AVIDYNE

DFC100 Digital Autopilot
Pilot Guide

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1 System Overview

This manual assumes that the pilot is appropriately licensed, is proficient in operation of the aircraft and its equipment, and is in compliance with all Federal Aviation Regulations (FARs).

All images contained in this manual are for reference use only, and are subject to change.

Avidyne strongly recommends that pilots use the DFC100 system only under VFR conditions until completely familiar with its operation and use.

Boxed areas marked as **NOTE** within this manual identify certain situations or areas of operation having safety implications. While it is important for the operator to be familiar with all of the information in the manual, it is essential to the safe use of the DFC100 that pilots give careful attention to the material contained within these **NOTE**s.

Boxed areas marked as **WARNING** within this manual identify certain situations or areas of operation having unique and heightened safety implications.

In order to avoid a diversion of attention from the task of safely taxiing, pilots should avoid performing the described cockpit tasks while the aircraft is in motion during taxi.

It remains the pilot's duty to monitor the autopilot for proper function upon activation and during use.

Internal DFC100 data logs are property of Avidyne.

DFC 100 Digital Flight Control Panel

FUNCTIONAL OVERVIEW

The Avidyne DFC100 autopilot supports the following functions:

- Flight Director
- Heading Capture/Hold
- NAV Tracking
- Vectors Mode
- VNAV Tracking
- Approach Mode (includes LOC, ILS, VOR, BC, LPV, LNAV/VNAV, LNAV+V)
- Altitude Hold
- Altitude Capture
- Vertical Speed Hold
- Indicated Airspeed Mode
- Straight and Level
- Pilot Selectable Intercept Angles
- Control Wheel Steering (not available in all aircraft)
- Takeoff/Go Around (TO/GA) Mode (not available in all aircraft)
- Speed-based Envelope Protection
- Full-time Envelope Alerting

NOTE

Envelope Protection vs. Envelope Alerting
There is a distinction between Envelope Protection and Full-time Envelope Alerting. Envelope Protection will result in active driving of the flight control surfaces by the autopilot. Full-time Envelope Alerting will only provide visual and aural alerting but it is up to the pilot to manually make any control surface changes.

GENERAL AUTOPILOT OPERATIONS

NOTE

Avoid Pilot Flight Control Input In AP
The pilot should not make any input to the flight controls while the autopilot is engaged.

BASIC AUTOPILOT OPERATION

The DFC100 autopilot always has both a lateral and vertical mode active when engaged. If a specific lateral mode has not been selected by the pilot, then the system defaults to Roll Hold mode. If a specific vertical mode has not been selected by the pilot, then the system defaults to Pitch Hold mode.

CAPTURE AND HOLD OPERATION

A single button press will typically engage the mode pressed and arm a logical choice that will capture if the capture criteria are met. For example, pressing IAS or VS will hold the indicated or vertical speed and arm altitude. Another example is pressing the HDG button will engage heading mode and arm NAV mode (if Primary Nav LSK is set to FMS).

If you want the autopilot to remain in the selected mode (e.g. stay in IAS mode and not capture altitude even if the aircraft flies through the altitude bug setting), press the desired button (IAS in this example) a second time to disarm the capture. The blue armed indicator (ALT in this example) on the autopilot and the PFD page will extinguish.

TARGET (BUG) SETTING

The primary location for setting both the IAS and VS targets are via the dedicated knobs on the autopilot control head.

The primary location for setting the HDG and ALT targets are via the dedicated knobs on the keyboard.

AURAL ALERTS

Aural alerting, through the aircraft intercom system, is provided for warnings from the autopilot. In the context of the bullets below, “coupled” describes the condition when the autopilot servos are flying the airplane and “non-coupled” describes the condition when the servos are not flying the airplane and instead, the pilot is expected to follow the flight director command bars. Specifically, aural alerts as defined in the parenthesis are provided under the following conditions:

- Autopilot Disengagement (Approximately 16 disconnect beeps)
- Underspeed during coupled operations (“Speed Protection Active”)
- Overspeed during coupled operations (“Speed Protection Active”)
- Underspeed during non-coupled operations (“Caution, Underspeed”)
- Overspeed during non-coupled operations (“Caution, Overspeed”)
- Dual AHRS equipped systems: Attitude and Heading Reference System (AHRS) Miscompare (“Gyro Miscompare”)
- Single AHRS equipped systems: Attitude and Heading Reference System (AHRS) and Turn Coordinator Miscompare (“Gyro Miscompare”)
- Single AHRS equipped systems: Crosscheck Attitude 1 (“Gyro Miscompare”)
- POH bank limit exceeded (“Caution, Excessive Bank”)
- POH flap extension speed exceeded (“Caution, Flap Overspeed”)

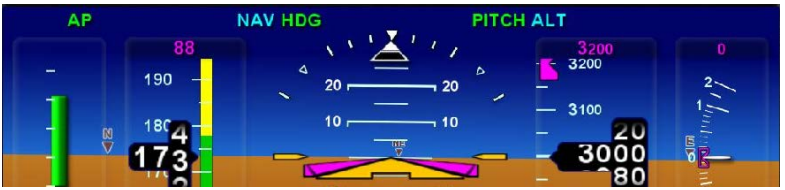
ARMED VS ENGAGED MODE INDICATIONS

The DFC100 autopilot has more readily distinguishable armed vs. engaged modes in order to provide the user higher awareness of the current autopilot state and upcoming state transitions.

An armed mode is defined as a state that will be captured when and if the airplane crosses that target. Armed modes are indicated by a **cyan** (blue) color on both the autopilot control panel and on the PFD mode annunciator strip.

An engaged mode is defined as a state that the autopilot is holding. Engaged modes are indicated by a **green** color on both the autopilot control panel and on the PFD mode annunciator strip. One exception is that when AP is on, both “FD” and “AP” are not lit on the PFD mode annunciator strip – FD is always on with AP.

The images below demonstrate the armed and engaged coloring on both the display and the autopilot control head. In this example, Heading (HDG) and Pitch modes are engaged and Nav mode and Alt are armed.



MODE TRANSITION INDICATION

Automatic transition from armed (cyan) to engaged (green) states is indicated by the cyan armed button on the autopilot control

panel and mode annunciation on the PFD changing to green and flashing for up to 10 seconds.

Note that the engaged (green) autopilot mode annunciators will also flash when in underspeed or overspeed conditions. This flashing is intended to gain the pilot's attention and to indicate that while the modes are still engaged (green), the underspeed or overspeed condition may be affecting the system's ability to hold the target value. As soon as the underspeed or overspeed condition is no longer true, the annunciators stop flashing and the system reacquires the target values as required.

MANUAL ELECTRIC TRIM DISCONNECT

Use of the manual electric trim (MET) in the pitch axis via the cockpit controls will result in the autopilot disconnecting and then the trim running as commanded by the MET control.

NOTE

Trim Behavior in Cirrus Aircraft
For Cirrus aircraft equipped with a pitch servo, actuating the trim switch will disconnect the AP. For Cirrus aircraft that are equipped with pitch trim only, actuating the trim switch will have no effect during autopilot operations (trim will not adjust and the AP will not disengage). For predictability of results, pilots of Cirrus aircraft should therefore determine whether the aircraft is equipped with a pitch servo or pitch trim before actuating the trim switch in IMC conditions.

ENVELOPE PROTECTION

The DFC100 system provides speed-based Envelope Protection (underspeed and overspeed warnings and protection) when in any coupled autopilot mode.

NOTE

No Envelope Protection in Flight Director Mode
Envelope Protection is not provided during flight director-only (non-coupled) operations.

NOTE

Aircraft Stall Possible with Envelope Protection
Conditions can exist where an aircraft can be placed in an attitude and/or configuration that would exceed the capability of the Envelope Protection system to prevent a stall.

When the servos are engaged (AP mode), the likelihood that a command can be made which results in an autopilot induced stall is significantly reduced over conventional autopilots. If for example, a positive rate of climb was commanded and a low power setting is being held, the autopilot will attempt to achieve the commanded state but as the energy of the airplane decays to approximately 1.2 V_S, the autopilot will adjust bank angle and then pitch angle as required to maintain no lower than 1.2 V_S. Bank angle may be reduced before pitch is adjusted in an effort to avoid even entering envelope protection. As soon as bank angle is adjusted by the autopilot, the pilot is alerted through visual means on the PFD ("**UNDERSPEED**" text alert and any engaged (green) autopilot mode annunciator will flash) and as soon as pitch is adjusted, the pilot is alerted through the same visual means on the PFD, and aural alerting in the headsets ("SPEED PROTECTION ACTIVE"). In all cases, when underspeed protection is active, maximum bank angle will be reduced, typically to 5 degrees.

Similarly, envelope protection will provide high-speed protection and alerting near V_{ne}. In this case, as V_{ne} is approached in AP mode, the autopilot will adjust pitch as required to maintain an airspeed near V_{ne}. Aircraft bank angle is not adjusted by the autopilot during overspeed protection. Depending on conditions (e.g. rapidly changing airspeed, turbulence, etc.), it is possible for V_{ne} to be exceeded. An overspeed condition is annunciated to the pilot via an "**OVERSPEED**" text alert on the PFD, a "SPEED PROTECTION ACTIVE" aural alert in the headsets, and by a flashing of any engaged (green) autopilot mode annunciators.

The DFC100 takes flap position into account in Envelope Protection and Envelope Alerting calculations and as a result, the definition of V_s, changes depending on flap position.

NOTE

Envelope Protection During Icing Conditions
The DFC100 autopilot is not to be used during icing conditions in any non-FIKI approved aircraft, or during severe icing conditions in any FIKI approved aircraft. The autopilot does not have any kind of AOA or icing input and therefore does not register changing aircraft dynamics during icing conditions. Therefore, Envelope Protection is not effective under icing conditions.

FULL-TIME ENVELOPE ALERTING

The DFC100 autopilot provides speed-based and attitude-based envelope alerting whenever the autopilot is not engaged (servos not coupled).

Full-time Envelope Alerting is provided during flight director operations (servos not coupled). Full-time Envelope Alerting is also provided even when the autopilot and flight director are off and the autopilot is in the standby position as noted by the **AP READY** mode annunciator on the top strip of the PFD pages.

