch located on the yoke; OR
 - a) First single press disconnects AP only, leaving FD engaged
 - b) Second single press subsequently disconnects FD
 - c) Hold AP DISC/TRIM INTR down for 1.25 seconds to disengage both AP and FD and mute any annunciations.
- 2) Set AP master switch to OFF position; OR
- 3) Pull the AP circuit breaker; OR
- 4) Press **AP** when AP mode is engaged.

NOTE:

The 3100 also disconnects under the following circumstances:

- 1) Push the manual electric trim switch;
- 2) When the 3100 detects a fault in the system or an attitude miscompare.

3.3. AUTOPILOT (AP) OPERATION

The 3100 interprets the steering commands calculated by the flight director and sends drive signals to the pitch and roll servos. The servos control the connected aircraft flight surfaces to fly the flight profile. The flight director display provides a visual indication of how accurately the 3100 is tracking the roll and pitch commands.

Active envelope protection is operating when the 3100 is in AP mode.

3.4. FLIGHT DIRECTOR (FD) OPERATION

The flight director (FD) calculates the vertical and lateral movement required for the aircraft to follow the flight profile. The flight profile is determined by the 3100 lateral and vertical mode selected and data from the interfaced avionics.

In FD mode, the 3100 outputs pitch and roll steering commands for display on a connected flight director display. The steering commands are present whether a flight director display is connected or not. The FD provides a visual indication of how accurately the pilot is tracking roll and pitch command.

Passive envelope protection is operating when the 3100 is in FD mode.

NOTE:

If the pilot does not track the steering cues when the 3100 is operating in FD only mode, the flight director steering bars continue to increase the pitch and roll to intercept the calculated flight profile at the time of mode engagement.

It is recommended to sync up the aircraft attitude with the flight director steering bars or select a new mode before engaging the 3100 to avoid aggressive banks or climbs.

NOTE:

When using FD mode on take-off, the 3100 should be in PITCH and ROLL hold or Take-Off-Go-Around (TOGA) modes.

3.5. YAW DAMPER (YD) OPERATION**NOTE:**

Not applicable to aircraft without optional yaw damper installed.



YD mode may be engaged or disengaged at any time, regardless of roll or pitch mode. When YD mode is engaged, the yaw damper dampens any excessive adverse yaw and coordinates turns.

Figure 3-2: Without Optional Yaw Damper Installed

CAUTION:

YD mode should always be disengaged prior to takeoff and landing.

3.6. ENVELOPE PROTECTION

The 3100 protects against underspeed, overspeed, and excessive bank conditions using the envelope protection feature. The envelope speed limits vary between airframes depending on stall speeds, V_{NE} , and whether the aircraft is approved for flight-into-known-icing (FIKI). Specific limits are stated within the relevant AFMS.

NOTE:

Underspeed and overspeed protection requires IAS data and are not operational on installations without IAS mode available.

3.6.1. Envelope Speeds for FIKI Aircraft

FIKI aircraft may have two different underspeed protection limits if the prop de-ice system power has been tied to the 3100. With the de-icing system activated the underspeed limit increases to match the increase in stall speed value for flying in icing conditions.

A remotely mounted LED in the aircraft panel labeled “AP ICE SPEED” illuminates when the higher underspeed limit is in effect.

3.6.2. Passive Envelope Protection

Passive envelope protection is operating anytime FD mode is engaged, indicated by the FD LED being illuminated.

- 1) **Underspeed** alert activates if the aircraft speed reaches the low speed limit, which triggers an audible alarm followed by an “Airspeed, Airspeed” voice alert. Alerts continue until the aircraft speed is increased beyond the underspeed recovery limit as stated in the AFMS
- 2) **Overspeed** alert activates if the aircraft speed reaches the high speed limit, which triggers an audible alarm followed by an “Overspeed, Overspeed” voice alert. Alerts continue until the aircraft speed is reduced below the overspeed recovery limit as stated in the AFMS.
- 3) **Excessive Bank** alert activates if the aircrafts roll attitude exceeds 60 degrees, which triggers an audible alarm followed by an “Attitude, Attitude” voice alert. Alerts continue until the aircraft roll attitude is reduced below 60 degrees.

3.6.2.1. Passive Envelope Protection on Approach

The overspeed and underspeed audible alarms and visual alerts are disabled when the 3100 is in any of the approach modes (APR_{LOC} , APR_{GPSS} , or APR_{GPSV}) and the 3100 is in FD only (AP not engaged). This allows pilots to hand fly slower approaches but retain flight director command bar guidance and to avoid nuisance speed callouts if AP is disconnected at minimums but the FD remains engaged.

3.6.3. Active Envelope Protection

Active envelope protection is operating anytime AP mode is engaged, indicated by the illuminated AP LED. Although excessive bank is still active, it is not relevant while AP is engaged as the 3100 is already under control of bank commands.

