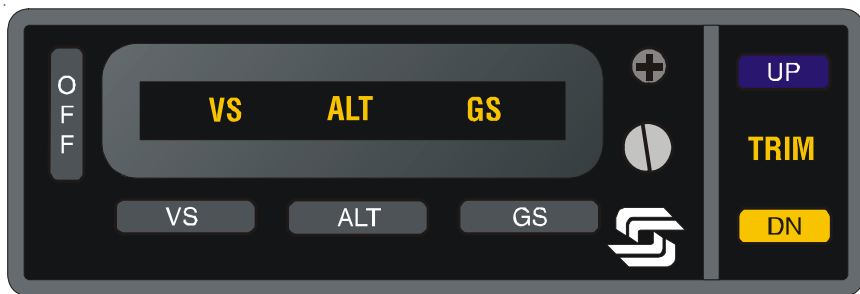




# S-TEC

## System 60 PSS Pitch Stabilization System Pilot's Operating Handbook



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## Table of Contents

<u>Section</u>	<u>Page</u>
1.0 Introduction.....	1-3
2.0 Block Diagram.....	2-3
3.0 Autopilot Overview.....	3-3
3.1 System 60 PSS Programmer/Annunciator.....	3-3
3.2 Modes of Operation.....	3-3
3.2.1 Off.....	3-3
3.2.2 Vertical Speed (VS).....	3-3
3.2.3 Altitude (ALT).....	3-4
3.2.4 Glideslope (GS).....	3-4
3.2.5 Trim.....	3-4
3.2.6 Up.....	3-5
3.2.7 Down (DN).....	3-5
4.0 Procedures.....	4-3
4.1 Pre-Flight Procedures.....	4-3
4.1.1 Pitch/Altitude and Vertical Speed.....	4-3
4.1.2 Manual Electric Trim.....	4-4
4.1.3 Autotrim.....	4-4
4.2 In Flight Procedures.....	4-5
4.2.1 Vertical Speed.....	4-5
4.2.2 Altitude Hold.....	4-5
4.2.3 Glideslope.....	4-6
4.2.4 Manual Arm/Automatic Engage.....	4-6
4.2.5 Manual Arm/Manual Capture.....	4-6
4.2.6 Glideslope Flight Procedure.....	4-8
4.2.7 Elevator Trim Indicator.....	4-8
4.2.8 Autotrim (Optional).....	4-8
5.0 Appendixes.....	5-3
6.0 Glossary.....	6-3

## List of Figures

<u>Figure</u>		<u>Page</u>
2-1	System 60 PSS Block Diagram.....	2-3
3-1	System 60 PSS Programmer/Annunciator.....	3-3
4-1	Glideslope Intercept and Track.....	4-7

# **SECTION 1 INTRODUCTION**

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## 1.0 Introduction

The primary purpose of the System 60 PSS **Pilot Operating Handbook (POH)** is to provide pilots with step-by-step Functional Preflight and In-Flight Operating Procedures for the installed system.

### Notice

This handbook must be used in conjunction with the Federal Aviation Administration (FAA) approved Aircraft Flight Manual (AFM) or Aircraft Flight Manual Supplement (AFMS). Refer to the applicable AFM or AFMS for aircraft specific information, aircraft emergency procedures, and return of aircraft to service.

If the autopilot is to be used during Instrument Flight Rules (IFR) operations, we recommend that you develop a thorough understanding of the autopilot system, its functions and characteristics in Visual Meteorological Conditions (VMC). Accomplish this before undertaking an IFR flight.

