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Pilot Operating Handbook
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Pilot Operating Handbook
Supplement 9.11 for Cavalon gyroplanes fitted with Garmin Autopilot system

AutoGyro Certification Ltd Document reference RSUK0444

This document is released by AutoGyro Certification Ltd under the UK CAA Approval DAI/9917/06.

Pilot Operating Handbook for Cavalon gyroplanes fitted with Garmin Autopilot system

AutoGyro Certification Ltd Document No. RSUK0444

Model: _____

Serial number: _____

Registration: _____

Type certificate number: _____

Aircraft manufacturer and type approval/certificate holder: The aircraft type approval/certificate may be held by AutoGyro Certification Ltd or AutoGyro GmbH, depending on the operational region. Both may be contacted at;
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Where required by local country approval, this flight manual is always to be carried on board of the aircraft and must be kept in current, up-to-date status. The latest revisions and version status is available at www.auto-gyro.com. Extent and revision status of the manual is recorded in the revision log and the table of content.

This gyroplane may be operated only in strict compliance with the limitations and procedures contained in this manual.

The manual is not a substitute for competent theoretical and practical training on the operation of this aircraft. Failure to adhere to its provisions or to take proper flight instruction can have high-risk consequences.

REVISION LOG

Rev.	Inserted by	Date	Signature
1.0	AutoGyro GmbH	06.JUN.2022	

Pilots Flight and Operation Handbook Document approval		
Signature Position: CVE Test Pilot	Signature Gerry Speich 24 / 07 / 2022 Position: Head of Engineering	Signature DocuSigned by: 87381729ED8946E... Andrew Lyons 27 July 2022 Position: Head of Airworthiness

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SECTION 1 - GENERAL

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1.1 Introduction

This manual is designed as an operating guide for pilots, instructors, and owners/operators, providing information for the safe and efficient operation of this gyroplane equipped with autopilot, as an addendum to the POH or AFM. It includes material required to be furnished to the pilot by the competent certification authority. This handbook is not, however, designed as a substitute for adequate and competent flight instruction.

Pilots of this aircraft must hold a proper license including the class rating ‘gyroplane’, corresponding to the aircraft’s registration. A special endorsement may be required to fly with passengers. It is the pilot’s responsibility to be familiar with this handbook, the special characteristics of this gyroplane, and all other information and legal requirements relevant for the operation in his country. The pilot is responsible to determine the gyroplane is safe for flight, and to operate the aircraft with respect to the procedures and limitations provided in this manual.

It is the owner’s/operator’s responsibility to have this gyroplane registered and insured, according to country-specific regulations. The aircraft owner/operator is also responsible for maintaining the gyroplane in airworthy condition. Maintenance instructions are provided in the Maintenance Manual and in SECTION 8 of this manual. Note that depending on the kind of operation, type of maintenance activity, or component involved, the competent authority may dictate qualified personnel and/or respective facilities.

1.2 Certification

The Cavalon with autopilot is designed, tested and certified according to the British Civil Airworthiness Requirements (BCAR) Section T issue 5. UK CAA Airworthiness Approval Notice 29345 refers, which should be read in conjunction with TADS BG05.

Caution!

It is the pilot/operators responsibility to operate this aircraft within the Published Limitations issued by the Regulatory Authority within the country of operation, regardless of permitted limits within this Addendum.

1.3 Performance Data and Operating Procedures

The legal basis for operating a gyroplane is provided by national law and its respective regulations. The instructions and conditions contained have to be considered when operating the gyroplane. In addition the gyroplane must be operated in compliance with the technical specifications and limitations from the national approval (e.g. Type Approval Data Sheet).

All documented performance data and operating procedures have been identified within the certification processes for this gyroplane by means of flight test and analysis.

1.4 Definition of Terms

This manual uses **WARNING**s, **CAUTION**s and **NOTE**s in bold capital letters to indicate especially critical and important instructions. Additionally, the colour of the panel (red, yellow, and grey shading) highlights the significance of the instruction. Definitions for each term are given below.

WARNING

A warning means that the neglect of the appropriate procedure or condition could result in personal injury or loss of life.

CAUTION

A caution means that the neglect of the appropriate procedure or condition could result in damage to or destruction of equipment.

NOTE

A note stresses the attention for a special circumstance, which is essential to emphasize.

1.5 Important Note

Before each flight pilots must make themselves familiar with the appropriate navigational, weather and safety information pertinent to their planned route.

The limitations provided in SECTION 2 of this manual must be respected at all times. Check the manufacturer's web site www.auto-gyro.com regularly for flight manual updates, airworthiness directives, service bulletins, or safety information.

Use of an autopilot does not remove the pilot's responsibility to be in command of the aircraft at all times. The pilot must always be ready to disconnect the autopilot and assume control in the event of an unexpected autopilot input or other external event.

1.6 Description

Installed Equipment Interfaces

The following is the list of probable installed equipment and functions associated with the GFC 500 Autopilot installation in this gyroplane. Ensure you are aware of the installed configuration.