Full-time Envelope Alerting is triggered when the DFC100 recognizes an underspeed, overspeed or excessive bank angle condition and will alert the pilot via text alerts on the PFD pages and aural alerts.

NOTE

Suppression of Full-time Envelope Alerting
Full-time Envelope Alerting is suppressed during very low power (near idle) conditions when flaps are set to the full-flap position in order to minimize nuisance calls in the landing phase. Full-time Envelope Alerting is also suppressed anytime Indicated Airspeed is less than 50 KIAS in order to minimize nuisance calls during rollout and taxi.

In Flight Director operations, the flight director command bars will continue to direct a pilot to fly to the commanded pitch and roll targets as defined by the bug and nav source entries but if an underspeed condition is recognized, a "**UNDERSPEED**" text alert is displayed along the top edge of the PFD pages and a "CAUTION, UNDERSPEED" aural alert is played in the headsets and is repeated approximately every 6 seconds until the condition is no longer valid. The autopilot mode annunciators do not flash during Envelope Alerting. The trigger for this Envelope Alerting underspeed alert is when the system has determined $1.2V_s$ has been reached. Flap position, bank angle and g-loading are taken into account to define V_s at any point in time (assumes max gross weight).

Similarly, during high-speed flight director operations, the flight director command bars will continue to direct a pilot to fly to the commanded pitch and roll targets as defined by the bug and nav source entries but if an overspeed condition is recognized, a "**OVERSPEED**" text alert is displayed along the top edge of the PFD pages and a "CAUTION, OVERSPEED" aural alert is played in the headsets and is repeated approximately every 6 seconds until the condition is no longer valid. There is no flashing of any autopilot mode annunciator during Envelope Alerting. The trigger for this Envelope Alerting overspeed alert is when the system has determined V_{ne} is about to reached.

If the autopilot is not engaged in any Autopilot or Flight Director modes and is in the standby condition, as indicated by the green "**AP READY**" annunciator on the PFD and no green or cyan lights on the autopilot control head, Full-time Envelope Alerting is still active. In this case, there are no flight director command bars present and no autopilot mode annunciators aside from the "**AP READY**" one along the top edge of the PFD.

If an underspeed condition is recognized, an "**UNDERSPEED**" text alert is displayed along the top edge of the PFD pages and a "CAUTION, UNDERSPEED" aural alert is played in the headsets and is repeated approximately every 6 seconds until the condition is no longer valid. The trigger for this Envelope Alerting underspeed alert is when the system has determined $1.2V_s$ has been reached. Flap position, bank angle and g-loading are taken into account to define V_s at any point in time. One common scenario this capability is designed to alert against is a traffic pattern stall.

Similarly, on the high-speed end of the spectrum with the autopilot in the standby condition (green "**AP READY**" along the top strip of the PFD pages), if an overspeed condition is recognized, a "**OVERSPEED**" text alert is displayed along the top edge of the PFD pages and a "CAUTION, OVERSPEED" aural alert is played in the headsets and is repeated approximately every 6 seconds until the condition is no longer valid. The trigger for this Envelope Alerting overspeed alert is when the system has determined V_{ne} is about to reached.

NOTE

Triggering of Overspeed Alerts

Full-time Envelope Alerting provides overspeed alerting as Vne is approached. The software uses a combination of speed rate, pitch rate, bank and indirectly, g-onset rate to determine when to issue the alarm. If it detects the aircraft is actually recovering as speed approaches Vne, the overspeed alert may be delayed until right at, or slightly over, Vne.

Finally, if at any time and in any flight director or standby state, the system detects an excessive bank condition, a "**BANK LIMIT**" text alert is displayed along the top edge of the PFD pages and a "CAUTION, EXCESSIVE BANK" aural alert is played in the headsets and is repeated approximately every 6 seconds until the condition is no longer valid. The trigger for this Envelope Alerting excessive bank limit is when the system has determined that the lesser of aircraft category or aircraft POH bank angle limits has been exceeded. This number is typically 60 degrees of bank.

If "**AP READY**" or "**FD**" are not displayed on the PFD page, Full-time Envelope Alerting may not be available.

To disable Full-time Envelope Alerting, pull the autopilot circuit breaker.

BAROMETER SETTING ADJUSTMENT

Upon input of a new barometric altimeter setting, the autopilot automatically re-captures the previously set target altitude, without further action required from the pilot. For example, if the autopilot was in Altitude Hold, changing the barometric pressure setting will result in the autopilot automatically correcting the appropriate amount to re-capture the previous MSL altitude hold target.

ENGAGEMENT AND HOLD LIMITS

The DFC100 has maximum engagement limits beyond which the autopilot may not allow a mode to be selected, and maximum hold limits for various parameters. The engagement limits of the autopilot are wider than the hold limits. If the autopilot is engaged between the maximum engagement limits and the maximum hold limits, the autopilot will reduce the value to be within the published maximum hold limits.

The maximum engagement and hold limits are as follows:

Autopilot Mode	**Maximum Demonstrated Engagement Limits**	**Maximum Hold Limits**
Roll Hold	±60° bank	±22°bank
Heading	±60° bank	±22° bank (but typically holds 1 stnrd rate of turn)
Pitch Hold	±30° pitch	-10° to +15° pitch
IAS Hold	20 KIAS to V_{ne}	1.2V_s to 185 KIAS
VS Hold	±1600 fpm	±1600 fpm
Straight and Level	±60° bank, ±30° pitch	Will stabilize in +2° pitch and zero bank angle
Localizer, VOR, GPS approach **Capture**	Not Applicable	±22° bank
Localizer, VOR, GPS approach **Track**	Not Applicable	±10° bank

COMPARATORS

There are various comparators running in the IFD and DFC100 system as noted in the chart below. If conflicting information is provided, the comparator identifying the conflict with the accompanying pilot indication and autopilot behavior is noted in the table below:

Type of Comparator	**Indication to Pilot**	**Autopilot behavior**
Internal kinematic comparator within the AHRS (compares AHRS state data with itself, eg. turn rate without accompanying heading change, etc)	"CROSSCHECK ATTITUDE 1" annunciation on PFD page for minor issues and indicator removal and replacement by "Red-X" for major issues	**Dual AHRS Systems**: No autopilot disconnect **Single AHRS Systems**: Autopilot will disconnect with a "Crosscheck Attitude 1" but will allow manual re-engagement by the pilot.
Dual AHRS Systems: AHRS-to-AHRS Comparator **Single AHRS Systems**: AHRS-to-Turn Coordinator (TC) Comparator	Miscompare Alert message(s) presented to the pilot on the IFD ("AHRS Miscompare" CAS message) and in the headset ("GYRO MISCOMPARE")	Autopilot will disconnect with a Pitch or Roll miscompare (dual AHRS systems) but not for an AHRS-TC miscompare (single AHRS systems) and allow manual re-engagement by the pilot after selection by the pilot of the operable AHRS by reference to the standbys.

AUTOPILOT ENGAGEMENT

From a standby state (autopilot has power, “AP READY” displayed but no modes are engaged and the airplane is within the engagement limits defined above), pressing any button on the DFC100 (except GS and APPR) will engage the autopilot. If a specific lateral and/or vertical mode is not pressed, the DFC100 will default to ROLL hold mode in the lateral channel and PITCH hold mode in the vertical channel.

From a standby state:

- Press “AP” : autopilot engages in **ROLL** and **PITCH** and will hold whatever bank and pitch was present at time of pressing (within maximum hold limits)
- Press “FD” : flight director (servos not coupled) engages in **ROLL** and **PITCH** and will command via the green flight director command bars whatever bank and pitch was present at time of pressing (within maximum hold limits). It is still up to the pilot to maneuver the plane as required to follow those command bars.
- Press “STRAIGHT & LEVEL” : autopilot engages and drives the airplane from whatever attitude it is in to zero bank and a small positive pitch that approximates level flight.
- Press any other button(s) (except GS or APPR) on the autopilot: autopilot engages and will enter the modes as commanded.

AUTOPILOT DISENGAGEMENT

The autopilot can be disengaged using any one of the following methods:

- Press the AP Disconnect switch on the control yoke (in some aircraft, this is a dedicated button and in others, it requires a push in of the trim hat on the yoke);
- Activate the pitch-axis trim switch on the control yoke (this does not apply on pitch trim-only aircraft);

- Press the “AP” button on the autopilot control panel (servos will disconnect but the flight director will remain active);
- Pull the circuit breaker(s) controlling the power to the autopilot.

For those aircraft with the stall warning wired directly to the autopilot, the autopilot will disconnect if the aircraft stall warning alarm is triggered.

In most cases, the autopilot disconnect will be accompanied by a 16-beep disconnect aural alert. This tone can be muted by another press of the AP Disconnect switch on the control yoke.

FD vs. AP

The status of the reference bugs, autopilot annunciators, autopilot control head, and flight director steering command bars indicate when the IFD is coupled with the autopilot.

A solid magenta heading, altitude, IAS or VS bug indicates that function is currently coupled to an engaged or armed mode of the autopilot or the flight director. A hollow magenta bug indicates that the function is not currently coupled to the autopilot or flight director in an engaged or armed mode. In other words, the autopilot and flight director, are ignoring any hollow magenta bug.

The flight director command bars will indicate the required steering of the aircraft to achieve the commanded tracking of the autopilot. In full autopilot mode, both the “AP” and “FD” buttons will be lit on the autopilot control panel and “AP” will be displayed in the autopilot annunciation field on the display, the command bars will be visible and **magenta** and the aircraft should track those bars very precisely.

In Flight Director only mode, only the “FD” button (and not the “AP” button) will be lit on the autopilot control panel and “FD” will be displayed in the autopilot annunciation field on the display, the command bars will be visible and **green**, and the pilot is expected to use the flight controls as required to track those bars. In Flight Director only mode, the pilot is hand flying the airplane and is expected to guide the aircraft such that the yellow aircraft reference symbol is tucked into the steering command bars.

The flight director command bars in a DFC100 autopilot are designed for easy use and improved performance during uncoupled autopilot operations.

