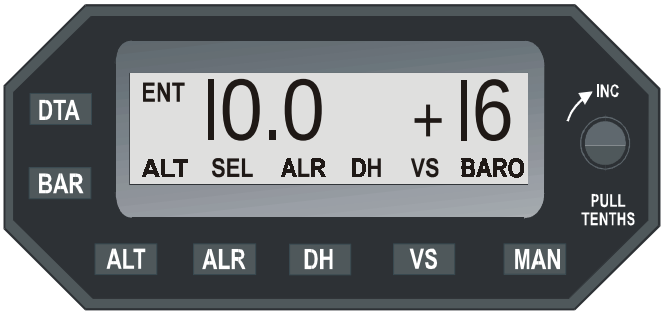
Altitude Selector/Alerter
P/N 01279



Pilot's Operating Handbook

MEGGITT
AVIONICS

S-TEC

REVISIONS

List of Effective Pages

* The asterisk indicates the pages changed, added, or deleted by the current change

Record of Revisions

Retain this record in the front of this manual. On receipt of revisions, insert revised pages in the manual and enter date inserted and initials.

REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER	REV NO	REVISION DATE	INSERTION DATE/BY	SB NUMBER
1st Ed	26 Oct 00						

NOTES

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INTRODUCTION

The Altitude/Vertical Speed Selector/Alerter, hereafter referred to as Altitude Selector/Alerter, allows the pilot to preselect altitude and vertical speed. In addition to these basic functions, the selector provides an Altitude (ALT) Alert Mode, a Decision Height (DH) Alert Mode, an Altitude Read-Out from the Encoder, barometric calibration in inches of mercury or millibars, and other features. This handbook provides information on the features and functions of the Altitude Selector/Alerter and operating instructions for its proper use.

The Altitude Selector/Alerter combines the computer and programmer units into a single panel mounted unit, which contains the display, the operating switches and the computer electronics. The system was designed to interface the S-TEC Autopilot with an altitude encoder/transponder providing a standard 100 ft increment altitude output.

Operation of the Altitude Selector/Alerter with the S-TEC Autopilot is easy and straightforward. However, in order to achieve maximum benefit and to utilize all of the systems features, it is important to have a clear understanding of the system and its operating characteristics, features and functions. Please read this manual carefully before using the Altitude Selector/Alerter.

ALTITUDE SELECTOR/ALERTER BLOCK DIAGRAM

ALTITUDE SELECTOR/ALERTER

ENCODING ALTIMETER/BLIND ENCODER

TRANSPONDER

AUTOPILOT PROGRAMMER COMPUTER

ALTITUDE SELECTOR/ALERTER

Theory of Operation

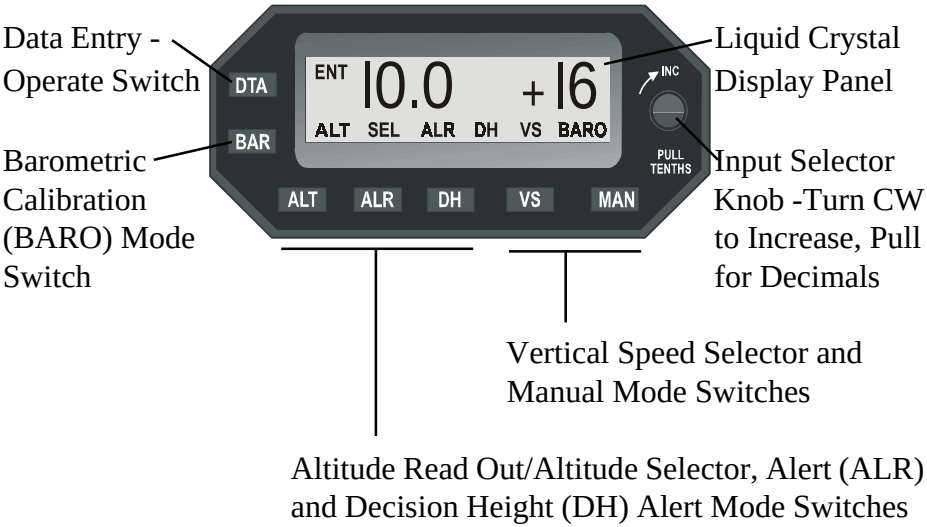
The Altitude Selector/Alerter (ASA) enables the pilot to preselect altitudes and rates of climb or descent to be used by the autopilot. The ASA reads and decodes the altitude information from the altitude encoder. This decoded information is adjusted by the setting of the barometric (baro) calibration and then compared to a selected altitude setting. When the information from the selected altitude matches the decoded altitude information from the encoder, the altitude selector computer signals the autopilot to electrically engage the altitude hold mode of the autopilot.