Table 1-1: Table of Installed Equipment Interfaces

DEVICE TYPE	**Manufacturer / Model** If not installed, note N/A	**Additional Information**
GPS Navigator #1		Is Navigator #1 interfaced to GFC 500?
VHF Nav Radio #1		Is VHF Nav Radio #1 interfaced to GFC 500?
VHF Nav Radio #2		

1.7 Abbreviations and Terminology

AFCS	Automatic Flight Control System
AFM	Gyroplane Flight Manual
AFMS	Gyroplane Flight Manual Supplement
AGL	Above Ground Level
AHRS	Attitude and Heading Reference System
ALT	Altitude
AP	Autopilot
APR	Approach
ATC	Air Traffic Control
BC	Back Course Approach
CDI	Course Deviation Indicator
DA	Decision Altitude
DISC	Disconnect
DWG	Drawing
ESP	Electronic Stability and Protection
FAA	Federal Aviation Administration
FAF	Final Approach Fix
FD	Flight Director
GA	Go Around
GFC 500	Garmin Autopilot
GMC 507	Autopilot Mode Control Panel
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GS	Glideslope
GSA	Garmin Servo Actuator
HDG	AFCS heading mode
IAS	Indicated Airspeed
ILS	Instrument Landing System
INT	Interrupt
KIAS	Knots Indicated Airspeed
KT	Knot
LNAV	Lateral Navigation
LNAV+V	Lateral Navigation with Advisory Vertical Guidance
AFCS	Automatic Flight Control System
LNAV/VNAV	Lateral Navigation / Vertical Navigation Approach
LOC	Localizer (no glideslope available)

LP	Localizer Performance
LP+V	Localizer Performance with Advisory Vertical Guidance
LPV	Localizer Performance with Vertical Guidance
LVL	Level
MDA	Minimum Descent Altitude
MPH	Miles per Hour
PFT	Preflight Test
POH	Pilot's Operating Handbook
STC	Supplemental Type Certificate
TO	Takeoff
TRK	Track
VHF	Very High Frequency
VOR	VHF Omni-directional Range
VS	Vertical Speed

SECTION 2 - LIMITATIONS

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This section contains operating limitations, instrument markings and basic placards which are required for safe operation of the gyroplane and autopilot.

The information contained herein supplements the information of the basic AutoGyro Gyroplane POH. For Limitations, Procedures, and Performance information not contained in this Supplement consult the basic Pilot's Operating Handbook.

2.1 General

WARNING

The operation of a gyroplane demands professional pilot instruction and dedicated training on gyroplanes. The aircraft must only be flown by a properly qualified and licensed pilot.

NOTE

The choice, selection and use of this particular aircraft for the purpose chosen is at the sole discretion and responsibility of the owner/pilot. AutoGyro Certification Ltd and AutoGyro GmbH take no responsibility for your decision to fly.

This aircraft is operated under a Permit to Fly, or restricted Certificate of Airworthiness. This means that it is only allowed to be used for recreation, or flight training (where allowed). It also means that the aircraft has not been certified to any international standard, and that the components used in the aircraft are not necessarily certified parts. Whilst the manufacturer takes great care to ensure the parts are of appropriate quality, the level of guaranteed service is less than that with a certified aircraft, and pilot operators must consider this in their flight planning

The Garmin GFC500 autopilot embodied in Cavalon is not certified. This means that there may be a higher risk of failure than in a certified aircraft, with the associated risks. Therefore strict compliance with the Garmin maintenance schedules, operational procedures and any additional instructions which may be given to you by AutoGyro GmbH, or issued by Garmin, is essential. The aircraft must always be flown with the risk of failure in mind, and must be flown in a manner where the pilot can recover the aircraft in the event of autopilot system failure.

2.2 Environmental Limitations

Minimum height before engaging autopilot.....500 ft AGL
Maximums disengage height on descent .....200 ft AGL

2.3 Other Limitations

The Garmin G5 (or equivalent G3x manual) Electronic Flight Instrument Pilot's Guide, part number 190-01112-12 Rev B (or later approved revisions), must be available to the flight crew.

This Addendum is applicable to the software versions shown below:

Software Item	Software Version (or later Approved version)
G5 Software Version	5.50

Do not use autopilot during takeoff and landing.

The GFC 500 AFCS preflight test must complete successfully prior to use of the autopilot or flight director.

The autopilot must be disengaged below 200 feet AGL during approach operations and not engaged below 500 feet AGL This is to enable the pilot enough altitude to recover the aircraft in the event of a problem occurring.

The GFC 500 autopilot is authorised for Category 1 precision approaches and non-precision approaches only.

If the aircraft trim system is inoperative, then the autopilot will not function correctly, and must not be engaged.

Autopilot Engagement Speed	
Minimum	45 KIAS (50 MPH, 85kmh)
Maximum	100 KIAS (115 MPH, 185kmh)

2.4 Flight Crew

Minimum crew is one pilot in the RH seat.
Harness in the LH seat must be fastened and tight, if not occupied.

2.5 Installed Features checklist

The checked autopilot modes and features are available on this aircraft.

Basic AP Features

☒ Flight Director
☒ Electric/pneumatic Pitch Trim
☒ Overspeed Protection
☒ Underspeed Protection

Electronic Stability and Protection

☐ Pitch/Roll Attitude
☐ High Speed Protection
☐ Low Speed Protection

Vertical Autopilot Modes

☒ Pitch (PIT)
☒ Level (Zero vertical speed)
☐ Go Around (GA)
☒ Altitude Hold
☒ Vertical Speed
☒ Altitude Capture via Altitude Preselect
☒ Indicated Airspeed (IAS)
☐ Vertical Navigation (VNAV)
☐ GPS Approach Glidepath
☐ ILS Glideslope

Lateral Autopilot Modes

☒ Roll (ROL)
☒ Level (Wings Level)
☐ Go Around (GA)
☒ Heading
☒ Track
☒ GPS Navigation
☒ VHF Navigation (with GNC225 &G3X
☐ Approach Mode
☐ GPS
☐ VOR/LOC

2.6 Additional Placards

In clear view of the pilot on centre panel
'Engagement of the autopilot below 500ft AGL is prohibited'

On each control stick around the AP disconnect button
'AP DISC'

SECTION 3 - EMERGENCY AND ABNORMAL PROCEDURES

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This chapter contains the procedures to be executed in emergency situations.

Emergencies due to defects of the gyroplane or its engine are extremely unlikely if the aircraft is checked thoroughly before each flight, and maintained in accordance with the AMM. If there an emergency does occur, follow the appropriate guidelines below. These procedures do not replace the pilot's appreciation of the individual situation.