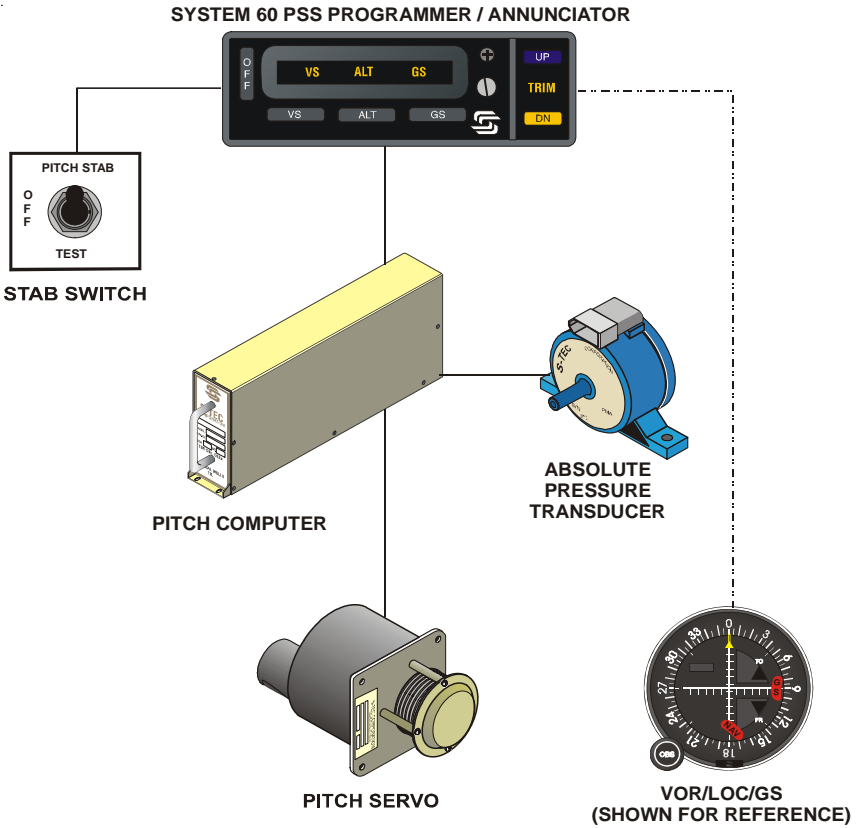


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# **SECTION 2 BLOCK DIAGRAM**

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2.0 Block Diagram



**Fig. 2-1. System 60 PSS Block Diagram**

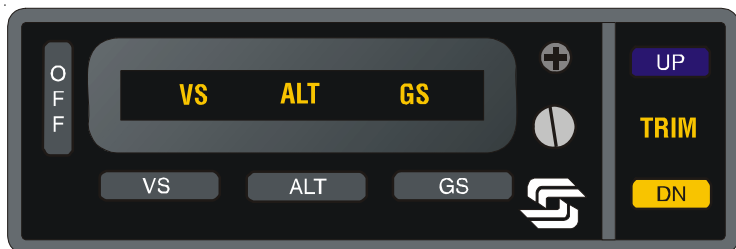
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# **SECTION 3 AUTOPILOT OVERVIEW**

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### 3.0 Autopilot Overview

#### 3.1 System 60 PSS Programmer/Annunciator



**Fig. 3-1. System 60 PSS Programmer/Annunciator**

The System 60 Pitch Stabilization System (PSS) is a rate based autopilot that provides control of the pitch axis of the aircraft. Pitch axis control is provided by deriving vertical speed, altitude position, altitude error and rate of vertical speed (acceleration) from the absolute pressure transducer.

The basic pitch modes provided are Vertical Speed (VS), for use in climbs and descents, and Altitude Hold (ALT) for maintaining a selected altitude (pressure) level. In addition, pitch attitude changes to accomplish commands are limited by acceleration in operation, providing a very slow, comfortable, maneuvering rate.

The System 60 Programmer/Annunciator also includes an ambient light sensor that automatically adjusts annunciator and knob light intensity for existing conditions.

### 3.2 Modes of Operation

#### 3.2.1 OFF

The OFF mode is the system disengage switch that is used to disable the autopilot.

#### 3.2.2 Vertical Speed (VS)

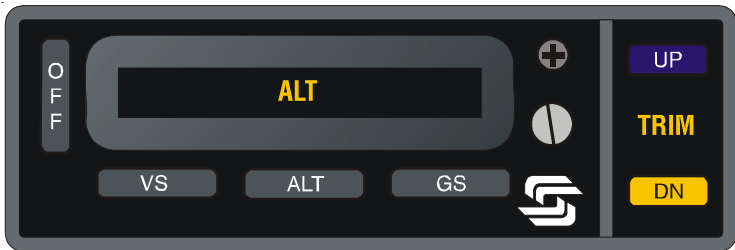
The VS mode provides pitch synchronization of the autopilot to the aircraft vertical speed. To activate, press the VS mode switch. This activates the UP/DN (Down) pitch modifier switches for pilot commanded changes of vertical speed, up to a maximum of +/- 1500 feet per minute (FPM) rate of climb/descent.