The Vertical Speed (VS) Selector provides an electrical output to the autopilot pitch flight guidance computer that is proportional to the amplitude and polarity (direction) of the vertical speed. For example, a + 500 feet per minute (FPM) climb VS, would produce a plus (+) voltage in an amount representing 500 FPM. This signal is not utilized by the autopilot until the VS Mode is engaged. At that time, the autopilot compares the existing vertical speed with the selected vertical speed and maneuvers the airplane to match these signals. The vertical speed selector portion of the ASA can be disabled by pushing the "MAN" (Manual) switch which will cause the autopilot to revert to its normal vertical speed command system.

The Vertical Speed Selector portion of the ASA will function any time the selector is showing a Vertical Speed and the Vertical Speed Mode of the autopilot is selected. However, the Altitude Selector will function only when the transponder and encoder are operating and when both the VS and ALT Modes of the autopilot are selected.

ALTITUDE SELECTOR/ALERTER

Quick Reference



Important Points to Remember

1. Set Barometric calibration, Altitude and Vertical Speed following initial self-test. System will be in data entry mode following self-test.

2. Push "DTA" to enter or change any data EXCEPT vertical speed - VS. Once entered, push DTA to close the entry mode or the unit cannot communicate your input/settings to the autopilot.

3. To activate pre-selected altitude and vertical speed, push both ALT and VS buttons on the autopilot at the same time. This is confirmed by the annunciation of both ALT and VS Modes on the autopilot.

4. For best accuracy relative to the target altitude, see "adjustment: baro calibration" on page 10-11.

5. If you are unsure of the correct operation, turn off the Altitude Selector/Alerter or push the MAN (Manual) button and revert to normal autopilot operation.

Features and Functions

Self Test

When power is applied, the Altitude Selector Alerter will conduct an internal self test of the computer electronic elements, the display and annunciations and the altitude alerter audio tone (a two tone "ding dong"). Successful test conclusion is indicated by the display of the barometric setting of 29.9 after completion of the test cycle.

Data (DTA) Entry - Operate

The DTA (Data) Switch button is used to select between data entry and operate modes. When the DTA button is selected, the display will show “ENT” to indicate entry mode and the SEL annunciator will flash to indicate that an entry will change the altitude selected. To change Baro, Decision Height or Vertical Speed, simply push the desired switch button and rotate the selector knob clockwise (CW) to increase the number and counter clockwise (CCW) to decrease the number. Pull the selector knob out (detent) to change decimal numbers.

When the system is in entry mode it is decoupled from the autopilot, however, the autopilot will hold the last vertical speed commanded.

After the required values are selected, push DTA to remove the “ENT” annunciation and return the system to operate mode. The entry will not be accepted unless the data field is closed by the second push of the data key.

> **NOTE:** In entry mode, only the altitude select mode annunciator will be active when “ALT” is selected - the actual altitude can not be called up to the display.

> **NOTE:** It is not necessary to select DTA Mode to enter vertical speed changes. Vertical speed inputs can be made directly in operate mode by simply rotating the selector knob.

Baro Calibration

Encoding altimeters provide altitude information referenced to a standard pressure of 29.92 inches of mercury. Conversion of this information is accomplished by computers in the Air Traffic Control Centers by applying the local altimeter setting, corrected to sea level. The baro calibration mode enables the pilot to provide a current altimeter setting by converting the altitude encoder output to Mean Sea Level.