This gyroplane is fitted with a non-certified autopilot. This means that there may be a higher risk of failure than with a certified aircraft autopilot. Therefore strict compliance with the manufacturer's maintenance schedules, operational procedures and any additional instructions is essential. The aircraft must always be flown with the risk of failure in mind.

3.1 Autopilot Malfunction /Pitch Trim Runaway

If the gyroplane deviates unexpectedly from the planned flight path:

1. AP DISC Button on stick .....PRESS and RELEASE
(Be prepared for high stick control forces)
2. Aircraft Attitude.....MAINTAIN / REGAIN AIRCRAFT CONTROL

3. Pitch Trim ..... RE-TRIM if necessary, using stick top hat switch

4. AUTOPILOT Circuit Breaker .....Press breaker switch and disengage circuit

NOTE

Pulling the AUTOPILOT circuit breaker will render the autopilot inoperative.

WARNING

In flight, do not overpower the autopilot. The trim will operate in the direction opposing the overpower force, which will result in large out-of-trim forces.

Do not attempt to re-engage the autopilot or use manual electric pitch trim until the cause of the malfunction has been corrected.

3.2 Autopilot Failure / Abnormal Disconnect

(Red AP in autopilot status box on display, continuous aural disconnect tone.)

1. AP DISC Button or G5/G3X Knob .....PRESS AND RELEASE
(to cancel disconnect tone)
2.Aircraft Attitude.....MAINTAIN / REGAIN AIRCRAFT CONTROL

NOTE

The autopilot disconnect may be accompanied by a red AFCS in the autopilot status box, indicating the automatic flight control system has failed. The flight director will not be available and the autopilot cannot be re-engaged with this annunciation present.

If the disconnect is accompanied by an amber AP with a red X, the autopilot will not be available however the flight director will still be functional.

In the event of a GMC failure, pressing the G5/G3X knob will acknowledge the disconnect tone.

3.3 Pitch Trim Failure

(Red PTRIM on G5/G3X display.)

1. Indicates a failure of the pitch trim servo.
2. Control stick ..... GRIP FIRMLY
3. AP DISC Button ..... PRESS and RELEASE
   (Be prepared for high stick control forces)
4. Pitch Trim ..... AS REQ'D USING STICK TOP HAT SWITCH

NOTE

The autopilot may be re-engaged. Refer to the normal procedures section of this AFMS, MANUAL PITCH TRIM WITH AUTOPILOT ENGAGED.

3.4 Overspeed Protection (MAXSPD)

(MAXSPD displayed on G5/G3X, AIRSPEED – AIRSPEED Aural sounds.)

1. Power ..... REDUCE
2. Aircraft Attitude and Altitude ..... MONITOR

After overspeed condition is corrected:

3. Autopilot ..... RESELECT VERTICAL AND LATERAL MODES (if necessary)
4. Power ..... ADJUST as necessary

NOTE

Autopilot Overspeed Protection Mode provides a pitch up command to maintain 105 KIAS (115 MPH, 185 KMH).

3.5 Underspeed Protection (MINSPD)

(MINSPD displayed on G5/G3X, AIRSPEED – AIRSPEED Aural sounds.)

1. Power .....INCREASE POWER AS REQUIRED TO CORRECT UNDERSPEED
2. Aircraft Attitude and Altitude..... MONITOR

After underspeed condition is corrected:

3. Autopilot ..... RESELECT VERTICAL AND LATERAL MODES (if necessary)
4. Power ..... ADJUST as necessary

NOTE

Autopilot Underspeed Protection Mode provides a pitch down command to maintain 45 KIAS (50 MPH, 85kmh).

3.6 Autopilot Abnormal Disconnect

(Red AP in the G5/G3X autopilot status box, continuous aural disconnect tone.)

1. AP DISC Button.....PRESS AND RELEASE
   (to cancel disconnect tone)
2. Aircraft Attitude.....MAINTAIN / REGAIN AIRCRAFT CONTROL

NOTE

The autopilot disconnect may be accompanied by a red AFCS in the autopilot status box, indicating the automatic flight control system has failed. The flight director will not be available and the autopilot cannot be re-engaged with this annunciation present.

If the disconnect is accompanied by an amber AP with a red X, the autopilot will not be available however the flight director will still be functional.

3.7 Autopilot Pre-Flight Test Fail

(Amber AP with a red X in G5/G3X autopilot status box.)

1. Indicates the AFCS system failed the automatic Pre-Flight test. The autopilot and electric trim are inoperative. Flight director will still function.

3.8 Manual Autopilot Disconnect

If necessary, the autopilot may be manually disconnected using any one of the following methods:

1.AP DISC Button ..... PRESS and RELEASE (Pilot's control stick)
2.AP Key ..... PRESS
3.AUTOPILOT Circuit Breaker ..... PULL

3.9 Loss of Navigation Information

(Amber GPS, VOR, LOC, or BC flashes for 10 seconds on G5/G3X.)

NOTE

If a navigation signal is lost while the autopilot is tracking it, the autopilot will roll the aircraft wings level and default to roll mode (ROL).

1. GMC 507 Mode Panel ..... SELECT HDG mode and SET desired heading
2. NAV Source ..... SELECT a valid NAV source
3. NAV Key ..... PRESS

If on an instrument approach at the time the navigation signal is lost:

4. Missed Approach Procedure ..... EXECUTE (as applicable)

3.10 Loss of Airspeed Data

(Red X through airspeed tape on the G5/G3X display, amber AP with a red X in autopilot status box.)

NOTE

If airspeed data is lost while the autopilot is tracking airspeed, the flight director will default to pitch mode (PIT).

1. AP DISC Button ..... PRESS AND RELEASE (to cancel disconnect tone)
2. Aircraft Attitude ..... MAINTAIN / REGAIN AIRCRAFT CONTROL
3. Manual Pitch Trim ..... TRIM as required

NOTE

If a navigation signal is lost while the autopilot is tracking it, the autopilot will roll the aircraft wings level and default to roll mode (ROL The autopilot cannot be re-engaged. The flight director is available however IAS mode cannot be selected. Loss of airspeed will be accompanied by a red PTRIM indication on the G5/G3X (where pitch trim is installed).