During coupled operations (both “AP” and “FD” buttons lit), pressing the “FD” button will have no effect. Pressing the “AP” button in this state will toggle the “AP” mode on/off. It is a good way to disconnect the servos but continue to have flight director command bars present. The recommended way to disengage both the “AP” and “FD” modes will be via trim or the AP Disconnect switch on the control yoke as described above.

PFD ANNUNCIATIONS

The top strip of the PFD page is dedicated for autopilot mode annunciators. Active modes are depicted in green and armed modes are depicted in cyan. Alerts are depicted in yellow and are listed in order of priority. If multiple alerts are received, then the highest priority message is displayed.

Whenever “**UNDERSPEED**” or “**OVERSPEED**” are displayed while the autopilot is coupled, all engaged (green) autopilot mode annunciators will flash.

The tables below are a listing of all annunciations that are possible with the DFC100 system.

DFC100 Annunciations

	AP/FD Mode	Armed Lateral	Active Lateral	Active Vertical	Armed Vertical	Alerts
Normal Annunciations	AP	NAV	ROLL	PITCH	ALT	BANK LIMIT
	FD	NAV APPR	HDG	ALT	GS	SERVO LIMIT
	AP READY		NAV	IAS	ALT GS	
	CWS		NAV APPR	VS	ALT VNAV	
			45° INT	GS	VNAV	
				VNAV		
Envelope Protection/ Envelope Alerting						OVERSPEED
						UNDERSPEED
Straight & Level		STRAIGHT AND LEVEL				
Autopilot Inop	AUTOPILOT INOP					
	AUTOPILOT INOP AHRS FAIL					
	AUTOPILOT INOP SELF TEST FAIL					
	AUTOPILOT INOP AHRS ALIGNING					
	AUTOPILOT INOP AHRS COMPARATOR FAIL					
	NO COMMUNICATION WITH AUTOPILOT					
Disconnect	AUTOPILOT DISCONNECTED					

2 Normal Startup Sequence

POWER CONSIDERATIONS

The DFC100 consumes 0.25A when no servos are in operation and up to 0.9A with all servos operating at 100% duty cycle.

There is no on/off switch for the DFC100. As soon as the power bus is active through normal aircraft checklist steps, the autopilot will power up.

SELF-TEST/ALIGNMENT

The DFC autopilot requires two events to be fully functional. The first is a successful completion of a self-test and the second is a successful alignment of all ADAHRS. To assure readiness of the autopilot for flight, it is also recommended that the pilot conduct the Pre-Flight Test described later in this chapter.

DFC self-test takes less than 5 seconds following power application. The normal self-test indications are a lighting of lights on the autopilot control panel, dwelling approximately 1-2 seconds on each color. The lighting color order is White-Cyan-Green-White. Self-test should be considered a success after the button lighting with no associated failure message along the top strip of the PFD page.

The top strip of the PFD page will display an annunciation that the autopilot is INOP (inoperative) while the ADAHRS is aligning. The message will explicitly state that the ADAHRS is aligning. Any other anomaly during alignment is displayed as a descriptive annunciation along that same top annunciator strip on the PFD.

BRIGHTNESS CONTROLS

The autopilot control head button and knob lighting is controlled via the cockpit dimming controls/rheostats.

If the autopilot control panel appears “inoperative” or non-responsive from a lighting perspective, check the instrument lighting rheostat on the bolster to ensure it is not set to a night position.

PRE-FLIGHT TEST

1. Ensure “AP READY” is displayed on PFD annunciator strip
2. Press AP button on autopilot control head
    a. Ensure AP button is lit in green
    b. Ensure “**AP**”, “**ROLL**”, “**PITCH**” annunciations are depicted in green on the PFD annunciator strip and “**ALT**” is depicted in cyan
3. Set the Heading Bug to be approximately 90 degrees off current aircraft heading
4. Press HDG button on autopilot control head
    a. Ensure HDG button is lit in green
    b. Ensure the ailerons are being driven in the proper direction by the servos (movement is slow and can be hard to see)
    c. Ensure “**HDG**” annunciation has replaced ROLL annunciation and that it is depicted in green on the PFD annunciator strip (“**SERVO LIMIT**” may also be displayed along the right edge – this is normal in some aircraft)
5. Press the AP Disconnect switch on the control yoke
    a. Ensure the aural autopilot disconnect tone is heard in the headset
    b. Ensure “**AUTOPILOT DISCONNECTED**” annunciation is depicted in yellow on the PFD
    c. Ensure “**AP READY**” annunciation is then depicted in green on the PFD annunciator strip
6. Trim the aircraft to the appropriate pre-takeoff position in accordance with normal aircraft checklist procedures.

NOTE

Preflight Test Does Not Test Every Aspect of AP
The Pre-Flight test of the DFC100 autopilot outlined above will check the functionality of such items as the ability of the autopilot to engage and disconnect, the ability of the autopilot to engage the roll axis control surfaces, and the communications between the autopilot and the IFD. However, the Pre-Flight test does not check the function of every item essential to the use of the autopilot. It remains the pilot's duty to monitor the autopilot for proper function upon activation and during use.

BEFORE TAKEOFF TECHNIQUES

A normal technique is to set up the desired autopilot targets while still on the ground (e.g. IAS or VS, ALT and HDG bugs).

Neither the Flight Director nor Autopilot should be engaged until in-flight and at a safe altitude, a minimum of 200' AGL.

3 Climb-out/Enroute

This section covers normal modes of the autopilot during climb-out and enroute operations as well as procedures, mode control and display.

NORMAL OPERATING MODES

Envelope Protection is active in all coupled autopilot modes.

PITCH MODE

Pitch mode is the default vertical mode if no other vertical mode was selected at time of autopilot entry.

There is no specific Pitch Hold button on the autopilot control head and no way to alter the commanded pitch once in Pitch Hold mode. In other words, pressing the “AP” button on the autopilot control panel from the “AP Ready” state will put the airplane into Pitch Hold mode. Similarly, pressing any one of the lateral mode buttons on the autopilot control panel (HDG or NAV) only from the “AP Ready” state will also engage Pitch Hold automatically.

In Pitch Hold mode, the autopilot will maintain a constant pitch from the moment of mode entry. If the mode was entered at a pitch that exceeds the maximum hold limit, the pitch will be reduced to the maximum hold limit value.

The autopilot modes annunciator indication is green “**PITCH**”.

ROLL MODE

Roll mode is the default lateral mode if no other lateral mode was selected at time of autopilot entry.

There is no specific Roll Hold button on the autopilot control head and no way to alter the commanded bank once in Roll Hold mode. In other words, pressing the “AP” button on the autopilot control panel from the “AP Ready” state will put the airplane into Roll Hold mode. Similarly, pressing any one of the vertical mode buttons on the autopilot control panel (ALT or VS or IAS) only from the “AP Ready” state will also engage Roll Hold automatically.

In Roll Hold mode, the autopilot will maintain a constant bank angle from the moment of mode entry. If the mode was entered at a bank angle that exceeds the maximum hold limit, the bank angle will be reduced to be the maximum hold limit value.

The autopilot modes annunciator indication is green "**ROLL**".

VECTORS (HDG) MODE

Vectors mode can be used to temporarily divert off your flight plan (e.g. to fly around a weather buildup, airspace, or traffic, etc.) without having to modify your flight plan as well as maneuvering tactically in the terminal area in a vectors-to-final type approach. When Vectors mode is active, a dashed magenta line is depicted on your moving map and is controlled by the HDG SEL knob on the FMS keyboard. The autopilot will follow that dashed line until the flight plan is re-intercepted or Vectors mode is deactivated. Vectors mode will even build an "on-ramp" back to the solid magenta active leg line on the map.

Vectors mode is entered by ensuring the Primary Nav LSK is set to FMS and then pressing the "HDG" button on the autopilot control panel. It is also entered if the Primary Nav LSK is set to NAV1/2, by pressing the "Fly Vectors" L5 LSK and then pressing the "HDG" button on the autopilot control panel. The system will light the control panel "HDG" button in green and track the dashed magenta vectors line as drawn on the IFD PFD and Map pages. The FMS vectors line is controlled by using the Heading knob on the keyboard and is also represented by the digital heading bug value and the heading bug displayed in solid magenta. You are commanding a manually selected heading to intercept the NAV course. Select a new vectors value by moving the heading bug at any time while the FMS and autopilot are in Vectors mode and the autopilot will track the new bug value/vectors line. Deselecting Vectors mode by changing the Primary Nav source from FMS to NAV1 or NAV2 reverts the autopilot back to standard HDG mode where the autopilot will track the assigned heading indefinitely.

The aircraft will turn in the same direction heading knob was turned. If the knob was turned 300 degrees to the right, the airplane will turn to the right for 300 degrees.

Typical bank angles used in Vectors mode is 1 standard rate of turn, or roughly 22 degrees of bank at normal airspeeds.

Pressing the heading knob synchronizes the selected vectors line to the current heading while in Vectors mode.

The autopilot modes annunciator indication for Vectors mode is a green “**HDG**” and a cyan “**NAV**”.

NAVIGATION (NAV) MODE

Nav mode is entered by pressing the “NAV” button on the autopilot control panel. The system will light the control panel button in green and track the lateral profile provided by the navigation source that is selected in the Primary Nav line select key (LSK) of the PFD page (FMS/NAV1/NAV2).

When the Primary Nav LSK is set to FMS, the FMS will default the autopilot to a 45-degree intercept angle to that nav course unless either the aircraft is sufficiently close to the commanded course (at which time it is in capture mode) or the pilot has set up a pilot-selectable intercept angle of something other than 45 degrees or the pilot has not set up the pilot-selectable intercept and the FMS has determined it needs to use an intercept angle greater than 45 degrees for geometry or leg compliance reasons.

Typical bank angles used during Nav mode intercepts are 22 degrees and this may be reduced if in close proximity to the intended course or during VOR station passage.

When the Primary Nav LSK is set to NAV1 or NAV2, the system will briefly transition to a coast mode during VOR station passage within the “cone-of-confusion” and any entered course changes while inside that area will result in a smooth turn to a wind-corrected heading until the station signal is re-acquired and signal tracking can resume.