ROLL	ALERT -- -- --
------	-------------------

During an underspeed or overspeed alert, the 3100 vertical mode display does not change, but **ALERT** flashes to indicate envelope speed protection has been triggered and the vertical mode is no longer active. Roll mode remains engaged, but the roll commands are reduced by half during envelope speed protection.

Figure 3-3: ALERT

The **underspeed** alert activates if the aircraft speed reaches the low speed limit, which triggers an audible alarm followed by an “Airspeed, Airspeed” voice alert. The 3100 automatically commands the aircraft to pitch down in order to increase airspeed to the underspeed recovery limit.

To recover the aircraft from an underspeed alert:

- 1) Press CWS switch (§ 3.9.1) and then increase aircraft speed beyond the underspeed recovery limit as stated in the AFMS.
- 2) If required, manually fly back onto the desired course, then release CWS to let the 3100 resume the previously active pitch and roll modes.

The **overspeed** alert activates if the aircraft speed reaches the high speed limit, which triggers an audible alarm followed by an “Overspeed, Overspeed” voice alert. The 3100 automatically commands the aircraft to pitch up in order to decrease airspeed to the overspeed recovery limit.

To recover the aircraft from an overspeed alert:

- 1) Press CWS switch (§ 3.9.1) and then reduce aircraft speed below the overspeed recovery limit as stated in the AFMS.
- 2) If required, manually fly back onto the desired course, then release CWS to let the 3100 resume the previously active pitch and roll modes.

3.6.3.1. Active Envelope Protection on Approach

During an ILS or GPS approach with AP engaged, active envelope protection operates until 1000 feet below glideslope capture point. Once the glideslope has been captured, indicated by **GS** or **GPSV** displayed as the active pitch mode, the 3100 remains in active envelope protection until the aircraft has descended 1000 feet below the initial capture point and then transitions to passive envelope protection for the remainder of the approach.

It is recommended to capture the glideslope at 1500 feet AGL so the envelope protection transition from active to passive occurs at 500 feet

AGL. Capturing the glideslope at a different altitude alters the envelope protection transition point.

CAUTION:

The autopilot deviates when tracking a glideslope in order to protect airspeed and prevent a potential stall. The pilot is responsible for maintaining the aircraft speed within the envelope limits stated in the applicable AFMS.

3.6.4. “AP ICE SPEED” (FIKI Aircraft Only)

Aircraft approved for FIKI may have different underspeed limits for when the aircraft icing system is operating or not. Aircraft with this optional input have an LED on the panel labeled “AP ICE SPEED.”

NOTE:

FIKI approved aircraft without the “AP ICE SPEED” option default to the higher underspeed protection limit as stated in the AFMS.

The “AP ICE SPEED” LED illuminates when the aircraft de-icing system is engaged and indicates the underspeed protection limit has changed to accommodate the increase in aircraft stall speed when flying into icing conditions.

With the “AP ICE SPEED” LED extinguished, the underspeed limit is lower and based from the aircraft stall speed in a normal configuration.

All underspeed and overspeed limits are stated within the AFMS.

3.7. LATERAL MODES

All modes may be selected by pressing the appropriate button on the 3100 bezel. A second press of the active mode button deselects the mode, and the 3100 reverts to the armed lateral mode or ROLL mode, if there is no armed lateral mode. For example, if the active mode is heading (HDG) mode **HDG** to deselect HDG and engage ROLL.



Figure 3-4: Roll Attitude (ROLL) Mode

3.7.1. Roll Hold (ROLL) Mode

ROLL hold mode is the default active mode when the FD or the AP+FD is first engaged. ROLL hold can also be activated by deselecting the current active mode or pressing **LVL**. In ROLL hold, the 3100 holds the current roll attitude. Control wheel steering (CWS) (§ 3.9.1) may be used to establish the aircraft on a new roll attitude.

3.7.2. Heading (HDG) Mode

HDG | **PITCH** Set the heading bug to desired heading on the compass card. Press **HDG** to engage HDG. The 3100 turns the aircraft onto the selected heading at a standard rate turn and holds it. A new heading may be selected thereafter by setting the heading bug to it.

Figure 3-5: Heading (HDG) Mode

If installed, half bank (§ 3.9.5) may be used in conjunction with heading mode for improved passenger comfort.

3.7.3. Navigation (NAV) Mode

Press **NAV** to arm or engage NAV mode. If the current engaged lateral mode is HDG, press **NAV** to arm NAV. From all other lateral modes, press **NAV** to engage NAV.

The selected navigation source determines what the 3100 follows and displays:

- 1) **NAV** – VOR navigation.
- 2) **NAV_{Loc}** – LOC navigation. No glideslope capture.
- 3) **NAV_{GPSS}** – Tracks GPS steering commands sent by the connected GPS navigator.

NOTE:

When interfaced to a DG, there is no course pointer input to the 3100. Set the DG selected heading to the required course value.