3.11 Loss of Altitude Data

(Red X through altitude tape on the G5/G3X display.)

NOTE

If altitude data is lost while the autopilot is tracking altitude, the autopilot will default to pitch mode (PIT).

1. Autopilot ..... SELECT different vertical mode

3.12 Loss of GPS Information

(GPS position information is lost to the autopilot.)

NOTE

If GPS position data is lost while the autopilot is tracking a GPS, VOR, LOC or BC course, the autopilot will default to roll mode (ROL). The autopilot will default to pitch mode if GPS information is lost while tracking an ILS. The autopilot uses GPS aiding in VOR, LOC and BC modes.

1. Autopilot ..... SELECT different lateral and vertical mode (as necessary)
If on an instrument approach:

- ·AP DISC button..... PRESS, Continue the approach manually

or

- ·Missed Approach Procedure EXECUTE (as applicable)

3.13 Heading Data Source Failure

Without a heading source to the navigator, GPSS will not be provided to the autopilot for heading legs. Navigator map cannot be oriented heading up.
Track information will be displayed on the G5/G3X.

1. Autopilot .....SELECT different lateral mode

3.14 Aircraft Mistrim (Autotrim)

(Amber TRIM UP or TRIM DOWN displayed on the G5/G3X.)

Indicates a mistrim of the aircraft while the autopilot is engaged, The autopilot will normally trim the gyroplane as required. However, during rapid acceleration, deceleration, configuration changes, or near either end of the aircraft trim limits, momentary illumination of this message may occur. If the autopilot is disconnected while this message is displayed, high stick control forces are possible.

WARNING

Do not attempt to overpower the autopilot in the event of a pitch mistrim. The autopilot servo will oppose pilot input and will cause pitch trim to run opposite the direction of pilot input. This will lead to a significant out-of-trim condition, resulting in large control forces when disengaging the autopilot.

NOTE

Momentary display of the TRIM UP or TRIM DOWN message during configuration changes or large airspeed changes is normal.

1. Stick ..... GRIP FIRMLY

Be prepared for significant sustained control forces in the direction of the mistrim annunciation. For example, TRIM DOWN indicates nose down stick force will be required upon autopilot disconnect.

2. AP DISC Button ..... PRESS AND RELEASE
3. Manual Trim ..... RE-TRIM as required

WARNING

Electric/pneumatic pitch trim should be considered inoperative until the cause of the mistrim has been investigated and corrected.

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This section contains check list items, instructions and procedures for the operation of the gyroplane. However, these procedures do not replace the pilot's appreciation of the individual situation.

4.1 GFC 500 Power up

Always engage the AP CB last, after other devices (G3X and/or G5, and any navigation devices) have booted up.
During the preflight test the G5/G3X will display PFT in the autopilot status box. The autopilot disconnect tone sounds at the completion of the preflight test. When the GFC 500 passes preflight test, PFT will be removed from the autopilot status box.

4.2 Preparation for Flight

The pilot shall be familiar with the aircraft limitations detailed in SECTION 2 of this manual and shall have performed proper flight planning, and have read and understood this manual.

WARNING

The Autopilot system is an aid to the flight operation of this aircraft. It is not an autonomous system. It is the pilots responsibility to be in full command of the aircraft at all times, and to take appropriate timely control as situations demand.

4.3 Flight Director / Autopilot Normal Operating Procedures

Autopilot/Flight Director mode annunciations are displayed at the top of the G5/G3X Electronic Flight Instrument. Green text indicates active autopilot/flight director modes. Armed modes are indicated in white text. Normal mode transitions will flash inverse video for 10 seconds before becoming steady. Abnormal mode transitions will flash for 10 seconds in amber text before the default mode is annunciated as the active mode in green text. Default autopilot/flight director modes are Roll (ROL) and Pitch (PIT) modes.

The autopilot status box displays the autopilot engagement status as well as armed and active flight director modes.

Autopilot Engagement with Flight Director Off — Upon engagement, the autopilot will be set to hold the current attitude of the gyroplane if the flight director was not previously on. In this case, ‘ROL’ and ‘PIT’ will be annunciated.

Autopilot Engagement with Flight Director On — If the flight director is on, the autopilot will smoothly pitch and roll the gyroplane to capture the FD command bars. The prior flight director modes remain unchanged.

Autopilot Disengagement — The most common way to disconnect the autopilot is to press and release the AP DISC button located on the control stick. An autopilot disconnect tone will sound and an amber AP will be annunciated on the G5/G3X autopilot status box. Other ways to disconnect the autopilot include:

– Pressing the AP Key on the GMC 507 Mode Controller
– Pulling the AUTOPILOT circuit breaker
In the event of unexpected autopilot behavior, pressing the AP DISC button will disconnect the servo clutches. Pressing the circuit breaker will cut power to the entire autopilot system.

4.4 Vertical Modes

Vertical Speed (VS) Mode

1. Altitude Preselect ..... SET to Desired Altitude
2. Press VS Key, autopilot synchronizes to the gyroplane's current vertical speed.
3. Vertical Speed Reference ..... ADJUST using UP / DN Wheel
4. Green ALT ..... VERIFY Upon Altitude Capture

Indicated Airspeed (IAS) Mode

1. Altitude Preselect ..... SET to Desired Altitude
1. Press IAS Key, autopilot synchronizes to the gyroplane's current indicated airspeed.
2. AIRSPEED Reference..... ADJUST using UP / DN Wheel
3. Adjust throttle as required ..... INCREASE POWER to climb
   DECREASE POWER to descend
4. Green ALT ..... VERIFY Upon Altitude Capture

Altitude Hold (ALT) Mode, Manual Capture

1. When at the desired altitude..... PRESS ALT key

The autopilot will hold the altitude at which the ALT key was pressed.