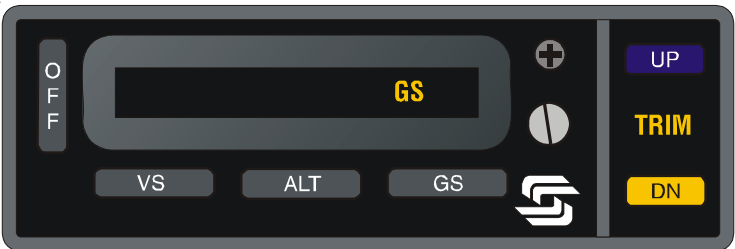
### 3.2.3 Altitude (ALT)

The ALT mode engages the altitude hold mode, capturing the altitude attained at the time of activation.



### 3.2.4 Glideslope (GS)

The GS mode switch will arm the GS mode when the aircraft is under the GS centerline. When armed, the GS mode will engage automatically when the aircraft reaches the GS centerline. If the aircraft is above the GS centerline, momentary activation will engage the GS mode. Arming is indicated by the GS annunciation appearing with the ALT annunciation. At engagement, the ALT annunciation will extinguish leaving only the GS annunciation.



### 3.2.5 TRIM

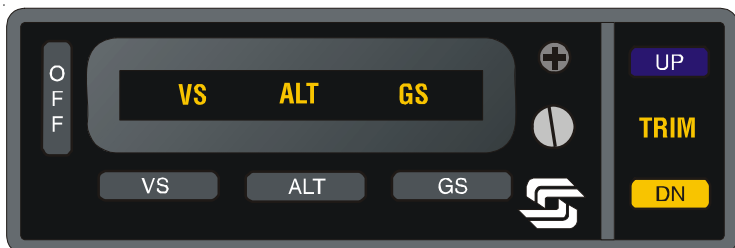
The TRIM mode illuminates in conjunction with the appropriate UP/DN modifier push button to indicate an out of trim condition. It also indicates the direction to trim in order to reestablish a trimmed pitch condition.

### 3.2.6 UP

When the VS mode is activated, the UP modifier switch will increase the rate-of-climb or decrease the rate-of-descent at 160 FPM for each second of continuous switch depression. In ALT mode, the UP switch will increase the altitude reference 20 feet per second.

### 3.2.7 Down (DN)

When the VS mode is activated, the DN switch will increase the rate-of-descent or decrease the rate-of-climb 160 FPM for each second of continuous switch depression. In ALT mode, the DN switch will lower the altitude reference 20 feet per second.



**NOTE:** For aircraft without auto trim, or where auto trim is disabled or turned off, the UP/DN annunciators are used to annunciate out of trim conditions when either the VS or ALT modes are engaged. If up trim is required, the UP annunciator will illuminate. If down trim is needed, the DN annunciator will illuminate. In both cases, the TRIM annunciation also will illuminate, and an audible warning will sound. The pilot should manually trim the aircraft in the direction indicated, until the light extinguishes and the warning stops. The aircraft will then be trimmed for existing flight conditions.

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# **SECTION 4 PROCEDURES**

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## 4.0 Procedures

### 4.1 Pre-Flight Procedures

**NOTE:** To perform the system function check, adequate DC voltage must be supplied to the system, either 12 or 24 VDC, depending on the aircraft.

#### 4.1.1 Pitch/Altitude and Vertical Speed

The following is a step by step procedure for preflighting the Pitch/Altitude and Vertical Speed Systems:

1. Place the Pitch Stab Switch in the TEST position. Ensure all indicators on the 60 PSS Annunciator light.
2. Move the control wheel to center and push the VS mode switch. Move the control wheel to check for engagement of the pitch servo.
3. Hold the control wheel and depress and hold the UP modifier switch. After approximately 1/2 second the pitch servo should disconnect. Release the UP modifier switch. The pitch servo should reengage. Repeat the procedure for the DN modifier switch. Move the Pitch Stab Switch to the Pitch Stab position.

#### **CAUTION**

**The above pitch limiter check should be conducted once each flight day. If the pitch servo does not disengage the controls when the UP and DN modifier switches are momentarily selected, the limit accelerometer may have failed. The pitch stabilization system should not be used until the problem is corrected.**

4. Move the control wheel to level flight position and engage the VS mode. Press the UP modifier switch and hold. The control wheel should move slowly aft. Press the DN modifier switch and hold. The control wheel should move slowly forward.
5. Overpower the pitch function by pulling the control wheel slowly aft. The TRIM and DN annunciator should illuminate and an audible warning should sound. Slowly push the control wheel forward. The TRIM and UP annunciator should illuminate and an audible warning should sound. During overpower, there should be no excessive play in the controls or ratcheting noise.