When the Primary Nav LSK is set to NAV1 or NAV2, Nav mode will typically conduct its own 45 degree intercept, this is depicted by a cyan “**NAV**” autopilot mode annunciator indicating Nav mode is armed, followed by a green “**45° INT**” indicating the system is currently conducting a 45 degree intercept of the commanded Nav course. When the transition to captured course happens, the green “**45° INT**” extinguishes and in its place a green “**NAV**” is displayed.

ALTITUDE HOLD (ALT) MODE

Altitude Hold mode is entered by pressing the “ALT” button on the autopilot control panel. In many cases, since Altitude Hold mode defaults to armed, this press of the ALT button will toggle the ALT button from armed (cyan) to engaged (green) and disengage the previously engaged vertical channel autopilot mode. The system will light the control panel button in green, and hold the altitude at the time of mode entry. It will not sync the altitude bug on the altimeter to current altitude and will only turn the altitude bug solid if the bug is moved to be within 50 feet of the autopilot holding altitude.

If the barometric setting is subsequently adjusted, the airplane will automatically climb or descend as required to reacquire the selected altitude.

If the altitude bug is moved more than 50’ away from the holding altitude, it will turn hollow. The autopilot does not command an aircraft altitude change at this point and it provides a means for a new future altitude target to be preset.

The primary place to set the Altitude bug is via the dedicated knob on the keyboard. An additional means is provided via a LSK on the “Bug Select” tab of the PFD page.

The autopilot modes annunciator indication for an engaged Altitude Hold mode is a green “**ALT**”.

INDICATED AIRSPEED (IAS) HOLD MODE

Indicated Airspeed Hold mode is entered by pressing the “IAS” button on the autopilot control panel. The system will light the control panel button in green, and adjust the aircraft pitch as required to achieve the bugged indicated airspeed target and turn the IAS bug solid. If already in IAS mode, any subsequent adjustments to the IAS bug sets a new IAS target for the system and aircraft pitch is automatically adjusted to achieve that new IAS target. Pushing the IAS knob will sync the IAS bug to the current indicated airspeed.

If an unterminated IAS climb or descent is desired, a second press of the “IAS” button on the autopilot control head may be required to disarm altitude capture. This is because ALT defaults

to armed. For example, if, during the natural course of flying the commanded indicated airspeed while in IAS mode, the aircraft crosses the altitude bug value, the autopilot will transition out of IAS mode and into Altitude Hold mode. In order to prevent this, and instead fly an unterminated IAS climb or descent, press the “IAS” button on the autopilot a second time which will result in the armed (cyan) ALT button extinguishing and leaving only a green IAS button.

In aircraft equipped with pitch trim only (no separate pitch servo), this mode is still functional but may feel less precise than those aircraft that also have a pitch servo. In these cases, the aircraft IAS may vary by as much as 5 knots around the target IAS as the trim system works to hold the target IAS.

The minimum settable IAS bug is V_{so} and the maximum settable IAS bug is 185 KIAS.

The only location to set the IAS bug is via the dedicated IAS knob on the autopilot control panel. The knob has a push-to-sync capability that will sync the target IAS to the current aircraft IAS.

The autopilot modes annunciator indication is a green “**IAS**”. There is no armed (cyan) IAS mode.

VERTICAL SPEED (VS) HOLD MODE

Vertical Speed Hold mode is entered by pressing the “VS” button on the autopilot control panel. The system will light the control panel button in green, turn the VS bug solid and adjust the aircraft climb/descent rate as required to match the bug setting.

Because ALT defaults to armed, if an unterminated VS climb or descent is desired, a second press of the “VS” button on the autopilot control head may be required. This will prevent an altitude capture. For example, if during the natural course of flying the commanded vertical speed while in VS mode, the aircraft crosses the altitude bug value, the autopilot will transition out of VS mode and into Altitude Hold mode. In order to prevent this, and instead fly an unterminated VS climb or descent, press the “VS” button on the autopilot a second time which will result in the armed (cyan) ALT button extinguishing and leaving only a green VS button.

The range of settable VS targets is ±1600 fpm.

The primary location to set the VS bug is via the dedicated VS knob on the autopilot control head. A secondary method is via a LSK on the “Bug Select” tab of the PFD page. The knob has a push-to-sync capability that will sync the target VS to the closest 50 fpm to the current aircraft VS.

The autopilot modes annunciator indication is a green “**VS**”. There is no armed (cyan) VS mode.

VNAV MODE

Provided three rules are met, Vertical Nav (VNAV) will capture and track the enroute, arrival, approach, and missed approach legs of the active flight plan within the FMS400/900w. It can also be useful with pilot selected vertical waypoints. VNAV mode is entered by pressing the “VNAV” button on the autopilot control panel. When VNAV is active, the system will light the control panel button in green. In enroute and descent operations, VNAV will hold current altitude until the system reaches the computed Top of Descent (TOD) point for the active leg, and then will start the descent when the TOD point has been reached. During missed approach operations, VNAV will climb to the target altitude and then level at that altitude until the next waypoint is crossed.

The three rules that must be met in order to allow VNAV operations are:

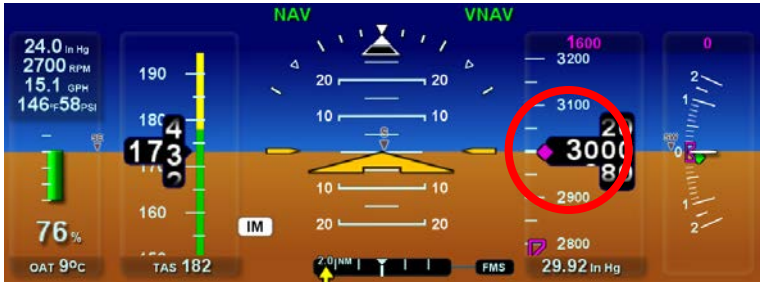
- Primary Nav LSK must be set to FMS;
- At least one down-path flight plan waypoint must have an altitude constraint associated with it;
- Autopilot must be in NAV mode (engaged or armed) for the lateral mode.

Selecting a published approach or arrival within the FMS will automatically fill in any associated altitude constraints in the flight plan, thereby eliminating any need for pilot input of VNAV altitude constraints. If a published approach has not been selected within

the active flight plan or if additional/different altitude constraints are desired, use the IFD flight plan edit controls to adjust the vertical constraint field of a flight plan leg. “At”, “At or Below”, “At or Above”, and “Window” constraints are all supported within the FMS but the VNAV calculation will attempt to reach the waypoint right “at” the constraint. An example of the FMS altitude constraint field is shown immediately below.

VNAV will plan and attempt to meet constraints using the preferred climb/descent rate, but will adjust as necessary up to the maximum rate. The default descent/climb rate for all VNAV operations is 500 fpm. If a different default rate is desired, the FMS Setup pages can be used to set a new value (up to 1500 fpm) but this is not recommended by Avidyne. Maximum rates may also be modified, but you should always be sure to leave at least a 250 FPM difference from the preferred rate so that VNAV has a margin for control. If the two rates are too close together, VNAV will have little to no margin and the “VNAV Unable Constraint” alert will be a frequent occurrence.

The FMS-computed VNAV target altitude is depicted on the altimeter tape as a magenta diamond as shown in the image below. The green VSR diamond on the VSI scale is advisory only.



Whenever VNAV is selected and the aircraft passes the last waypoint in the flight plan with an altitude constraint, the autopilot will automatically transition to ALT Hold mode at the last VNAV waypoint altitude constraint.

If conducting a precision approach in VNAV mode, VNAV will automatically disengage when the final approach course is captured. For ILS approaches, the system will almost simultaneously switch primary nav source so that the aircraft continues to intercept and follow the glideslope. For precision WAAS approaches, the system will automatically begin following the vertical guidance provided by the WAAS approach.

If conducting a non-precision approach in VNAV mode, VNAV will fly all defined step-down fixes until reaching the leg that contains the Missed Approach Point, at which time, VNAV will automatically disengage and the autopilot will transition to Altitude Hold and hold the altitude of the waypoint just prior to the Missed Approach Point.

NOTE

VNAV Altitude Constraints on an Airfield
If a flight plan leg altitude constraint is entered for a flight plan waypoint that is an airport, the default VNAV target altitude constraint will be 1000' AGL and 5 miles prior to the airport. Taking advantage of this feature can produce a good technique of using VNAV to enter a VFR pattern including presenting a Top of Decent marker on the map and a smooth, controlled entry into the VFR pattern in VNAV mode.

When flying a published missed approach in VNAV mode, all altitude constraints will be achieved until there are no further altitude constraints in the procedure. Holding patterns as part of a published missed approach do not typically have an associated altitude constraint and, therefore, VNAV will typically automatically transition to Altitude Hold mode upon entering the hold.

If VNAV is engaged when the next altitude constraint in the flight plan is above the current aircraft altitude, the system will hold the aircraft altitude (and not climb to that constraint) and the display the cyan advisory message, “VNAV Holding Alt”.

Change 1

If the system has concluded that it cannot make the next vertical constraint for any reason, a yellow R6 caution message, “VNAV Unable Constraint” is issued. In this case, additional pilot input may be required if the entered vertical constraint is to be met.

If VNAV is terminated for some reason other than an overt pilot action, a cyan advisory message, “VNAV Terminated” is displayed. Likewise, whenever VNAV is pressed on the autopilot control panel but conditions are invalid for VNAV (e.g. Primary Nav source not FMS, autopilot not in NAV, no down-path altitude constraints in the flight plan, etc), a cyan advisory message, “VNAV Unavailable” is displayed.

The autopilot modes annunciator indication is a green “**VNAV**”. There is no armed (cyan) VNAV mode.

ALTITUDE CAPTURE MODE

Altitude captures can be performed using IAS, VS, VNAV or PITCH.

To perform an indicated airspeed-based altitude capture, set both the IAS bug and the ALT bug to the desired values and press the “IAS” button on the autopilot control panel. The system has a Alt-Always-Armed design that means the “ALT” button will automatically arm after pressing just the “IAS” button. The system will light the IAS button in green and turn the IAS bug solid and light the ALT button in cyan and turn the ALT bug solid.

To perform a vertical speed-based altitude capture, set both the VS bug and the ALT bug to the desired values and press the “VS” button on the autopilot control panel. The system has a Alt-Always-Armed design that means the “ALT” button will automatically arm after pressing just the “VS” button. The system will light the VS button in green and turn the VS bug solid and light the ALT button in cyan and turn the ALT bug solid. A pilot throttle input may be required to sustain the target vertical speed.