If climbing or descending at a high rate when the ALT key is pressed, the gyroplane will overshoot the reference altitude and then return to it. The amount of overshoot will depend on the vertical speed when the ALT key is pressed.

The altitude reference is displayed in the autopilot status box. The reference may be changed by +/- 200 FT using the UP / DN wheel.

Vertical Navigation (VNAV)

1. Navigation Source ..... SELECT CDI to GPS
2. Vertical Navigation Profile ..... LOAD into the GPS navigator's flight plan
3. Altitude Preselect ..... SET to the vertical clearance limit
   When ATC clearance received.
4. GMC 507 Mode Panel..... PRESS VNAV within 5 minutes of the top of descent (TOD)

NOTE

VERTICAL NAVIGATION WILL NOT FUNCTION FOR THE FOLLOWING CONDITIONS:

- **SELECTED NAVIGATION SOURCE IS NOT GPS NAVIGATION. VNAV WILL NOT FUNCTION IF THE NAVIGATION SOURCE IS VOR OR LOCALIZER.**
- **VNAV IS NOT ENABLED ON THE GPS NAVIGATOR**
- **IF THE ALTITUDE PRESELECT IS NOT SET BELOW THE CURRENT AIRCRAFT ALTITUDE.**
- **NO WAYPOINTS WITH ALTITUDE CONSTRAINTS IN THE FLIGHT PLAN**
- **GLIDESLOPE OR GLIDEPATH IS THE ACTIVE FLIGHT DIRECTOR PITCH MODE.**
- **OBS MODE IS ACTIVE**
- **DEAD RECKONING MODE IS ACTIVE**
- **PARALLEL TRACK IS ACTIVE**
- **AIRCRAFT IS ON THE GROUND**

VERTICAL NAVIGATION IS NOT AVAILABLE BETWEEN THE FINAL APPROACH FIX (FAF) AND THE MISSED APPROACH POINT (MAP)

ALTV WILL BE THE ARMED VERTICAL MODE DURING THE DESCENT IF THE ALTITUDE PRESELECT IS SET TO A LOWER ALTITUDE THAN THE VNAV REFERENCE ALTITUDE. THIS INDICATES THE AUTOPILOT / FLIGHT DIRECTOR WILL CAPTURE THE VNAV ALTITUDE REFERENCE. ALTS WILL BE THE ARMED MODE DURING THE DESCENT IF THE ALTITUDE PRESELECT IS SET AT OR ABOVE THE VNAV REFERENCE ALTITUDE, INDICATING THAT THE AUTOPILOT / FLIGHT DIRECTOR WILL CAPTURE THE ALTITUDE PRESELECT ALTITUDE REFERENCE.

4.5 Lateral Modes

Heading Mode (HDG)

1. HDG Key.....PRESS
   The autopilot will turn the gyroplane in the direction of the heading bug.

2. HDG/TRK Knob ..... Rotate to set heading bug to desired heading.

NOTE

IF HEADING BUG IS RESET TOO QUICKLY, THE GYROPLANE COULD TURN IN THE OPPOSITE DIRECTION AS THE HEADING BUG'S MOVEMENT.

1. When the gyroplane reaches the heading bug, the autopilot will roll the wings level to track the reference.

Track Mode (TRK)

1. TRK Key ..... PRESS
   The autopilot will turn the gyroplane in the direction of the track bug.

2. HDG/TRK Knob ..... Rotate to set track bug to desired track.

NOTE

IF HEADING BUG IS RESET TOO QUICKLY, THE GYROPLANE COULD TURN IN THE OPPOSITE DIRECTION AS THE HEADING BUG'S MOVEMENT.

1. When the gyroplane reaches the track bug, the autopilot will roll the wings level to track the reference.

Navigation (VOR)

1. Navigation Source ..... SELECT CDI to VHF NAV
   Tune and identify the station frequency.
2. Course Pointer ..... SET CDI to the Desired Course
3. Intercept Heading ..... ESTABLISH in HDG, TRK or ROL mode
4. NAV Key ..... PRESS

NOTE

If the Course Deviation Indicator (CDI) is greater than one dot from center, the autopilot will arm the VOR mode. The pilot must ensure that the current heading will result in a capture of the selected course. If the CDI is one dot or less from center, the autopilot will enter the capture mode when the NAV key is pressed.

Navigation (GPS)

1. Navigation Source ..... SELECT CDI to GPS
2. Waypoint ..... SELECT on Navigation Source
3. Course Pointer ..... VERIFY CDI set to the Desired Course
4. Intercept Heading ..... ESTABLISH in HDG or ROL mode
5. NAV key ..... PRESS

NOTE

If the Course Deviation Indicator (CDI) is greater than one dot from center, the autopilot will arm the GPS mode. The pilot must ensure that the current heading will result in a capture of the selected course. If the CDI is one dot or less from center, the autopilot will enter the capture mode when the NAV key is pressed.

4.6 Approaches

ILS

1. Navigation Source ..... SELECT CDI to VHF Nav
   Tune and Identify an ILS station frequency.
2. CDI.....SET to front LOC course
3. Ensure that the current heading will result in a capture of the selected course.
4. Press APR Key..... VERIFY LOC and GS ARMED
5. Verify..... Gyroplane Captures and Tracks LOC and GS
6. Set Missed Approach Altitude in Altitude preselect.
7. At Decision Altitude (DA),
   - AP DISC button .....PRESS, Continue visually for a normal landing

NOTE

If the Course Deviation Indicator (CDI) is greater than half scale deflection, the autopilot will arm the LOC mode. The pilot must ensure that the current heading will result in a capture of the selected course. If the CDI is within half scale deflection, the autopilot will enter the capture mode when the APR key is pressed.