**NOTE:** There will be approximately a 2-3 second delay between the overpower and the trim indication. If the trim lights do not function the system should not be used until the problem is corrected.

6. Momentarily depress the OFF switch. Move the control wheel to assure freedom of movement of the controls.

#### 4.1.2 Manual Electric Trim

**NOTE:** Manual Electric Trim should be tested prior to each flight.

1. Place Trim Master Switch to ON and Pitch Stab Switch to Pitch Stab.
2. Operate manual trim switch (both segments) nose DN. Autopilot TRIM annunciator flashes, trim moves nose down.
3. Operate trim switch (both segments) nose UP. Autopilot TRIM annunciator flashes, trim moves nose up.
4. With trim operating nose up and down, grasp manual trim control and overpower electric trim.
5. Operate each segment of the trim switch separately. Trim should not operate unless both halves of the trim switch are operated simultaneously in the same direction.
6. With trim operating, press trim interrupt switch. Trim motion should cease while interrupt switch is activated. Trim motion should resume when interrupt switch is released.

#### 4.1.3 Autotrim

1. Place Trim Master Switch to ON and engage the VS mode.
2. Grasp control wheel and slowly push forward. After approximately 3 seconds, trim should run nose up.
3. Slowly pull control wheel aft. After approximately 3 seconds, trim should run nose down.
4. Move manual trim switch up and down. Autopilot disengages, trim should operate in commanded direction.
5. Reengage VS mode and press Trim Interrupt/Pitch Stab Disconnect switch. The autopilot should disconnect.
6. Retrim aircraft for takeoff. Check all controls for freedom of motion and to determine that the pitch system and trim have disconnected.

#### **CAUTION**

**If either the manual electric trim or autotrim fails during any portion of the preflight, turn trim master switch OFF. Do not use the trim system until the fault is corrected. With trim master switch OFF, the pitch system trim indicators and audio warning are reactivated. If the electric trim fails, or has an in-flight power failure, the system automatically reverts to indicator lights and audio warning. Should this occur, turn trim master switch OFF, and revert to aircraft manual trim until the fault is corrected.**

## 4.2 In Flight Procedures

### 4.2.1 Vertical Speed (VS)

When establishing an automatic climb out to a desired altitude (without optional ALT Selector Alerter), press and release the VS mode switch to engage the vertical speed mode. The autopilot automatically synchronizes to the established rate-of-climb or descent. If the established rate-of-climb exceeds 1500 FPM, at VS engagement, the autopilot will seek to maintain 1500 FPM. Should a specific rate-of-climb/descent be required, press the appropriate UP/DN modifier switch. For each second of depression (UP or DN), there is a 160 FPM change of vertical speed. For example, to establish a 500 FPM rate-of-climb, press and hold the UP modifier switch for approximately 3 seconds to transition from level flight to a 500 FPM climb. To descend at approximately 500 FPM, press the DN switch for approximately 3 seconds.



**NOTE:** If the VS mode annunciator flashes, it indicates an excessive error between the actual VS compared to the selected VS. The pilot should adjust the aircraft power or correct the VS that has been selected.

#### CAUTION

**Vertical speed change is time related: 160 FPM for each second of switch depression. Autopilot response to a commanded VS change is precise. DO NOT continue to depress modifier switches beyond the time required to program the desired vertical speed change. In other words, until the attitude change "looks right". The autopilot will change attitude very slowly in the direction of the command.**

### 4.2.2 Altitude Hold (ALT)

Upon reaching the desired or assigned altitude, press and release the ALT switch. The altitude hold mode will engage at the altitude reached at the time of engagement. There is typically no need to "lead" the desired altitude. If there is a difference between the altitude engagement point and the altimeter, the altitude may be modified.



To modify the selected altitude, depress the UP/DN modifier switch, in the direction of desired change, for the required time period. The UP/DN modifier switch will change the reference altitude 20 feet per second of switch activation. For example, if a barometric change requires a 40 foot climb to return to the desired altitude, depress the UP modifier switch for approximately 2 seconds. The aircraft will slowly change altitude to the new reference.