NOTE

Altitude Capture Needs Achievable Commands
Care should be taken such that a logical set of IAS (or VS) and ALT targets are selected in order to capture the desired altitude. For example, if a negative vertical speed is selected and an altitude above present aircraft altitude is selected, and then an Altitude Capture commanded, the autopilot will attempt to fly at the commanded negative vertical speed and never cross the targeted altitude, thereby never transitioning to Altitude Hold mode.

There is also a 'black out' period where the autopilot will ignore the commanded target altitude if it is being edited as the original target altitude is approached. For example, if the system is currently performing an altitude capture on departure leg to an ATC assigned altitude, and as the aircraft is approaching that original assigned altitude, ATC issues a new assigned altitude that the pilot is in the process of entering into the system, the autopilot will ignore the original target and keep climbing to the new target. As soon as the edit mode is exited, as indicated by the altitude bug value no longer being reverse-highlighted, the autopilot will honor whatever target altitude is active in the system.

The autopilot modes annunciator indication for altitude captures are a green "**IAS**" or "**VS**" and a cyan "**ALT**". As the target altitude is approached, the "IAS" or "VS" annunciators and buttons on the autopilot control panel extinguish and the "**ALT**" annunciator and button turns green and flashes for up to 10 seconds indicating the system is capturing the target altitude. At the end of the flashing period, both the modes annunciator and the control panel button are displayed in steady green.

STRAIGHT AND LEVEL

NOTE

Straight and Level Definition
Pressing the “STRAIGHT AND LEVEL” button on the autopilot will result in a zero bank, +2° pitch angle attitude. It is not an altitude hold mode or a zero vertical speed mode, nor does it hold a heading.

NOTE

Straight and Level Usable Envelope
The Straight and Level button and functionality were demonstrated to the POH limits of the aircraft (±60° bank, ±30° pitch). Straight and Level is not to be relied upon to stabilize an aircraft under all conditions. Activating this mode will result in the autopilot making its best effort to reach a wings level, +2° pitch angle attitude. Depending on the power setting and aircraft configuration, this could produce a climb, steady altitude, or a descent

Straight and Level mode is entered by pressing the “STRAIGHT & LEVEL” button on the autopilot control panel. The system will light the control panel button in green (blinking) and immediately change the bank and pitch as required to seek wings level, +2° pitch angle conditions. Once straight and level is achieved, the Straight & Level button on the control panel will be steady green until another mode is selected. Upset recovery will be a smooth, but depending on the entry attitude, aggressive maneuver designed to achieve those steady state conditions in an expedited manner. At sufficiently high power settings and aircraft configurations (e.g. no flaps), a +2° pitch angle will result in a shallow climb. At low power settings and/or aircraft configurations, a +2° pitch angle may result in a descent.

Straight and Level mode can be entered from any autopilot state, including from the off position.

NOTE

Limitation of Overspeed Protection in Straight and Level

Overspeed protection is not ensured during initiation of Straight and Level mode. Depending on the dynamics of the airplane and the available torque in the servos, the recovery to straight and level conditions may exceed V_{ne}. For example, if the aircraft were in an extreme nose-low and/or high-speed condition at time of Straight and Level activation, it is possible for V_{ne} to be exceeded during the recovery to straight and level conditions.

The autopilot modes annunciator indication is a green "**STRAIGHT AND LEVEL**". If the aircraft was not in a wings level, zero flight path condition at time of mode entry, then both the button and the mode annunciator will flash green while the aircraft is being maneuvered to achieve those conditions. At that time, both the control panel button and the mode annunciator stop flashing and turn steady green.

PILOT SELECTABLE INTERCEPTS

The autopilot can be commanded to perform a pilot selectable intercept angle in the lateral modes of NAV. This can prove useful both enroute as well as in the terminal area and approaches.

To perform a pilot selectable intercept of a calculated nav course, set the heading bug to the desired value and press the "HDG" button on the autopilot control panel. If the Primary Nav LSK was set to FMS, the system will light the HDG button in green and turn the heading bug solid and light the NAV button in cyan. If the Primary Nav LSK was set to NAV1 or NAV2, then make a

simultaneous push of both the heading (HDG) and lateral nav (NAV) buttons on the autopilot control panel.

The heading knob can be adjusted at any time (before or after entering pilot selectable intercept mode) and the system will adjust the intercept angle accordingly.

To disarm the intercept of the selected Nav source, press the "HDG" button. To re-arm the intercept, press "NAV" again.

The autopilot modes annunciator indication for pilot selectable intercepts are a green "**HDG**" and a cyan "**NAV**". As the lateral nav course is approached, the "HDG" annunciators and buttons on the autopilot control panel extinguish and the "**NAV**" annunciators and button turns green and flashes for up to 10 seconds indicating the system is capturing the lateral nav course. At the end of the flashing period, both the modes annunciator and the control panel button are displayed in steady green.

CONTROL WHEEL STEERING MODE

Control Wheel Steering (CWS) mode is entered by pressing the CWS button on the aircraft yoke in those aircraft that support this functionality.

CWS mode allows the servos to be temporarily disengaged for the duration that the CWS button is held down, providing an opportunity for the pilot to manually maneuver the aircraft as desired without disconnecting the autopilot. Typical uses for this mode include an easy way to adjust the pitch and bank targets while in PITCH and/or BANK hold modes, maneuvering to avoid traffic, weather, or airspace conflicts, flying a more aggressive intercept scenario than the autopilot would have provided, and an alternative method of syncing the active vertical mode bugs (ALT, IAS, or VS) to present aircraft state.

The flight director command bars will be removed from display for the duration that the CWS mode is active.

During CWS, the horizontal targets (HDG or CRS) remain unchanged and if either HDG or NAV modes were active immediately prior to engaging CWS, the autopilot will automatically re-establish its tracking of those modes and targets when the CWS button is no longer depressed. If one of the

commandable vertical modes (ALT, IAS, or VS) were active immediately prior to engaging CWS, the bug associated with the active mode (e.g. altitude bug for ALT mode, IAS bug for IAS mode, and VS bug for VS mode) will stay synchronized with the actual aircraft state and when the CWS button is no longer depressed, the new bug value becomes the new target.

If PITCH and/or BANK modes were active at the time of CWS engagement, the pitch and bank values at the time of CWS button release will become the new pitch and bank values the autopilot will hold.

The autopilot modes annunciator indication is white "**CWS**". The autopilot modes annunciators that were lit immediately prior to entering CWS remain lit in the same manner and the "**CWS**" annunciation takes the place of the "AP", "FD", or "AP READY" annunciation location while it is active.

TAKE OFF/GO AROUND (TO/GA) MODE

TO/GA mode is entered by pressing the TO/GA button on or near the aircraft throttle(s) in those aircraft that support this functionality.

The system uses the current autopilot state to determine if Take-Off (TO) or Go-Around (GA) behavior is desired.

If the autopilot was not engaged in any mode ("**AP READY**" displayed in the autopilot modes annunciators strip), then activating the TO/GA control will put the autopilot into Flight Director ("**FD**"), Pitch ("**PITCH**"), and Roll ("**ROLL**") modes. In this case, the system will provide flight director command bars, that if followed, result in a fixed pitch that results in climb under full power for the aircraft type and zero roll. That pitch value varies with aircraft type but ranges from 5 deg (e.g. most single engine piston aircraft) to 8 deg (e.g. most turbine aircraft).

Once safely away from the ground, the expectation is that the pilot will then adjust the autopilot targets and modes as desired.

If the autopilot had been in any mode other than **AP READY** at the time of TO/GA control activation, it is assumed that Go-Around behavior is desired as described in Section 4 of this guide.

4 Approach Procedures

GENERAL BEHAVIOR

The integrated DFC100 and IFD system is designed to take full advantage of the auto transition capability of the FMS900w for flying a GPS flight plan ending in a GPS or ILS approach. As long as the desired approach has been selected in the FMS900w and is part of the active flight plan, courses will be automatically loaded and many mode transitions will be automatic resulting in a hands-free transition.

If the approach was not part of the active FMS flight plan, or NAV1/2 was manually selected in the PFD Pri Nav field, it is required that the inbound course be set using the PFD course set knob for accurate localizer intercept and tracking.

Note that “GS” mode as annunciated refers to a generic glideslope, encompassing both ILS glideslope and GPS WAAS approach vertical guidance.

APPROACH MODES

LPV (RNAV) approaches are the preferred approach for the combined IFD-DFC100 system, if available.

WAAS APPROACHES

When “FMS” has been selected as the source in the “Primary Nav” LSK, and one of the RNAV/GPS approach types with vertical guidance (LPV, L/VNAV, LNAV+V) is selected in the FMS, the ADI will provide horizontal and vertical guidance by means of the CDI, HDI and VDI.

WAAS approaches must be flown with the DFC100 system in NAV APPR mode and the “Primary Nav” LSK set to FMS. For a full approach, the autopilot will remain in NAV throughout the approach. For a vectors-to-final approach, the autopilot will be in HDG with NAV armed until the final approach course is captured, and then it will switch automatically to NAV. For those WAAS approaches that have a vertical guidance component, once the aircraft is on final, the GS mode will also engage.

There are several types of WAAS approaches. The FMS will automatically select the best available approach based on current GPS integrity and will indicate the selection as the HDI source. The pilot must monitor the HDI source throughout the approach and use charted minimums appropriate to the approach type. If an approach type is not indicated by the time the final approach fix (FAF) is reached and the HDI source is given as FMS, ***do not descend*** – the conditions required to fly the approach have not been met and you must fly the missed approach procedure.

WAAS approach types that may be indicated as the HDI source include:

LNAV (Lateral Navigation)

Provides lateral (horizontal) guidance only, with standard GPS precision of 0.3 NM full-scale deflection. This is essentially the same as a non-WAAS GPS approach. It is flown as any other non-precision approach – observing step down restrictions, descend to MDA, fly at MDA altitude to the MAP, and execute the missed approach procedure if appropriate. Since there is no vertical guidance associated with this type of approach, the VDI is not displayed.