When the selected navigation source is an ILS, glideslope coupling is automatically armed when the APR key is pressed. The glideslope cannot be captured until the localizer is captured. The autopilot can capture the glideslope from above or below the glideslope.

LOC (GS out)

1. 1. Navigation Source ..... SELECT CDI to VHF Nav
   ..... Tune and Identify an ILS station frequency.
2. Course Pointer.....SET to front LOC course
3. Ensure that the current heading will result in a capture of the selected course.
4. Press NAV Key.....VERIFY LOC ARMED
5. Verify.....Gyroplane Captures and Tracks LOC Course
6. Once gyroplane is in ALT mode inbound to the FAF, set the altitude preselect to the next required step down altitude. Use VS mode to descend gyroplane along the vertical step downs and to the MDA.
7. When in ALT mode at the MDA, set missed approach altitude in the altitude preselect.
8. At Missed Approach Point,
   AP DISC / TRIM INT button.....PRESS, Continue visually for a normal landing

GPS Approach (LPV, LNAV/VNAV, LP+V, or LNAV+V)

1. Navigation Source .....SELECT CDI to GPS
2. Course Pointer ..... VERIFY CDI set to the Desired Course
3. Ensure that the current heading will result in a capture of the selected course.
4. Press APR Key.....VERIFY GPS and GP ARMED
5. Verify ..... Gyroplane Captures and Tracks GPS and GP
6. Press ALT Key to level off at the MDA for a LP+V or LNAV+V approach
7. At DA (LPV or LNAV/VNAV approach), or MDA and Missed Approach Point (LP+V or LNAV+V)
   AP DISC / TRIM INT button ..... PRESS, Continue visually for a normal landing

GPS Approach (LP, LNAV)

1. Navigation Source .....SELECT GPS on the CDI
2. Course Pointer ..... VERIFY CDI set on the Desired Course
3. Ensure that the current heading will result in a capture of the selected course.
4. Press NAV Key.....VERIFY GPS ARMED
5. Verify Gyroplane Captures and Tracks GPS Course
6. Once the gyroplane is in ALT mode inbound to the FAF, set the altitude preselect to the next required step down altitude. Use VS mode to descend the gyroplane along the vertical step downs and to the MDA.
7. When in ALT mode at the MDA, set missed approach altitude in the altitude preselect.
8. At Missed Approach Point,
   AP DISC button ..... PRESS, Continue visually for a normal landing

BC

1. Navigation Source ..... SELECT CDI to VHF Nav
   ..... Tune and Identify an ILS station frequency
2. Course Pointer..... SET CDI to LOC Front Course
3. Ensure that the current heading will result in a capture of the selected course.
4. Press NAV Key.....VERIFY BC ARMED
   ..... (when heading is within 75 degrees of BC course)
5. Verify..... Gyroplane Captures and Tracks BC Course
6. Once gyroplane is in ALT mode inbound to the FAF, set the altitude preselect to the next required step down altitude. Use VS mode to descend gyroplane along the vertical step downs and to the MDA.
7. When in ALT mode at the MDA, set missed approach altitude in the altitude preselect.
8. At Missed Approach Point:
   AP DISC / TRIM INT button.....PRESS, Continue visually for a normal landing

VOR Approach

1. Navigation Source ..... SELECT CDI to VHF Nav
   Tune and identify the station frequency
2. Course Pointer.....SET CDI to the Desired Course
3. Ensure that the current heading will result in a capture of the selected course.
4. Press NAV Key..... VERIFY VOR ARMED
5. Verify..... Gyroplane Captures and Tracks VOR Course
6. Once gyroplane is in ALT mode inbound to the FAF, set the altitude preselect to the next required step down altitude. Use VS mode to descend gyroplane along the vertical step downs and to the MDA.
7. When in ALT mode at the MDA, set missed approach altitude in the altitude preselect.
8. At Missed Approach Point:
   AP DISC / TRIM INT button.....PRESS, Continue visually for a normal landing

SECTION 5 - WEIGHT AND BALANCE

5.1 General

The aircraft weight and balance is marginally affected by the embodiment of the autopilot. Normally it is fitted together with the EarthX battery. The weight reduction by using this battery is similar to the weight gain from the autopilot installation.

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SECTION 6 - SYSTEM DESCRIPTION

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6.1 Introduction

This section contains the description of the Autopilot system.

6.2 AFCS Overview

The GFC 500 is a digital Automatic Flight Control System (AFCS). It is a three-axis autopilot and flight director system which provides the pilot with the following features:

G5/G3X Outputs to Autopilot — The G5/G3X flight instrument provides attitude, rate, and acceleration information to the servos. Additionally, indicated airspeed, vertical speed, pressure altitude and GPS information are sent to the autopilot for mode control.

Flight Director (FD) — The flight director processing occurs in the G5/G3X instrument. Selected modes for the flight director are displayed on the G5/G3X autopilot status box.

The flight director provides:

- Command Bars showing pitch/roll guidance
- Vertical / lateral mode selection and processing

Autopilot (AP) — Autopilot operation occurs within the pitch, roll, and yaw servos. Servo monitoring is disabled. It provides automatic flight control in response to flight director steering commands, attitude and rate information, and airspeed.

Pneumatic/Electric Pitch Trim — The pitch trim pneumatic system works as normal when the autopilot is not engaged. The trim system provides automatic pitch trim when the autopilot is engaged and the gyroplane is in the air. Automatic trim functionality is disabled when the autopilot is off.

GMC 507 — Pilot commands to the autopilot and flight director are entered through the GMC 507 autopilot mode panel. The GMC 507 contains internal sensors which calculate the aircraft attitude, attitude rate and accelerations. These inertial sensors are completely independent from the sensors within the G5/G3X and the rest of the autopilot system, and are not used for the flight director, autopilot, trim or ESP functions. They are used solely to provide independent monitoring of the GFC 500.