3.7.3.1. Tracking a VOR (NAV)

- 1) Select VOR frequency on navigator.
- 2) Set course pointer to the desired course radial (for DG only installations, set heading to desired course value).
- 3) Select course intercept method:

- a) **Straight-In:** Press **NAV**. Aircraft intercepts the selected radial at a 45° angle; OR



- b) **Pilot Selectable Angle:** Set heading bug to desired intercept heading. Press **HDG** to engage HDG. Press **NAV** to arm NAV.



- 4) If armed, NAV automatically engages at the course capture point.



- 5) Once captured, the 3100 establishes the crosswind correction angle and tracks the course.

NOTE:

Once tracking, if CDI needle deflection exceeds 50% from center for a period of 15 seconds, **NAV** flashes. If the aircraft subsequently returns to within 50% CDI needle deflection from center, **NAV** stops flashing.

NOTE:

At point of station passage, the 3100 recognizes the condition and holds the last known course. Either allow the aircraft to pass over the station and pick it up again on the other side or select another VOR to track.

NOTE:

If a reference signal required for NAV fails, NAV mode transitions to FAIL, and **NAV** and **FAIL** alternately flash until the signal is valid once more. If this occurs during or after course capture, the 3100 holds the last known crosswind corrected course and ignores CDI needle deflection until the signal becomes valid.

NOTE:

For analog (Non-EFIS) configurations, the course data is fed to the 3100 via both DG/HSI and GPS navigator. When intercepting a VOR, the DG/HSI should be manually synced to the flight plan radial or the flight plan should be cleared to force the 3100 to use the DG/HSI course input and prevent conflicting course information.

3.7.3.2. GPS Steering (NAV_{GPSS}) Mode

- 1) Program a valid waypoint or flight plan into the GPS navigator.
- 2) Press **NAV** to engage NAV GPSS mode.

NAV _{GPSS}	PITCH -----
---------------------	----------------
- 3) The 3100 laterally steers the aircraft along the predefined course.

NOTE:

NAV_{GPSS} mode is slaved to the GPS navigator roll steering output.

NOTE:

During GPSS mode of operation, the 3100 does not accept any course error input from the course pointer.

3.7.4. Approach (APR) Mode

Press **APR** to arm or engage APR mode. If the current active lateral mode is HDG, press **APR** to arm APR. From all other lateral modes, press **APR** to engage APR. The loaded approach from the navigator determines which approach type the 3100 follows and displays:

- 1) **APR** – VOR approach
- 2) **APR_{LOC}** – LOC/ILS approach. Glideslope (GS) mode automatically arms as the vertical mode.
- 3) **APR_{GPSS}** – Tracks inbound course using internally calculated GPS steering commands.
- 4) **APR_{GPST}** – Follows lateral deviations from WAAS capable GPS for LPV, LNAV/VNAV, and LNAV+V approaches. **APR_{GPST}** also automatically arms as the vertical mode.

NOTE:

When interfaced to a DG there is no course pointer input to the 3100. Set the DG selected heading to the required course value.

NOTE:

The airspeed must be kept within the envelope speeds stated within the AFMS during coupled approaches. Active envelope protection may deviate the aircraft from the glideslope path to remain within the airspeed envelope range in order to maintain safety of flight and reduce the risk of stall.

NOTE:

It is recommended to capture the glideslope at 1500 feet AGL to avoid active envelope protection operation below 500 feet AGL.

NOTE:

Back course (REV) approaches are only available when interfaced to an EFIS and automatically detected by the 3100. Non-EFIS interfaces do not have back course (REV) capability.

3.7.4.1. VOR Approach (APR)

A VOR may be tracked in APR mode and should only be engaged when cleared for the approach. APR mode provides greater control and authority than tracking in NAV mode.

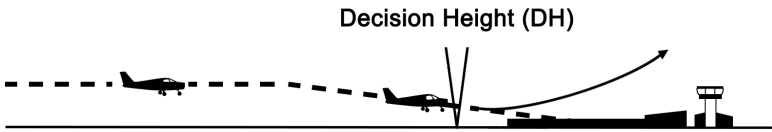


Figure 3-6: VOR Approach

- 1) Select VOR frequency on navigator.
- 2) Set course pointer to the desired course radial (for DG only installations, set heading to desired course value).
- 3) Select course intercept method:
 - a) **Straight-In:** Press **APR**. Aircraft intercepts inbound selected course at a 45° angle; OR

APR	PITCH	-----
------------	--------------	-------
 - b) **Heading Bug (Vectors):** Set heading bug to desired intercept heading, press **HDG** to engage HDG. Press **APR** to arm APR.

HDG	PITCH	-----
APR		
- 4) If armed, APR automatically engages and tracks the localizer once the aircraft captures the inbound course.

APR	PITCH	-----
------------	--------------	-------
- 5) There is no vertical guidance on a VOR approach. Use PITCH, IAS, or VS mode to descend.

APR	VS	↓500	-----
------------	-----------	-------------	-------
- 6) At the decision height (DH) or missed approach point (MAP), disconnect AP to execute either a manual landing or go-around (GA), respectively.