LNAV+V (Lateral Navigation with Vertical Information)
This mode provides the same lateral navigation as LNAV, but presents an ILS GS-like presentation on the VDI. The GPS draws a 3-D picture of the approach based on crossing the FAF at the depicted altitude. Then it follows a glidepath from the published approach, which is typically a 3 degree angle to the touchdown zone. This type of approach remains a non-precision approach and does not consider any step-down limitations.

For this approach type, manual coupling to the autopilot is permitted. After “LNAV+V” is annunciated as the HDI source but prior to FAF, the NAV (or APPR) button on the autopilot must be pressed. GS will arm or engage depending on your position relative to the glide slope. Fly coupled to the MDA, observing any step down restrictions as needed. If a level off at the MDA is desired, the ALT button must be pressed on the autopilot.

LNAV/VNAV (Lateral Navigation with Vertical Navigation) In this mode, the GPS provides lateral navigation, providing more accurate guidance than regular LNAV but easier to follow indications than a localizer. The vertical navigation is driven by GPS signals. LNAV/VNAV approaches are operationally different from LNAV+V in that the glide path is protected from obstructions but attention still must be applied to step down fixes. Also, the minimum altitude presented is a decision altitude/height (DA/DH) – DA being what is on the altimeter, and DH being the height of the DA above the touchdown zone elevation. This is not a MDA, thus, fly it just as though it were an ILS approach: follow the glide slope all the way to the DA before initiating a missed approach, if appropriate.

This type of approach is automatically coupled to the autopilot, meaning that somewhere in the vicinity of the FAF, with “L/VNAV” annunciated as the HDI source, the FMS will automatically toggle the autopilot mode to NAV APPR and GS will either arm or engage depending on your position relative to the glide path.

LP (Lateral Performance) The lateral guidance is significantly more precise than LNAV, and equivalent to that of a localizer, except easier to fly. There is no glide slope in a LP approach so a manual means to accomplish the vertical component of this approach needs to be enabled (VS and ALT). Then fly coupled to MDA.

Lateral tolerance starts out at 0.3 NM full-scale (slightly tighter than a localizer at the FAF), transitioning to 350 feet either side at the runway threshold (slightly looser than a localizer). The steering remains linear all the way so you don’t get the difficult to follow swings of a real localizer close in.

For this approach type, a manual coupling to the autopilot is permitted. Prior to FAF the “NAV” (or “APPR”) button on AP must be pressed. There is no glide slope in an LP approach so a manual means to accomplish the vertical component of this approach needs to be enabled (VS and ALT). Then fly coupled to MDA.

LP+V (Localizer Performance with Advisory Vertical Guidance) The lateral guidance is significantly more precise than that of a localizer, except easier to fly.

Lateral tolerance starts out at 0.3 NM full-scale (slightly tighter than a localizer at the FAF), transitioning to 350 feet either side at the runway threshold (slightly looser than a localizer). The steering remains linear all the way so you don't get the difficult to follow swings of a real localizer close in. The GPS draws a 3-D picture of the approach based on crossing the FAF at the depicted altitude, which is typically a 3 degree angle to the touchdown zone. This type of approach remains a precision approach.

This type of approach is also automatically coupled to your autopilot. This means, in the vicinity of the FAF, the system will automatically toggle the autopilot mode from GPSS to NAV APPR. The pilot is ultimately responsible for managing the vertical component.

LPV (Localizer Precision with Vertical Guidance) (FMS900w only) The lateral guidance is significantly more precise than LNAV, and equivalent to that of a localizer, except easier to fly. Vertical guidance is provided to minimums as low as 200' AGL above the touchdown zone. Lateral tolerance starts out at 0.3 NM full-scale (slightly tighter than a localizer at the FAF), transitioning to 350 feet either side at the runway threshold (slightly looser than a localizer). The steering remains linear all the way so you don't get the difficult to follow swings of a VHF localizer close to the runway. The vertical guidance is precise and has a DA/DH (shown as "DA(H)" on approach charts) rather than a MDA.

This type of approach is also automatically coupled to your autopilot. In the vicinity of the FAF, with "LPV" annunciated at the HDI source, the FMS will automatically toggle the autopilot mode to NAV APPR and GS will either arm or engage depending on your position relative to the glide path.

If the FMS has determined that satellite coverage is insufficient for use of GPS as the primary navigation source, a Caution is

provided. This may occur at any time during the approach and requires that you execute a missed approach.

NON-WAAS GPS APPROACH (RNAV OR OVERLAY OR LNAV)

- □ Ensure the Primary Nav LSK is set to FMS as the source and a GPS or RNAV approach is loaded in the FMS900w
- □ Press the “NAV” or “APPR” buttons on the autopilot control panel
- □ Note that the “NAV” and “APPR” buttons on the autopilot control panel are lit in green
- □ Note that “**NAV APPR**” is displayed in the PFD mode annunciator section
- □ Execute a missed approach, if appropriate

VOR APPROACH

- □ Ensure the Primary Nav LSK is set to a VHF source (NAV1 or NAV2) and tuned to a VOR and the VOR approach is loaded in the FMS900w
- □ Ensure the approach course is set in the Selected Course window
- □ Press “APPR” on the autopilot control panel, or “NAV” and then “APPR” (VOR approaches are the only types of approaches in which the “APPR” button must be pressed.)
- □ Note that both the “NAV” and “APPR” button on the autopilot control panel are lit in green
- □ Note that “**VOR APPR**” is displayed in the PFD mode annunciator section
- □ Execute a missed approach, if appropriate

LOCALIZER APPROACH

If flying a Vectors-To-Final approach, use 1 of 2 techniques:

1. Use the Vectors-To-Final selection in the FMS400/900w drop down windows to select that type of transition to the localizer final and the “HDG” button on the autopilot control panel and control the aircraft vector via the Heading knob on the keyboard. (**Avidyne Recommended Technique**);

2. Use the Heading knob on the keyboard and the “HDG” button on the autopilot control panel when ATC is issuing vectors.

NAV APPR can be armed prior to capturing the localizer beam but it is highly recommended to wait until ATC clears you for the approach before trying to arm NAV and APPR. To arm NAV APPR while still in Heading/Vectors mode, press the “NAV” (or “APPR”) button. Once armed, the system will automatically capture the localizer signal and transition out of Heading/Vectors mode on its own.

- □ Ensure the Primary Nav LSK is set to a VHF source (NAV1 or NAV2) and tuned to a localizer and the localizer approach is loaded in the FMS900w
- □ Ensure the front course is set in the Selected Course window
- □ When cleared for the approach or established on final, press the “NAV” or “APPR” buttons on the autopilot control panel (either will work)
- □ Note that the “NAV” and “APPR” buttons on the autopilot control panel are lit in cyan
- □ Execute the approach by commanding heading until the localizer is captured
- □ Note that “**NAV APPR**” is now displayed in green in the PFD mode annunciator section
- □ If desired, VS mode can be used to control the vertical axis
- □ Execute a missed approach, if appropriate

ILS APPROACH INCLUDING GLIDE SLOPE INTERCEPT

When flying a Vectors-To-Final approach, use 1 of 2 techniques:

1. Use the Vectors-To-Final selection in the FMS900w drop down windows to select that type of transition to the localizer final and the “HDG” button on the autopilot control panel and control the aircraft vector via the Heading knob on the keyboard. (**Avidyne Recommended Technique**);

2. Use the Heading knob on the keyboard and the “HDG” button on the autopilot control panel when ATC is issuing vectors.

NAV APPR can be armed prior to capturing the localizer beam but it is highly recommended to wait until ATC clears you for the approach before arming NAV and APPR. To arm NAV APPR while still in Heading/Vectors mode, press the “NAV” (or “APPR”) button. Once armed, the system will automatically capture the localizer signal and transition out of Heading mode on its own.

- □ Ensure the Primary Nav LSK is set to a VHF source (NAV1 or NAV2) and tuned to a properly identified ILS and the ILS is loaded in the FMS900w
- □ Press “NAV” or “APPR” on the autopilot control panel (Approach mode will automatically arm if tuned to an ILS frequency)
- □ The autopilot will enter NAV and Approach lateral modes or arms them if off course
- □ The autopilot will automatically arm the GS vertical mode, retaining the existing vertical mode until capture
- □ At this point, “NAV” and “APPR” buttons along with the previous vertical buttons will be lit green on the autopilot control panel and the “GS” button will be lit in cyan
- □ PFD mode annunciator will display **NAV** and **APPR** along with the previous vertical mode in green and **GS** in cyan
- □ When the autopilot captures glideslope, the vertical mode button on the autopilot control panel and mode annunciator on the PFD will transition to a flashing green

"**GS**" which will flash for approximately 10 seconds before going steady green

□ Execute a missed approach, if appropriate

Glide slope is intended to be captured from below. If so desired, or required via NOTAM, GS mode can be toggled on/off through presses of the "GS" button on the autopilot control panel. There is no other required time to press the "GS" button.

In the event the pilot is attempting to capture the glide slope from above, glide slope will be captured as the aircraft passes through the glide slope signal, if GS mode was previously armed. If GS hadn't been armed, glide slope will be captured by manually pressing the "GS" button on the autopilot control panel when within 1 dot of glide slope centerline.

PROCEDURE TURN ILS OR LOCALIZERS

The procedure for an ILS or Localizer with a procedure turn in a combined DFC100/FMS900w system results in the aircraft automatically flying the outbound procedure turn heading, automatically making the turn inbound to the inbound procedure turn heading, then automatically capturing and flying the final approach course.

To fly the full published procedure turn, ensure the approach is loaded and activated in the FMS and ensure the Primary Nav LSK is set to FMS. In this case, the DFC100 should be in NAV and VNAV modes (other vertical modes are permitted) and the GS should be automatically armed in blue as soon as the VHF signal is received. Once established inbound and within glide slope capture criteria, the previously engaged vertical mode will automatically transition to GS. In any case, the vertical mode of the autopilot won't automatically change until the system recognizes it is on final.

BACK COURSE APPROACHES

Always ensure the front course is set in the Selected Course window. The system will recognize it is on a back course when the VHF receiver is locked onto a valid signal and there is a sufficient difference between aircraft heading and the selected course. There is no need or ability to manually select back course operations with the DFC100. A “BCRS” annunciation will be added to the HDI, the HDI and CDI indicators will display correct sensing, and the autopilot will turn in the proper direction.