Airspeed and Altitude Information — The GFC 500 requires airspeed and altitude information from the G5/G3X instrument.

Other components of the AFCS include the GSA 28 pitch, roll, and yaw servos that also contain autopilot processors, automatic pitch trim, and two stick mounted autopilot disconnect (AP DISC) button switches.

Underspeed Protection (USP) — The GFC 500 will provide Underspeed Protection when the autopilot is engaged.

When the minimum airspeed of 45 KIAS (50 MPH, 85kmh) is reached, a visual MINSPD message will appear above the airspeed tape and the autopilot will lower the nose to maintain 45 KIAS (50 MPH, 85kmh). An aural “AIRSPEED, AIRSPEED” voice alert will sound for installations connected to an audio panel.

Underspeed Protection is inhibited when the airspeed exceeds 50 KIAS (60 MPH, 85 Kmh).

Overspeed Protection (OSP) — The GFC 500 will provide Overspeed Protection when the autopilot is engaged.

When the maximum airspeed of 100 KIAS (115 MPH, 185Kmh) is reached, visual MAXSPD message will appear above the airspeed tape and the autopilot will raise the nose of the aircraft to avoid exceeding 105 KIAS (120 MPH, 195kmh). An aural “AIRSPEED, AIRSPEED” voice alert will sound for installations connected to an audio panel.

Overspeed Protection is inhibited when the airspeed is below 95 KIAS (105 MPH, 185 Kmh).

Coupled Go-Around — Go around is not installed.

Disconnect Methods

The following conditions will cause the autopilot to automatically disconnect:

- Electrical power failure, including pulling the AUTOPILOT circuit breaker.
- Internal autopilot system failure (including internal AHRS failure).

The following pilot actions will cause the autopilot to disconnect:

- Pressing the AP DISC button on the pilot’s or co-pilots stick (where fitted).
- Pushing the AP Key on the GMC 507 mode controller when the autopilot is engaged.
- Pulling the AUTOPILOT circuit breaker.

Autopilot Control Unit and Display

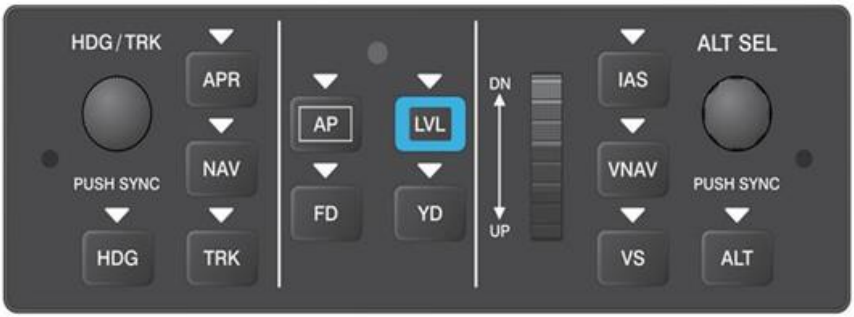


Figure 7-3: GMC 507 Control Unit (Reference Only)

Figure 7-4: G5/G3X Display (Reference Only)

The following tables list the available AFCS vertical and lateral modes with their corresponding controls and annunciations. The UP/DN wheel can be used to change the vertical mode reference while operating in Pitch Hold, Vertical Speed, Altitude Hold, or IAS mode. Increments of change and maximum ranges of values for each of these references using the UP/DN wheel are also listed in the table.

AFCS Vertical Modes

Vertical Mode	Control	Annunciation	Reference Range	Reference Change Increment
Pitch Hold	(default)	PIT	20° Nose Up 15° Nose Down	0.5°
Selected Altitude Capture	*	ALTS		
Altitude Hold	**ALT** Key	ALT nnnnn		10 FT
Vertical Speed	**VS** Key	VS nnnn	-2000 to +2000 FPM	100 FPM
IAS Hold	**IAS** Key	IAS nnn	45 to 100 KIAS 50 to 115 MPH 80 to 185 Kmh	1 KT 1 MPH 1 KMH
Vertical Path Tracking (VNAV)	**VNV** Key	VNAV		
VNAV Target Altitude Capture	**	ALTV		
Glidepath	**APR** Key	GP		
Glideslope		GS		
Level (LVL)	**LVL** Key	LVL	Zero Vertical Speed	

* ALTS arms automatically when PIT, VS, IAS, or GA is active.

** ALTV arms automatically if the VNAV Target Altitude is to be captured instead of the Selected Altitude.

AFCS Lateral Modes

Lateral Mode	Control	Annunciation	Maximum Roll Command Limit
Roll Mode	(default)	ROL	30°
Heading Select	**HDG** Key	HDG	30°
Track Select	**TRK** Key	TRK	30°
Navigation, GPS	**NAV** Key	GPS	30°
Navigation, VOR Enroute and Approach		VOR	30°
Navigation, LOC Arm/Capture/Track (No		LOC	30°
Backcourse Arm/Capture/Track		BC	30°
Approach, GPS Arm/Capture/Track (Glidepath Mode	**APR** Key	GPS	30°
Approach, ILS Arm/Capture/Track		LOC	30°
LVL (Level)	**LVL** Key	LVL	Wings Level

The autopilot may be engaged within the following ranges:

Pitch 50° nose up to 50° nose down, Roll ±75° (Engagement Limits)

If the above pitch or roll limits are exceeded while the autopilot is engaged, the autopilot will disconnect. Engaging the autopilot outside of its command limits, but within its engagement limits, will cause the autopilot to return the aircraft within command limits. The autopilot is capable of commanding the aircraft in the following ranges:

Pitch 20° nose up to 15° nose down, Roll ±30° (Command Limits)

Reflight Test

During the preflight test the G5/G3X will display PFT in the autopilot status box. The autopilot disconnect tone sounds at the completion of the preflight test and the PFT annunciation is removed. If GFC 500 fails the PFT, a yellow AP with a red X is displayed in the autopilot status box on the G5/G3X.