When the system is initially powered up, the baro mode will be displayed immediately after the test cycle. At other times, it will be necessary to select the DTA (Data) button for Data Entry (ENT will be displayed) and then select "baro" which will display the last baro setting. Repeated pushes of the baro button will cause the displayed baro units to alternate between displaying the setting in inches of mercury (in Hg) or millibars. When baro is displayed in millibars, the first two digits are omitted: 1013.2 would display as 13.2 and 1036.9 would show as 36.9. For any questions on the setting in millibars, a quick reference to in. Hg. can be made by simply pushing the "baro" button once again.

> **NOTE:** To ensure optimum accuracy of the Altitude/Selector Alerter, the barometric setting should be updated along with the other barometric flight instruments in the aircraft, as required.

Adjustment: Baro Calibration

If the altitude encoder is in proper adjustment, simply rotate the input selector knob to display the desired baro calibration, matching the current altimeter setting as shown in the Kollsman window of the altimeter to the nearest 1/10th of an inch of mercury or millibar. Rotate the selector knob clockwise (CW) to increase the setting (regardless of whether the selector knob is pushed in or pulled out).

In normal use, it is not uncommon for encoders and/or altimeters to vary in calibration. When this occurs, the altitude selector will engage the altitude hold mode (ALT) on the autopilot at an altitude that is higher or lower than that selected. These calibration variations can be compensated for as follows:

If the Selector/Alerter engages altitude on the autopilot higher than the selected altitude, adjust the baro calibration to a higher number than the current altimeter setting. If the Selector/Alerter engages at a lower altitude than is selected, adjust the baro calibration to a lower number. An adjustment of .1 (1/10 in. Hg.) will provide an altitude adjustment of 100 ft. In normal operation, the altitude selector will engage the altitude hold mode (ALT) of the autopilot 50 ft. prior to arrival at the selected altitude either climbing or descending. Due to hysteresis in the altimeter, this may change slightly in use, but barometric calibration should always result in ALT hold engagement within 100 ft. of the selected altitude.

Auto-Barometric Calibration for Altitudes Above 18,000.00 FT. (Flight Levels)

When at or above an altitude of 18,000 ft., the baro calibration will automatically change to 29.92, the required altimeter setting for all flights above flight level (FL) 180. The baro setting on the display will continue to display the last baro setting. This allows the input of the new area altimeter setting prior to the descent below FL 180. When below an altitude of 18,000 ft., the system will reference to the displayed baro setting.

Vertical Speed (VS) Selector

NOTE: Some installations allow a maximum of +/- 3000 FPM. The example given below is for units limited to +/- 1600 FPM.

After power up, push the VS button to display the vertical speed and enable the vertical speed selector mode. The initial vertical speed will be +2 indicating a 200 FPM climb vertical speed. Rotate the selector knob to input the desired vertical speed in 100 FPM increments. Rotate the selector CW to add 100 FPM increments to the vertical speed. Rotate the selector CCW to subtract 100 FPM increments from the vertical speed. The maximum climb vertical speed available is + 1600 FPM which will be displayed as + 16. The maximum descent vertical speed is -1600 FPM which will be displayed as -16. Zero vertical speed is not selectable nor displayed. The vertical speed steps from + 1 to -1 and vise versa in a single increment of the selector knob.

The vertical speed display is the only function that can be accessed directly in the operate mode, therefore, vertical speed changes can be commanded by simply rotating the selector knob. If you are in the "Entry" (ENT) mode you can access the VS Mode by selecting the VS button and then rotating the selector for the desired vertical speed, however, you must push DTA to return to "operate" mode before the selected VS will be commanded.

The vertical speed selector function may be disabled by pushing the manual "MAN" button which will extinguish the VS display and the "SEL" annunciation on the optional autopilot remote annunciator display.

Automatic VS Select

If you select an altitude that requires an opposite polarity vertical speed, the vertical speed command displayed will automatically change polarity to match the direction of the altitude and also change to 500 FPM. For example, if you climb to a selected altitude of 6000 ft., the vertical speed display will show +3 or lower (+300 FPM climb) upon arrival. If you next select 5000 ft., or lower, the vertical speed command will automatically change polarity to a negative sign and 500 FPM, which will be displayed as -5 (-500 FPM descent).