- □ Ensure the Primary Nav LSK is set to a VHF source (NAV1 or NAV2) and tuned to a LOC/ILS and the approach is loaded in the FMS900w
- □ Ensure the front course is set in the Selected Course window (if the backcourse approach is loaded in the FMS, then the course is automatically loaded in the Primary Nav LSK datablock.)
- □ Press either the “NAV” or “APPR” button on the autopilot control panel (either will work fine)
- □ Note that the “NAV” and “APPR” button are lit in green on the autopilot control panel
- □ Note that “**NAV APPR**” is displayed in green in the autopilot modes annunciator section of the display

MISSED APPROACH

Prior to going missed approach, apply go-around power, ensure the aircraft is trimmed for the power setting, establish a climb attitude and use the autopilot to smoothly execute the assigned climb-out or published missed approach procedures.

To fly a coupled missed approach:

ATC assigned climb-out

A recommended technique for executing the assigned climb-out instructions is as follows:

- □ Set the altitude bug to the assigned climb-out altitude, ideally prior to passing the FAF
- □ Set the VS bug to the desired climb speed or rate, ideally prior to passing the FAF
- □ Set the heading bug to the ATC assigned heading
- □ At the point when you decide to go missed, add power as required
- □ Press the “HDG” or “NAV” button on the autopilot control head, depending on missed approach instructions
- □ Press the “VS” buttons on the autopilot control head to command an altitude capture at the desired VS

Published Missed Approach

A recommended technique for executing the published missed approach procedures is as follows:

- □ Ensure the published missed approach is part of the active FMS flight plan
- □ Press “Enable Published Missed” L5 LSK when departing FAF
- □ At the point when you decide to go missed, add power as required

- □ After the aircraft is cleaned up, go-around power applied and climb-out attitude established, press the “Enable Published Missed” L5 LSK on the PFD page if not already pressed
- □ Press the “NAV” button and the “VNAV” button on the autopilot control head after crossing the MAP.

NOTE

Using VNAV to fly a Coupled Missed Approach
Using VNAV to fly a coupled published missed approach is a highly recommended technique because it automatically fills in all autopilot lateral and vertical targets and even protects against insufficient climb power via Envelope Protection. However, do NOT press the VNAV button prior to reaching the Missed Approach Point (MAP).

TAKE OFF/GO AROUND (TO/GA) MODE

TO/GA mode is entered by pressing the TO/GA button on or near the aircraft throttle(s) in those aircraft that support this functionality.

The system uses the current autopilot state to determine if Take-Off (TO) or Go-Around (GA) behavior is desired.

If the autopilot had been in any mode other than **AP READY** at the time of TO/GA control activation, it is assumed that GA behavior is desired

In GA, the system will initially seek a fixed pitch that results in climb under full power for the aircraft type and zero roll. That pitch value varies with aircraft type but ranges from 5 deg (e.g. most single engine piston aircraft) to 8 deg (e.g. most turbine aircraft). Once the initial fixed pitch and zero roll have been achieved, follow-on navigation and autopilot performance will take over as described below.

There is a distinction between whether a missed approach has been enabled or not, and, what type of missed approach is called for by the pilot – Published Missed Approach or Assigned Missed Approach. Enabling the missed approach, and selecting Published vs. Assigned is done via the L5 Line Select Key on a PFD-configured Integrated Flight Display.

On final approach, pressing TO/GA causes the autopilot to:

- Activate PITCH mode and pitch aircraft up
- Arm ALT mode
- Disarm all lateral modes and activate ROLL mode, wings level, if no missed approach is enabled
- Remain in NAV mode, if a missed approach is enabled
- Arm HDG mode, if an assigned missed approach is enabled
- Arm VNAV mode, if a published missed approach is enabled

At the Missed Approach Point (MAP), the following additional actions are automatically performed:

- All armed (**cyan**) autopilot modes transition to engaged (**green**)
- Primary Nav source selection on the IFD automatically switches to FMS

In summary, the system will immediately initiate a pitch up, and assuming sufficient power/energy, a climb but, aside from the FMS monitoring progress toward the MAP, no lateral action will take place until passing the MAP.

If TO/GA is activated at any time other than take-off or on an approach, the system will still activate PITCH mode, pitch up and arm ALT mode in the vertical axis and disarm any lateral axis mode and activate ROLL mode.

5 Abnormal Procedures

GENERAL FAILURE MODE INFORMATION

The only failure modes that result in the loss of a DFC-series autopilot are when all of the system AHRS are unavailable (Red-Xs over the attitude display), the autopilot has completely failed or lost power, or when all of the IFDs have no power.

Each autopilot contains an internal data recorder for use during service operations. The contents of the data logs remain the property of Avidyne. If an anomalous behavior is observed with the autopilot, pressing the “GS” button on the autopilot control panel multiple times will produce a series of events in the data log that will aid the Avidyne Service Center in finding and analyzing the data logs during troubleshooting operations.

Some failure modes identified in this section do not affect the functioning of the AHRS and therefore allow continued use of the autopilot.

In all cases, basic airmanship should be exercised and fundamentals utilized such as maintain aircraft control, analyze the situation, and take proper action.

Refer to the Release 9.2 or later IFD Pilot Guide for more detail on the IFD-related system malfunctions.

The following failure modes result in no DFC100 autopilot functionality:

- Loss of all on-board AHRS
- Loss of power to all on-board IFDs
- Loss of autopilot power
- Complete loss of system-wide Databus
- Failure of all installed AHRS to align initially

The following failure modes result in some degradation of the DFC100 autopilot functionality as noted:

- Loss of all on-board air data systems (results in the inability to use any of the air data modes such as VS, IAS, ALT modes, and loss of Envelope Protection and Full-time Envelope Alerting functions - note that Straight and Level, Pitch, Roll, and ILS capabilities are retained and the VS knob can be used to adjust pitch)
- Ice in the pitot-static lines (results in inability to track or track accurately any IAS, VS, or ALT related mode)
- Inoperative Mx and Safety Recorder (results in loss of all aural alerting and autopilot disconnect tones)
- Servo Failure (depending on the servo lost, potential inability of the airplane to achieve set targets)
- Servo Limit reached (results in the inability of the autopilot to track the commanded targets)
- Loss of Keyboard (forces the use of the *Bug Select* tab of the PFD page to set Heading and Altitude bug targets)
- Loss of both VHF radios (results in the inability to select and track any VHF-based target such as Localizer, ILS or VOR)
- Loss of both GPS (results in inability to use FMS as the source in Primary Nav LSK and therefore, no Vectors)
- Crosscheck Attitude 1 (in single AHRS-equipped aircraft, this specific Crosscheck Attitude message will result in an autopilot disconnect and “Gyro Miscompare” aural alert but it will allow a manual autopilot reengagement)
- Gyro miscompare in the air (results in a disconnect of the autopilot in dual AHRS equipped systems after a pitch or roll miscompare and after any subsequent manual reengagement, loss of comparator)

The following failure modes have no effect on DFC100 autopilot functionality:

- Loss of turn coordinator (in dual AHRS systems)
- Loss of a single IFD (in dual AHRS systems with 1-2 switch set to Auto or the failed IFD did not house the AHRS)
- Loss of a single AHRS (in dual AHRS systems with 1-2 switch set to Auto)
- Loss of a single VHF radio
- Loss of a single GPS
- Loss of LCD display(s)

OTHER ERROR MODES

Autopilot failures that prevent any operation are annunciated across the center of the PFD mode annunciator strip in amber (yellow) as shown in the example immediately below.

IFD Autopilot Annunciator

AUTOPILOT INOP	The autopilot is unusable but the system cannot determine why. Recommend immediate transition to hand-flying and if no automatic restart has been initiated, consider cycling the autopilot circuit breaker one time.
AUTOPILOT INOP AHRS COMPARATOR FAIL	**Dual AHRS system**: The system has concluded that one of the AHRS is unavailable (not failed and not aligning). **Single AHRS system**: The system has concluded that the turn coordinator has failed or is not available.
AUTOPILOT INOP SELF TEST FAIL	The autopilot failed its power-up self-test. If the fault does not clear itself within 15 seconds, consider cycling power to the autopilot via the circuit breaker or avionics master.
AUTOPILOT INOP AHRS FAIL	All on-board AHRS have failed, rendering the autopilot non-functional.

AUTOPILOT INOP AHRS ALIGNING	If any of the on-board AHRS have not yet completed alignment, this message will be displayed. This message should be expected to be seen during all normal ground operations in the course of all standard alignments.
AUTOPILOT DISCONNECTED	Displayed anytime the autopilot has been manually or automatically disconnected and should be accompanied by 16 beeps.
NO COMMUNICATION WITH AUTOPILOT	Indicates the IFDs have stopped receiving data from the autopilot resulting in the loss of all autopilot functionality for the duration of the message. It is possible that the autopilot will conduct an auto-reset and if successful, all functionality would be restored and a manual re-command of the autopilot modes will be available. If an auto-reset is not conducted, consider cycling power to the autopilot via the circuit breaker or avionics master.

ALERTS

In addition to system failures as noted above, there are several alerts that may affect DFC autopilot and subsequent pilot operations. The following list generates a yellow caution lamp and associated R6 LSK messages:

AHRS Miscompare	**Dual AHRS system**: The system has detected a roll or pitch miscompare between the two AHRS. The autopilot will disconnect upon initiation of this miscompare alert and will generate a "GYRO MISCOMPARE" aural alert. **Single AHRS system**: The system has detected a roll miscompare between the AHRS and the turn coordinator. The autopilot will not disconnect upon initiation of this miscompare alert but will generate a "GYRO MISCOMPARE" aural alert. In either case, evaluate the accuracy of the IFD AHRS solution by comparing the PFD display to the backup gauges, and if in VMC conditions, the out-the-window view. If it can be concluded that the PFD is accurate, consider re-engaging the autopilot, as required and continue standard autopilot operations but be vigilant knowing that the AHRS-AHRS or AHRS-TC comparator has noted a sensor miscompare.
AP Audio Unavail	The autopilot aural alerts are unavailable. Apply extra vigilance to the autopilot annunciator status messages along the top of the PFD due to the absence of the associated aural alerts. After the flight, notify an Avidyne Service Center or Avidyne Customer Support for a repair action.