Messages and Annunciations

Autopilot Messages	
AFCS Controller Key Stuck	The system has sensed a key input on the GMC 507 for 30 seconds or longer.
AFCS Controller Audio Database Missing	The audio database is missing from the GMC 507. The aural voice alerts will not be heard.
Servo Clutch Fault	One or more autopilot servos has a stuck clutch. The servo needs service.
Servo Trim Input Fault	The inputs to the trim system are invalid. The trim system needs service.

Autopilot Annunciations	
AFCS	Autopilot has failed. Autopilot and trim are inoperative and flight director is not available.
AP	Autopilot normal disconnect.
AP	Autopilot abnormal disconnect.
AP	Autopilot has failed. The autopilot is inoperative. FD modes may still be available.
MAXSPD	Autopilot Overspeed Protection mode is active. Autopilot will raise the nose to limit the aircraft's speed.
MINSPD	Autopilot Underspeed Protection mode is active. Autopilot will lower the nose to prevent the aircraft's speed from decreasing.
PFT	Autopilot preflight test is in progress
PTRIM	Pitch Trim Fail – Manual Electric Pitch Trim is inoperative.
TRIM DOWN	Elevator Trim Down – Autopilot is holding elevator nose down force. The pitch trim needs to be adjusted nose down.
TRIM UP	Elevator Trim Up – Autopilot is holding elevator nose up force. The pitch trim needs to be adjusted nose up.

6.3 Flight Controls

Rotor head and trim control

Pitch and roll of the gyroplane are controlled by tilting the complete rotor head by means of the control stick. Control input is transferred via torsion tube and linkage running below the seats to the base link and from there to the rotor head via push-pull control cables.

The control stick head is ergonomically shaped to fit the pilot's right hand and features control buttons for radio transmission (1), a four-way trim function (2), and activation of the autopilot disconnect (3).

The trim control works as a classical 4-way beep switch. Pulling the beep switch back increases aft trim or nose-up tendency, while pushing the switch forward reduces back trim pressure, leading to a nose-down tendency. Roll trim is affected by pushing the trim switch to the respective side.

Because of a safety circuit, activation of the pre-rotator is only possible with the pneumatic mode selector in FLIGHT position and the control stick fully forward. This prevents inadvertent activation of the pre-rotator during flight or in BRAKE mode. Where autopilot is fitted, the pre rotator engagement button is relocated to the side of the throttle lever.

Control stick head

1 – Radio transmission

2 – Trim switch

3 – Autopilot disconnect

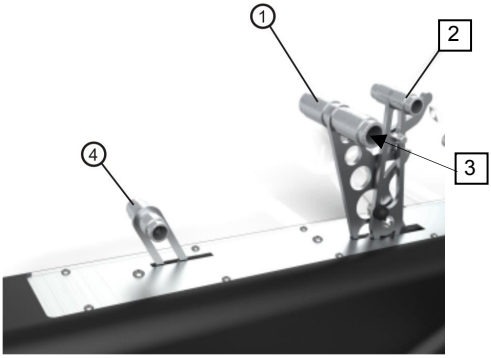
Throttle and brake panel

The throttle and brake panel and cabin heat / cabin temp control is located on the left side of the pilot station in the centre panel. Throttle control (1) is conventional with IDLE in aft (or pulled) and full throttle in most forward position. The throttle lever is linked with cable controls to the engine. A mechanical spring applies tension to the control cables and brings the engine to full throttle in case of a cable break. The throttle lever has a pre-set friction brake which holds the throttle in the selected position.

The hydraulic wheel brake is actuated by pulling the brake lever (2). A locking pawl mechanism allows setting for use as parking brake. In order to release the parking brake pull the brake lever a little further to let the spring-loaded locking pawl disengage, and then release wheel brake.

Do not try to disengage the locking pawl by pressing the small release lever without pulling the brake lever at the same time. Releasing the pawl using the small release lever only will lead to premature deterioration of the teeth. If the teeth are worn the function of the parking brake will be compromised!

Throttle and brake panel



1 – Throttle lever

2 – Brake lever with locking pawl

3 – Pre rotator engagement button

4 – Cabin heating / Cabin temp (if installed)

The quadrant also features the control for cabin heating / air conditioning system (4). All controls are labelled correspondingly by engraved text and symbols on the cover plate.

6.4 Lighting System

All Cavalon aircraft are approved for Day-VFR operation. Those equipped with the necessary additional equipment are approved for Day-VFR and Night-VFR. Refer to SECTION 9 of this manual for description of External lighting)

6.4.1 Instrument panel lighting.

When the aircraft's dimming bus is selected off, or full dim, GMC 507 mode control panel lighting is controlled by integrated photocells which sense the ambient cockpit lighting.

6.5 Electrical circuit protection

Fuse description	Rating	Protects	Fuse type	Location
Autopilot	5A	Autopilot	CB	Right Inst panel

CAUTION

Do not reset CB's in flight unless essential for continued safe flight

6.6 Instrument Panel

Different instrument panel layouts are available.

The autopilot may be integrated with a number of G3x and G5 panel configurations to suit customer demand. Examples are shown below.

NOTE

Any moving map system shall be used for reference only and does not replace proper flight planning and constant oversight and awareness.

WARNING

All GPS and/or EFIS display units requires regular updating of the displays and potentially, the basic software itself It is the operators responsibility to ensure the equipment is correctly updated prior to flight, and to understand that the GPS system is NOT a primary navigational aid. The GPS system (or any other information displayed on the device) has not been approved to any airworthiness standard.

NOTE

The cockpit panel detail layouts may vary from those shown.

Example of panel from Cavalon 915 with dual panel Garmin G3x.

Simple panel installation with Garmin G5, GMC 507, and a portable GPS

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