3.7.4.2. ILS Approach (APR_{Loc})

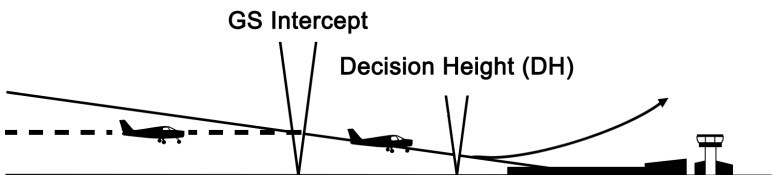


Figure 3-7: Straight-In ILS Approach

- 1) Select LOC frequency on navigator.
- 2) Set course pointer to front inbound LOC course.
- 3) Select course intercept method:

a) **Straight-In:** Press **APR**. Aircraft intercepts inbound selected course at a 45° angle; OR

APR _{LOC}	PITCH -----
---------------------------	-----------------------

b) **Heading Bug (Vectors):** Set heading bug to desired intercept heading, press **HDG** to engage HDG. Press **APR** to arm **APR**_{LOC}.

HDG APR _{LOC}	PITCH -----
---	-----------------------

- 4) **APR** automatically engages and tracks once the aircraft captures the inbound course.

APR _{LOC}	ALT HOLD GS 02 ⁵⁰⁰
---------------------------	---

- 5) **GS** automatically arms, and then captures once the aircraft is within ½ dot (25%), above or below, the **GS** centerline.

APR _{LOC}	CAP ↓400 GS -----
---------------------------	-----------------------------

During **GS** capture, a **VS** descent proportional to the aircraft speed is established.

Recommended **GS** capture altitude is 1500 feet AGL.

- 6) **GS** engages and tracks the glideslope once the aircraft is within 5%, above or below, the **GS** centerline; or 10 seconds has elapsed since glideslope capture.

APR _{LOC}	GS -----
---------------------------	--------------------

- 7) At the **DH** or **MAP**, disconnect **AP** to execute either a manual landing or **GA**, respectively.

3.7.4.3. GPS RNAV Approach (**APR**_{GPSS}/**APR**_{GPSSL})

For aircraft equipped with a WAAS capable **GPS** navigator, the 3100 can execute the **LPV**, **LNAV/VNAV**, or **LNAV+V** approach sequences.

NOTE:

APR_{GPSS} uses an internally calculated roll steering command to steer the aircraft onto the inbound course with greater accuracy.

If preferred, NAV_{GPSS} may be used to slave the 3100 to the GPS navigator output. APR_{GPSS} must then be manually selected for the 3100 to arm and track any vertical guidance.

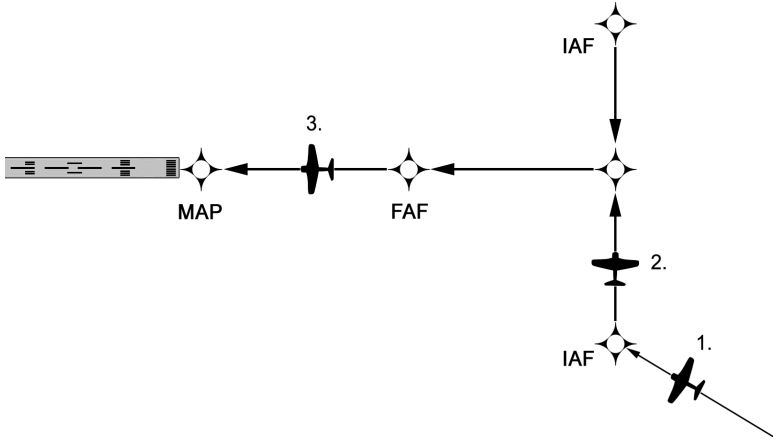


Figure 3-8: RNAV Approach Procedure

- 1) Program approach into GPS navigator.
- 2) Track the approach procedure using NAV_{GPSS} mode.

NAV _{GPSS}	PITCH -----
---------------------	----------------

APR_{GPSS} should not be used until the aircraft is on the final inbound course or at the FAF and looking for vertical guidance.

- 3) Begin descent at IAF in PITCH, VS, or IAS mode. Recommended altitude at FAF is 1500 feet AGL.

NAV _{GPSS}	VS ↓500 GS 02 ⁵⁰⁰
---------------------	---------------------------------------

- 4) Prepare for turn towards FAF.

APR _{GPSS}	ALT HOLD GS 02 ⁵⁰⁰
---------------------	-------------------------------------

Press **APR** once established on the inbound course to arm vertical guidance.

- 5) Lateral mode transitions to APR_{GPSL} and tracks GPS lateral deviations when the CDI <1 dot (50%).

APR _{GPSL}	ALT HOLD GPSV 02500
---------------------	------------------------

- 6) Vertical mode transitions to GPSV and tracks GPS vertical deviations when the GDI <1 dot (50%).

APR _{GPSL}	GPSV -----
---------------------	---------------

- 7) At the DH or MAP, disconnect AP to execute either a manual landing or GA, respectively.