The following list generates a cyan L6 LSK advisory message:

Trimming Up **Trimming Down**	The system has recognized that trim has been running for an excessive duration. In all cases, trim can be manually overridden with pilot-controlled control stick/yoke inputs. If the alert is present for more than a few seconds, consider disconnecting the autopilot, manually trim the aircraft accordingly, and if autopilot operations are still desired, re-engage the autopilot in the desired mode.
AP/Nav Invalid	The system has recognized that the VHF lateral nav signal is invalid. A Red-X will cover the Horizontal Deviation Indicator (HDI) on the ADI and the autopilot will command a wind-corrected course hold and, if sufficient power is available, the flight path angle at the time the system displayed the L6 Advisory message. Consider switching the nav source in the PFD page Primary Nav selection. If unable to reacquire the nav signal, take the proper action when a navigation source has been lost. If on a published approach that requires VHF-based lateral guidance, the approach must be terminated.
AP/GS Invalid	The system has recognized that the vertical nav signal is invalid. A Red-X will cover the Vertical Deviation Indicator (VDI) on the ADI and the autopilot will coast for 5 seconds and, if at the end of that 5 second period, the signal has not been reacquired, the autopilot will transition to Alt Hold mode with all the associated mode change indications. Consider switching the nav source in the PFD page Primary Nav selection. If unable to reacquire the vertical nav (**more**)

	signal, take the proper action when a navigation source has been lost. If on a published ILS approach, transition to non-precision approach procedures and minimums or go missed approach.
AP AHRS Comp Unavail	If at any time after an initial AP READY condition has been achieved, one of the attitude comparator sources becomes unavailable, this message is presented. No disconnect will happen and the autopilot will “fly-through” this event unaffected.
AP/IFD Comm Fault	If the DFC is unable to recognize the message data from both IFDs (e.g. a software mismatch has occurred between the autopilot and all IFDs), then some autopilot modes will become unavailable. In this event, Pitch Hold, Roll Hold, Alt Hold and Straight and Level modes are still fully functional. Consider cycling power to the IFDs and autopilot and if that does not clear the condition, contact Avidyne Customer Support.
AP MSR Failure	The system is unable to write and access data to/from the autopilot maintenance and safety data recorder. The autopilot will still be fully functional in all pilot-usable modes but the on-board data logging has likely stopped and all autopilot aural alerts will be unavailable Apply extra vigilance to the autopilot annunciator status messages along the top of the PFD due to the absence of the associated aural alerts. After the flight, notify an Avidyne Service Center or Avidyne Customer Support to coordinate for a repair action.

VNAV Unable Constraint	The system has determined that it can not make the next vertical constraint. It may be too close or require too much of a climb or descent rate. Additional pilot input may be required.
VNAV Unavailable	Message displayed when the VNAV button on the autopilot has been pressed but the system is not able to provide VNAV because either Primary Nav is not set to FMS, the autopilot is not in NAV mode (engaged or armed), or there is no down-path altitude constraint in the flight plan.
VNAV Terminated	The system has transitioned out of VNAV mode. This may be a normal operation during VNAV descents to instrument finals. The autopilot will typically transition to ALT Hold in this case.

LOSS OF ENGINE

Loss of engine does not affect the DFC100 operation but the DFC100 autopilot can be useful during loss of engine situations. One technique is to set the IAS bug to best glide speed and engage IAS mode in the event of engine-out conditions. The autopilot will adjust aircraft pitch as required to slow down, or speed up to achieve V_g, freeing up time to perform other cockpit duties during this emergency situation.

One minor variation of this technique is to set the IAS bug to V_g after climb-out so that it is already preset to V_g.

In either technique, it is recommended to press the “IAS” button on the autopilot control panel a second time to prevent an inadvertent altitude capture.

Envelope Protection will prevent the autopilot from stalling the aircraft during power-off operations.

6 Limitations and Performance

LIMITATIONS

1. For non-FIKI approved aircraft: the DFC100 must not be used during icing conditions;

   For FIKI approved aircraft: the DFC100 must not be used during severe icing conditions. Note that in icing conditions, periodic autopilot disconnect is recommended to allow control movement checks. High forces to move airplane controls are an indication of severe icing and the autopilot should remain disconnected until exiting severe icing conditions. Indications of severe icing include:

   a. Indications of frequent autopilot re-trimming during straight and level flight;

   b. Unusually extensive accumulation of ice on the windshield in areas not normally observed to collect ice;

   c. Accumulation of ice on the upper surface of the wing aft of the protected area;

   d. Accumulation of ice on the engine cowling and/or spinner further aft than normally observed;

2. Unusual control force or control deflection, or unusually large control forces to move flight controls when the autopilot is disconnected.

3. The DFC100 minimum use height is 200ft AGL. This means the autopilot must be disengaged for takeoff and landing and disengaged for missed approach or go around until climb and configuration are established above 200ft AGL.

4. DFC100 operations are prohibited in aircraft equipped with pitch trim-only when flaps are deployed more than 50% (no dedicated pitch servo).

5. Maximum flap retraction speed (50% to full retracted) with autopilot engaged is 110 KIAS in aircraft equipped with pitch trim-only.
6. DFC100 operation is prohibited above:
    a. SR2X - 185 KIAS
    b. PA46-350 – 180 KIAS
    c. PA32 – 180 KIAS
7. The Avidyne DFC100 Series of Digital Autopilots Pilot's Guide, P/N 600-00270-000, Revision 02, or later appropriate revision, must be available to the pilot during all flight operations.

SOFTWARE COMPATABILITY AND NOTES

The following table identifies authorized combinations of IFD and autopilot code and any associated operational notes. For the purposes of this table, differences noted in the Operational Notes column are when compared to DFC100 Pilot Guide 600-00270-000 Rev **01**.

IFD Version	AP Version*	Operational Notes
9.2.3 Or 9.2.4	02	Full functionality per DFC100 Pilot Guide 600-00270-000 Rev 01 (except TO/GA which requires IFD 9.3)
9.2.1	02	- No TO/GA mode - TRIMMING UP/DOWN message is displayed more frequently
9.2.3 or 9.2.1	01	- Same as above, and: - No Flap Overspeed alert - DFC100 will disconnect during any AHRS-TC Miscompare in single AHRS equipped aircraft - Underspeed alerts are not suppressed in the flare and on rollout - MSR FAIL means no AP disconnect tones

* The Autopilot Version number can be obtained from the aircraft logs or via Mx Mode of the IFD unit. Once in Mx Mode (enter via the same method by which logs are downloaded or nav databases uploaded), press the “SYS” page function key, “System Status” tab, “Info” line select key (LSK R6) set to “Software” and scroll down the list looking for the entry “AP 563 App” and look for the revision number (e.g. “02”).

Note: All DFC100-equipped Piper aircraft must have IFD Version 9.2.4 or later **and** DFC100 Version 2 or later.

Note: All DFC100-equipped Cirrus aircraft must have IFD Version 9.2.1 or later.

Note: IFD Version 9.2.2 was never fielded.

Note: IFD Version 9.2.3 and later must use DFC100 Version 2 or later.

GENERAL PERFORMANCE – CIRRUS AIRCRAFT

The input forces required for roll-axis control surface actuation are demonstrably light and it is not difficult to force the servo (roll trim spring cartridge) to drive to its limit. By design, reaching the physical limit causes a micro-switch to be tripped which effectively decouples the autopilot commands from the flight control surfaces.

Pilot-induced inputs on the system including yoke input, rudder input, p-factor, fuel imbalance, airspeed and general aircraft trim alignment can all contribute to this condition.

In the event the DFC system believes the roll-axis servo limit has been reached, a yellow "**SERVO LIMIT**" text message is displayed along the top edge of the PFD pages.

WARNING

Reaching Servo Limits Can Cause Uncommanded Rolls

If the roll servo limit is reached, the autopilot may stop following lateral commands. This could appear to the pilot as an uncommanded roll or a failure to follow the commanded lateral target.

As a result, it is highly recommended that a pilot avoid making flight control inputs while in coupled autopilot mode operations

aside from minor rudder input to maintain coordinated flight. Moderate rudder or any roll input may result in an inability of the DFC100 autopilot to track the commanded targets.

It is also important to note that in aircraft equipped with only roll trim motors (no roll servo), the maximum aileron deflection is ½ the total possible aileron throw.

PERFORMANCE IN PITCH TRIM-ONLY AIRCRAFT

As noted earlier, all modes and behaviors described in this manual work both in aircraft with pitch servos and those without (pitch trim-only) with the exception of the reaction to manual electric trim inputs. However, aircraft equipped with pitch trim only (no pitch servo) should expect a less precise and, depending on the environmental and aircraft dynamic conditions, a slower reaction time in the vertical axis when experiencing vertical turbulence or other inputs like flap deployment/retraction, IAS mode tracking and unusual attitude recoveries using the Straight and Level button.

PERFORMANCE IN NON-CIRRUS AIRCRAFT

It is highly recommended that a pilot avoid making flight control inputs while in coupled autopilot mode operations aside from minor rudder input to maintain coordinated flight. Moderate rudder or any roll input may result in an inability of the DFC100 autopilot to track the commanded targets.

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Website There is a dedicated website that provides more information on this product at http://www.dfc100.com

FAQs
http://www.avidyne.com/downloads/products/dfc90/DFC90-DFC100-FAQs.pdf

Service Hotline A hotline has been established to service questions or issues regarding Avidyne products. The U.S. Toll Free number is 1-888-723-7592. International toll free numbers are listed at http://www.avidyne.com/contact/intphones.asp

Email Customer/product support issues can be emailed as well

- Europe – support@avidyneeurope.com
- Australia & Asia – support@avidyneaustralasia.com
- Everywhere else should email techsupport@avidyne.com

When calling or emailing for product-related help, please have the following information available, if able:

Customer Name/Account Information

Aircraft tail number, DFC100 serial number, PFD serial number and software versions.

A good description of the problem or question.

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P/N 600-00270-000 Rev 03