**NOTE:** The total range of the modifier switch in ALT mode is 200 feet of change. If more than 200 feet of change is required after ALT mode engagement, it will be necessary to return to VS mode and reselect ALT mode when the desired altitude is reached.

#### 4.2.3 Glideslope

The glideslope mode must be manually armed using the GS mode switch on the 60 PSS Programmer. If the aircraft is below the glideslope centerline, actuation of the GS mode switch will cause the GS mode to arm, lighting the GS annunciator in addition to the ALT annunciator. If the aircraft is above or on the GS centerline, actuation of the GS mode switch will arm and immediately engage the GS mode. The ALT annunciation will extinguish leaving the GS annunciation illuminated. The GS mode can only be armed while operating in ALT mode.

#### 4.2.4 Manual Arm/Automatic Engage

1. The NAV receiver must be tuned to the correct ILS frequency.
2. The glideslope signal must be valid with no flag.
3. Place the Pitch Stabilization System in ALT mode, inbound to the outer marker.
4. Select the GS mode, the GS annunciator will illuminate indicating the GS is armed. At the GS intercept, the ALT annunciator will extinguish, leaving only the GS annunciator illuminated and automatically engaging the GS mode.

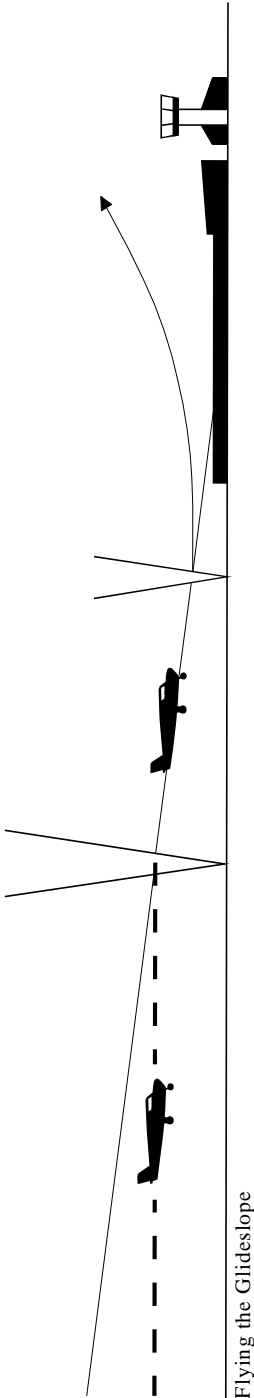
#### 4.2.5 Manual Arm/Manual Capture

If approach vectoring results in the location of the aircraft above or too near the GS centerline at the intercept point, it will be necessary to execute a manual arming of the GS.

1. Select the ALT mode (the system will not arm from the VS mode).
2. Select the GS mode.

**NOTE:** If the glideslope receiver indicator is equipped with an external flag output which is connected to the Pitch Stabilization System, a GS flag in view will inhibit the glideslope mode. If the flag extends once the glideslope is engaged, the GS annunciator will flash.

## Glideslope Intercept and Track



Flying the Glideslope

**NOTE:** When making an ILS approach, follow the published procedure for the approach you have been cleared to make.

1. Approach the glideslope intercept point with the aircraft stabilized in the Altitude Hold (ALT) mode. Press the GS switch to arm the glideslope. ALT and GS will both be annunciated.
2. If the aircraft requires approach flaps, lower the flaps to the proper position. (refer to FAA/AFM supplement for flap use limitations.)
3. At glideslope intercept (ALT will extinguish), lower the landing gear (if applicable) and adjust power for the desired descent speed and published rate of descent. For best tracking results, make small power adjustments to maintain the desired rate of descent and airspeed.
4. At the decision height, or the autopilot's minimum operating altitude, whichever is higher, disengage the autopilot to execute a manual landing, or a go around maneuver. If a missed approach is declared, the autopilot can be re-engaged after a stabilized climb has been established.

**Fig. 4-1**

#### 4.2.6 Glideslope Flight Procedure

Approach the intercept point with the flaps set to approach deflection of 15° - 25° (one or two notches), and with the aircraft stabilized in ALT mode. Determine the GS signal is valid (no flag) and arm the GS by momentarily depressing the GS switch. At the glideslope intercept, reduce the power for the desired decent speed. For best tracking results, make power adjustments in small, smooth increments to maintain the desired airspeed. At the missed approach point or the decision height, disconnect the Pitch Stabilization System by depressing the OFF switch. If a missed approach is required, the system may be reengaged after the aircraft has been reconfigured for and established in a stabilized climb.