3.8. VERTICAL MODES

All vertical modes may be selected by pressing the appropriate button on the 3100 bezel. A second press of the engaged mode button deselects the mode, and the 3100 reverts to the armed vertical mode or PITCH mode, if there is no armed vertical mode. For example, if the active mode is VS, press **VS** to deselect HDG and engage PITCH.



Figure 3-9: Pitch Attitude (PITCH) Mode

3.8.1. Pitch Attitude (PITCH) Mode

PITCH mode is engaged when the current active vertical mode is deselected or when FD or AP+FD is first engaged.

The 3100 holds the aircraft at its current (captured) pitch attitude. Press **UP** to increase or **DN** to decrease captured pitch attitude. A single press changes the pitch attitude 0.25°.

If an altitude target is active, the aircraft automatically levels off and holds at the selected altitude target (§ 3.8.5).

NOTE:

If the ROLL or PITCH mode was entered by pressing **LVL** or go-around (GA), the altitude target is not captured.

3.8.2. Indicated Airspeed (IAS) Mode

ROLL	IAS	105 -- --
------	-----	--------------

Press **IAS** to engage IAS mode. **IAS** appears. If available, the external IAS target from an EFIS is displayed in units of knots, otherwise the current (captured) IAS is displayed (for example, **105**).

Figure 3-10: Indicated Airspeed (IAS) Mode

The 3100 holds the aircraft at the captured IAS. Use the EFIS IAS target bug or press **UP** or **DN** to increase or decrease the captured IAS. Press once to change the IAS by 1 KT, or press and hold to change at a rate of 5 kts per second.

If an altitude target is active, the aircraft automatically levels off and holds at the selected altitude target (§ 3.8.5).

CAUTION:

Engine power and airspeed must be monitored when IAS mode is engaged, since insufficient power at low airspeeds may cause the aircraft to stall and AP to disconnect. Although the 3100 should limit the airspeed to 3-5 kts below the aircraft's maximum operating airspeed (V_{MO}), large power changes at higher airspeeds may cause the aircraft to momentarily exceed V_{MO} .

3.8.3. Vertical Speed (VS) Mode

ROLL	VS	↑500 -- --
------	----	---------------

Press **VS** to engage VS mode. **VS** appears, and the VS target is displayed in units of feet per minute (fpm). The initial VS target displayed depends on which type of altitude preselect is available (§ 3.8.5). VS target is prefixed by either ↑ (up arrow) indicating climb, or ↓ (down arrow) indicating descent (for example, **↑500** indicates 500 fpm climbing).

Figure 3-11: Vertical Speed (VS) Mode

The 3100 holds the aircraft at the captured VS. Use the EFIS VS target bug or press **UP** or **DN** to increase or decrease the captured VS. A single press changes the VS by 100 fpm.

If an altitude target is active, the aircraft automatically levels off and holds at the selected altitude target (§ 3.8.5).

NOTE:

During a climb, if the commanded VS exceeds the actual VS by 300 fpm for a period of 10 seconds, **VS** flashes as an alert to the potential for an impending stall condition. In this event, immediately increase the aircraft's thrust if possible, reduce the commanded VS with **DN**, or both, until **VS** stops flashing.

3.8.4. Altitude Hold (ALT HOLD) Mode

ALT HOLD mode is engaged either by pressing **ALT** or automatically if an altitude target has been reached from altitude pre-select.

ROLL	ALT HOLD 12 ⁵⁰⁰
------	-------------------------------

Subsequent modification of the altitude target does not change ALT HOLD mode. The 3100 holds the aircraft at the captured altitude. Press **UP** or **DN** to increase or decrease captured altitude. A single press changes the altitude by 20 ft. Range is ± 500 ft. from the original captured altitude.

Figure 3-12: Altitude Hold (ALT HOLD) Mode

NOTE:

When the aircraft has entered ALT HOLD mode and then subsequently exceeds a distance of ± 200 ft. from the captured altitude, the audible alert, "Check Altitude," sounds.

3.8.5. Altitude Pre-Select

ROLL	CAP $\uparrow 400$ ALT 12 ⁵⁰⁰
------	---

Figure 3-13: Altitude Pre-Select

The altitude pre-select function allows for pre-selection of a target altitude and the speed (if within the aircraft's capabilities) or pitch angle at which the aircraft climbs or descends until the altitude is automatically captured.

Audible alerts and voice alerts sound at 1000 ft. and 200 ft. from the target altitude. "One Thousand to Go" and "Two Hundred to Go," respectively.

At the capture point, The 3100 begins a scheduled reduction in VS. **CAP** replaces the active annunciation indicating engagement of ALT HOLD CAP mode.

When the aircraft reaches the target altitude, the voice alert, “Altitude,” sounds, and ALT HOLD mode engages.

If required, use **UP** or **DN** modifiers to increase or decrease captured altitude. A single press changes the altitude by 20 feet.

Altitude pre-select operation differs depending on the type of installation, as follows.

- 1) No Altitude Pre-Select (Manual Altitude Capture)
- 2) S-TEC 3100 Internal Altitude Pre-Select
- 3) S-TEC ST-360 Altitude Selector/Alerter Pre-Select
- 4) Garmin G500/600/TXi Pre-Select

3.8.5.1. No Altitude Pre-Select (Manual Altitude Capture)



Figure 3-14: No Altitude Pre-Select

The altitude pre-select function is not available on some installations. In this case, any target selected by scrolling either concentric SELECT knob is replaced with dashes, **-----**, and altitude pre-select is not available.

- 1) Climb or descend in VS, IAS, or PITCH mode, as preferred.
- 2) Before desired altitude:
 - a) VS/IAS mode – reduce the VS/IAS target with **UP** or **DN** to reduce the climb/descent rate.
 - b) PITCH mode – use CWS to shallow the pitch angle and reduce the climb or descent rate.
- 3) At the desired altitude, press **ALT**. The 3100 holds the current altitude in ALT HOLD mode.


3.8.5.2. S-TEC 3100 Internal Altitude Pre-Select


ROLL	PITCH
	ALT 12 ⁵⁰⁰

Figure 3-15: Target Altitude in ft. with ALT HOLD Mode Armed

To use the 3100 internal altitude pre-select function:

- 1) Pre-select the target altitude with the SELECT knob.

a) Outer knob  changes target altitude in increments of 1000 ft.

b) Inner knob  changes target altitude in increments of 100 ft.

c) Push inner knob to toggle cancellation/recall of the target altitude.

d) Target altitude appears in units of feet (for example, 12⁵⁰⁰).

- 2) Climb or descend in VS, IAS, or PITCH modes.

a) VS mode – VS target defaults to 500 fpm in the direction of the altitude target. Adjust the VS target with **UP** or **DN** to the desired rate of climb/descent.

b) IAS mode – IAS target syncs to the current airspeed. Adjust the IAS target with **UP** or **DN** to the desired speed.

c) PITCH mode – use CWS to establish desired angle of climb or descent.

NOTE:

Once the aircraft has entered the capture phase (CAP), any subsequent target changes are ignored until the 3100 has completed the target capture or if the vertical mode is changed.

3.8.5.3. S-TEC ST 360 Altitude Selector/Alerter




Figure 3-16: S-TEC ST 360 Altitude Selector/Alerter, 3100 Display

To use an ST-360 altitude pre-selector:

- 1) Pre-select the target altitude on the ST-360. Since altitude target is set on an external pre-selector unit, the 3100 is unable to display the target altitude and displays dashed lines instead.
- 2) Climb or descend in VS, IAS, or PITCH mode:
 - a) VS mode – VS target may be preset on the ST-360 or adjusted on the 3100 bezel after VS mode has been engaged.
 - b) IAS mode – IAS target can only be set on the 3100 bezel. Adjust the IAS target with **UP** or **DN** to the desired speed.
 - c) PITCH mode – use CWS to establish desired climb or descent angle.

3.8.5.4. Garmin G500/G600/TXi Pre-Select



Target altitude may be pre-selected with the altitude bug on the PFD. This altitude target is transferred to the 3100 memory once it has been steady for 3 seconds. Since the altitude target is set on an external EFIS unit, the 3100 does not display the target altitude and displays dashed lines instead. To recall the target stored in the 3100 memory, push the SELECT knob in once to display the current altitude target.

Figure 3-17: Target Altitude Not Displayed

NOTE:

Altitude target on the G500/600/TXi PFD must be steady for at least 3 seconds before the 3100 reads the target into memory. This is to avoid the 3100 pitching the aircraft to chase the altitude target as it is being changed.

NOTE:

When interfaced to the Garmin G500/600/TXi, it is best practice to always use the PFD bugs to set the altitude, VS, and IAS targets instead of the SELECT knob and **UP/DN** modifiers.

The 3100 synchronizes to targets set on the Garmin G500/600/TXi. However, targets set with the 3100 are not automatically synchronized or displayed on the Garmin G500/600/TXi.

- 1) Set the required altitude target using the ALT bug on the PFD
- 2) Climb or descend by engaging VS, IAS, or PITCH mode:
 - a) VS mode – Ensure the VS target has been set on the PFD. If the VS bug is set in the opposite direction of the target altitude, the 3100 defaults to 500 fpm in the correct direction of the altitude target.
 - b) IAS mode – Set the IAS target bug on the PFD (if available). For PFDs without an IAS bug, the 3100 synchronizes to the current airspeed when IAS mode is engaged.
 - c) PITCH mode – Use CWS to establish desired climb or descent angle.

3.9. ADDITIONAL MODES

3.9.1. Control Wheel Steering (CWS) Mode

CWS allows the pilot to manually control the aircraft without disengaging the AP to set new targets or maneuver around obstacles such as weather or traffic. If envelope protection is active, CWS can be used to establish the aircraft back inside the safe envelope – without disengaging the AP.



Press and hold the CWS switch to engage control wheel steering mode.