#### 4.2.7 Elevator Trim Indicator

The autopilot pitch servo contains a sensor for detection of elevator out-of-trim loads. Without optional Autotrim, when such forces exceed a preset level, the TRIM annunciator will illuminate, and either the UP or DN annunciator will light up, indicating the direction of required trim. The annunciators will be accompanied by a low level audio signal. Annunciation will be steady for about 5 seconds, then will flash until proper trim conditions have been met.

**NOTE:** If the TRIM annunciation is illuminated and the autopilot is disengaged, there will be a residual out-of-trim force at the control wheel. Be alert for this condition if the autopilot is disengaged while the TRIM lights are on.

#### 4.2.8 Autotrim (Optional)

If the autopilot is equipped with optional Autotrim, the aircraft elevator trim will be maintained automatically when the Trim Master Switch is ON and the pitch mode is activated.

When the Trim Master Switch is ON, the trim annunciators are disabled. If the switch is OFF, or a power failure occurs, the annunciators automatically become functional.

The trim system is designed to accept any type of single failure, mechanical or electrical, without uncontrolled operation resulting. To ensure that no hidden failures have occurred, conduct a trim preflight check prior to every flight.

**NOTE:** With the optional autotrim system installed, do not overpower the autopilot pitch axis for more than three (3) seconds because autotrim will operate to oppose the pilot causing an increase in overpower loads. If it becomes necessary to overpower the pitch axis, immediately disconnect the autopilot using the control wheel disconnect switch.

# **SECTION 5 APPENDIXES**

**Table of Contents**

**Appendix A:** System Failure and Caution Annunciations.....5-3  
**Appendix B:** Specifications.....5-4

## Appendix A

### System Failure and Caution Annunciations

<b><u>ANNUNCIATION</u></b>	<b><u>CONDITION</u></b>	<b><u>ACTION</u></b>
Flashing "VS"	Indicates excessive vertical speed error over selected VS (usually in climb).	Reduce Command VS and/or adjust power.
Flashing "GS"	Indicates off glideslope centerline by 50% and/or glideslope flag in view.	Check attitude and power and glideslope raw data display for flag. Add or reduce power as necessary for off course - check radio, execute missed approach, if glideslope flag extended.

**NOTE:** If any of the above annunciations occur at low altitude or during an actual instrument approach, disengage the autopilot, execute a go-around, and inform Air Traffic Control (ATC) of the problem. Do not attempt to troubleshoot or otherwise determine the nature of the failure until a safe altitude and maneuvering area are reached.

**Appendix B**  
**Specifications**

**Programmer**

Power required	14/28 VDC
Weight	1.1 lbs
Dimensions	4.50 x 1.31 x 6.00 in.

**Pitch Computer**

Power required	14/28 VDC
Weight	3.0 lbs.
Dimensions	5.25 x 2.1 x 13.3 in.

**Pitch Servo/Trim Sensor**

Power required	14/28 VDC
Current	Included in system value power required.
Weight	2.9 lbs.
Dimensions	7.25 x 3.75 in.

**Altitude Pressure Transducer**

Power required (supplied by pitch computer)	10 VDC
Pressure range	0-15 PSI absolute
Overpressure	150% operating maximum

**NOTE:** Unit will operate with either 14 or 28 VDC. However, servo amplifier circuit board must be set up for specific voltage.

# **SECTION 6 GLOSSARY**



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<b>Term</b>	<b>Meaning</b>
AFMS	Airplane Flight Manual Supplement
ALT	Altitude
ATC	Air Traffic Control
DC	Direct Current
DN	Down
ED	Edition
FAA	Federal Aviation Administration
FPM	Feet Per Minute
GS	Glideslope
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IN.	Inches
LBS	Pounds
LOC	Localizer
POH	Pilot Operating Handbook
POHS	Pilot Operating Handbook Supplement
PSI	Pounds Per Square Inch
PSS	Pitch Stabilization System
SFM	Supplemental Flight Manual
VDC	Volts Direct Current
VMC	Visual Meteorological Conditions
VOR	Very High Frequency Omnidirectional Radio Range
VS	Vertical Speed

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