CWS appears, while an audible alert

sounds. In addition, both the roll and pitch servos disengage. Maneuver the aircraft as desired, and then release the CWS switch to disengage CWS mode. **CWS** extinguishes, and both servos re-engage.

Figure 3-18: Control Wheel Steering (CWS) Mode

The 3100 resumes operation in the previous mode.

- 1) If HDG, NAV, APR, or REV mode was engaged, the 3100 returns to tracking the selected.
- 2) If IAS, VS, or ALT mode was engaged, the 3100 holds the new IAS, VS, or altitude, respectively unless an EFIS target bug is active. If the EFIS bug is active and valid, the 3100 reverts back to the bug value once CWS is released.
- 3) If ROLL or PITCH mode was engaged, the 3100 holds the new roll attitude or pitch attitude, respectively.

3.9.2. Go-Around (GA) Button

The go-around button is installed in the aircraft cockpit and may be used when a missed approach is required. Once pressed, the 3100 disconnects, clears all targets and armed modes, and engages the flight director in go-around mode with the steering bars are referenced to wings level and a pitch attitude specific to the aircraft type (reference AFMS).



Figure 3-19: Go-Around (GA)

The AP may be engaged once established in a stabilized climb and above the minimum height as stated in the AFMS to hold the pitch and roll angles. Use HDG to follow a pre-selected heading bug or NAV to laterally fly a missed approach pattern from the GPS/FMS. Vertical maneuvering (climb rates and level-off altitudes) are the responsibility of the pilot.

NOTE:

Some GPS navigators require the pilot to un-suspend the missed approach pattern before engaging NAV mode on the 3100.

3.9.3. Take-Off-Go-Around (TOGA)

The go-around button can also be used to setup the flight director steering bars prior to take-off. The steering bars reference to wings level and a pitch attitude specific to the aircraft type (reference AFMS).

3.9.4. Level (LVL) Mode

NOTE:

Level (LVL) mode functionality may differ from airframe to airframe. Reference the specific aircraft models AFMS for LVL mode functionality and operation.

Press **LVL** to engage LVL mode and place the 3100 in an attitude recovery mode. Press **LVL** again to disengage LVL mode and return to ROLL and PITCH hold modes.

Engagement is indicated by 3100 modes changing to **ROLL/PITCH**, and the flight director setting to wing-level and the configured pitch angle for the aircraft (refer to AFMS for pitch angle value). LVL mode may be engaged or disengaged at any time, regardless of the roll axis or pitch axis mode.



Figure 3-20: Level Mode, Roll and Pitch Hold Modes

3.9.4.1. Emergency Level Mode

Emergency level (LVL) mode is designed to bring the aircraft to wing-level recovery from any powered on state. Press **LVL** once to engage emergency LVL mode. The 3100 servos automatically engage to bring the aircraft to wings-level and the configured pitch angle for the aircraft (refer to AFMS for pitch angle value).

The AP LED does not illuminate, but the “Level Mode, Engage Autopilot” voice alert repeats. To resume normal AP functionality and cancel the audible alert, AP must be manually engaged by pressing **AP** or disconnecting using the AP DISC/TRIM INTR button.



Figure 3-21: Emergency Level Mode; Servos Engaged, No AP

3.9.5. Half Bank (HB) Mode

Half bank (HB) mode is an optional switch/annunciator that limits the 3100's authority and improves passenger comfort. From HDG or GPSS mode, press the HB switch to engage HB mode. When HB is engaged, the 3100 limits the commanded bank angle and maximum command bank angle by 50%.



“ON” illuminates when half bank is engaged. “OFF” illuminates when half bank is disengaged. HB mode disengages either by pressing the switch again or if the 3100 mode is not HDG or GPSS mode.




Figure 3-22: HB Mode Switch/Annunciator

NOTE:

HB mode ONLY operates in HDG or GPSS mode.

3.9.6. Menu (MNU) Button

Press **MNU** to modify the display contrast and brightness and to mute selected audible alerts, as follows:

- 1) Rotate  (outer knob) CW to increase or CCW to decrease display contrast.
- 2) Rotate  (inner knob) CW to increase or CCW to decrease display and mode button brightness.
- 3) Push  (inner knob) to toggle mute (indicated by icon). When muted, all audible alerts are muted except for the disconnect tone. When unmuted, all configured (loaded) audible alerts and tones sound.



Muted



Unmuted

Figure 3-23: Mute Icons



Figure 3-24: Unmute Icon on 3100 Display

- 4) Press **UP** to increase brightness of 3100, FD, and YD LEDs.
- 5) Press **DN** to decrease brightness of 3100, FD, and YD LEDs.
- 6) Press **ALT** to toggle green-on-black or black-on-green display.

Menu activity does not affect the engaged 3100 modes. If the 3100 does not detect any menu activity for a period of 5 seconds, it reverts to the previous display. All menu settings are retained through subsequent power cycles, except for muted audible alerts.

3.9.7. Maintenance Mode

When the maintenance discrete is asserted during power up, the 3100 enters a diagnostic mode. This mode allows for more diagnostics messages to be transmitted from the 3100, a flight test tool to inject failures using controller area network (CAN) messages, and a variety of monitors to be disabled. This mode is primarily intended to be used during initial flight testing and tuning for the aircraft type by a Genesys Aerosystems flight test engineer.

3.10. TRIM

3.10.1. Automatic Trim Annunciations

When the trim master switch is in ON position, the 3100 indicates when it is automatically trimming the aircraft. If the servo loading exceeds a preset threshold for a period of 3 seconds, the 3100 indicates out-of-trim (**TRIM** ↑) as the 3100 is automatically trimming the aircraft. If the 3100 is still automatically trimming the aircraft after 8 more seconds, the trim annunciation flashes, and “Trim in Motion” audible alert repeats. As soon as the aircraft has been sufficiently trimmed, so the servo loading is below the preset threshold, the trim annunciation extinguishes, and the audible alert ceases.



Figure 3-25: Pitch Trim Annunciations

3.10.2. Manual Trim Annunciations

When the trim master switch is OFF, the 3100 indicates when it is necessary to trim the aircraft. If servo loading exceeds a preset threshold for a period of 3 seconds, the 3100 indicates out-of-trim (**TRIM** ↑). In addition, the “Check Pitch Trim” voice alert sounds once. After 8 more seconds, the trim annunciation flashes. As soon as the aircraft has been sufficiently trimmed, the trim annunciation extinguishes.

3.10.3. Manual Electric Trim

AP READY TRIM -----

The manual electric trim switch, located on the control wheel/stick, can only be used to trim the aircraft when AP mode is disengaged. Attempting to use it otherwise disconnects AP but FD mode remains engaged (if previously engaged). To trim the aircraft nose up, press aft and maintain pressure on both segments of the manual electric trim switch. To trim the aircraft nose down, press forward and maintain pressure on both segments of the manual electric trim switch. In either case, **TRIM** flashes.

Figure 3-26: Manual Electric Trim

3.10.4. Automatic Trim Disable

Disconnect the automatic trim function by any of the following:

- 1) Press/Hold remote AP DISC/TRIM INTR switch.
- 2) Set trim master switch to OFF position.

Section 4 Emergency Procedures

Please refer to the aircraft AFMS for emergency procedures for:

- Generator Failure
- Engine Failure
- Autopilot Failure
- Trim Runaway
- Yaw Damper Failure

Section 5 Operating Parameters

5.1. ROLL AXIS LIMITS

Roll Attitude: Greater 38° and not recovering (AP disconnects)

Roll Rate: 10°/sec (AP disconnects)

5.2. PITCH AXIS LIMITS

Pitch Attitude: 22° and not recovering (AP disconnects)

Pitch Rate: 4°/sec (AP disconnects)

5.3. LEVEL MODE RECOVERY

Level mode is approved to recover from a maximum attitude of 51° pitch and 76° roll.

5.4. ENVELOPE SPEED LIMITS

The AP is approved to operate within the indicated airspeed limits as stated within the relevant AFMS.

Section 6 Glossary

Term	Meaning
ADAHRS	Air Data, Attitude, and Heading Reference System
AFCS	Aircraft Flight Control System
AFM	Aircraft Flight Manual
AFMS	Aircraft Flight Manual Supplement
ALT	Altitude
AP	Autopilot
APR	Approach
BC	Back course
CAN	Controller Area Network
CAP	Capture
CCW	Counter–Clockwise
CDI	Course Deviation Indication
CW	Clockwise
CWS	Control Wheel Steering
DFCS	Digital Flight Control System
DH	Decision Height
DISC	Disconnect
DN	Down
EFIS	Electronic Flight Instrument System
FAA	Federal Aviation Administration
FAF	Final Approach Fix
FD	Flight Director
FGC	Flight Guidance Computer
FIKI	Flight Into Known Icing
FPM	Feet per Minute
FT	Feet
GA	Go Around
GDI	Glideslope Deviation Indication
GPS	Global Positioning System

GPSL	Global Positioning System Lateral Navigation
GPSS	Global Positioning System Steering
GPSV	Global Positioning System Vertical Navigation
GS	Glideslope
HB	Half Bank
HDG	Heading
IAF	Initial Approach Fix
IAS	Indicated Airspeed
IFR	Instrument Flight Rules
ILS	Instrument Landing System
INTR	Interrupt
KTS	Knots
LED	Light Emitting Diode
LOC	Localizer
LVL	Level
MAP	Missed Approach Point
MEMS	Micro-Electro-Mechanical Systems
MNU	Menu
NAV	Navigation
PFD	Primary Flight Display
PN	Part Number
PWM	Pulse Width Modulated
RDY	Ready
REV	Reverse
STC	Supplemental Type Certificate
TAS	True Airspeed
TOGA	Take-Off-Go-Around
VMC	Visual Meteorological Conditions
VOR	Very High Frequency Omni-directional Radio Range
VS	Vertical Speed
YD	Yaw Damper