Vertical Speed Compatibility Warning

In the above example, we selected a new altitude which was incompatible with the sign of the existing VS command and the system automatically changed the vertical speed sign.

If we select a vertical speed that is incompatible with the existing altitude displayed, the system will cause the altitude annunciation to flash for 5 seconds to alert the operator of the existing incompatibility. **The system will not automatically change the altitude selected.**

Automatic Vertical Speed Reduction at Altitude Capture

NOTE: Some installations allow a maximum of +/- 3000 FPM. The example given below is for units limited to +/- 1600 FPM.

While in operate mode (ENT blank), the vertical speed commanded will be automatically reduced as the aircraft approaches the selected altitude in order to provide smooth altitude transitions from climbs and descents to cruising flight. The vertical speed command will begin to automatically diminish in 100 FPM increments at an altitude which will result in a 300 FPM vertical speed at the altitude capture. For example:

When climbing 800 FPM, to 6000 ft.:
At 5500 ft. the VS will diminish to 700 FPM
At 5600 ft. the VS will diminish to 600 FPM
At 5700 ft. the VS will diminish to 500 FPM
At 5800 ft. the VS will diminish to 400 FPM
At 5900 ft. the VS will diminish to 300 FPM - where it will remain until altitude capture.

At the maximum climb or descent rate of 1600 FPM, the vertical speed schedule will commence at an altitude error of 900 ft. where the VS will diminish to 1100 FPM and continue to diminish at each 100 ft. according to the previously outlined schedule.

NOTE: As a result of this automatic scheduling of closure rate, the system will not accept high vertical speeds for small altitude changes. For example, for a 500 ft. altitude change, the maximum selectable VS is 700 FPM.

Altitude (ALT) Select Function

The ALT Mode switch has two functions. When selected in entry mode it will address the altitude selector function as indicated by the "SEL" annunciator flash. Select the desired altitude by rotating the selector knob to input the altitude in thousands and hundreds, i.e. 5500 ft. would be 5.5 (x1000). Reselect "DTA" to return to operate mode - the "SEL" will stop flashing and remain steady with the "ALT" annunciated.

Altitude Read Out

When the "ALT" switch is pushed in operate mode, the "SEL" annunciator will extinguish and the display will show "ALT" and display the encoded altitude corrected by the baro calibration - if the encoder and baro setting are correct. The altitude shown should be the Mean Sea Level altitude of the aircraft displayed to the nearest 100 ft. While in operate mode, repeated pushes of the "ALT" button will alternately display the encoded or the selected altitude.

Altitude Alert (ALR) Mode

The Altitude Alert Mode switch enables the altitude alert system in conjunction with the selected altitude displayed in ALT SEL Mode.

Activation of the ALR switch will display "ALR" indicating arming of the alert mode. The alert mode will cause a chime throughout the cabin audio system and flashing of the "ALR" annunciator when the aircraft is 1000 ft. from the selected altitude and again at 300 ft. from the selected altitude. The alert will also activate at 300 ft. if the aircraft deviates from the selected altitude by more than 300 ft.

The alert function can be alternately enabled and disabled by pushing the ALR switch. When alert is enabled, the "ALR" annunciation will be visible on the display.

Decision Height (DH) Alert Mode

The Decision Height (DH) Alert Mode will provide altitude alerting at the set DH altitude by activation of the chime and flashing of the DH annunciator. The chime will sound entering and leaving a 100 ft. window at the DH.

To set, push DTA for entry, select DH Mode. The display will initially show 0.0. Rotate the selector knob to obtain the desired DH to the nearest 100 ft. above the specified decision height. For instance, for a DH of 1160 ft., set in 1.2 (x1000) for 1200 ft. After setting the desired DH, push DTA to enter the selected DH. The display will show the selected DH for approximately 5 seconds and will then revert to altitude mode and display the altitude until the DH is reached in the descent. At the set DH window, the DH alert will activate. In our example, the alert will sound/flash at 1250 ft. and again at 1150 ft., alerting the pilot that he is at or near the set decision height.

The DH Mode can be disabled by pushing the DH switch causing the DH annunciator to extinguish, leaving the altitude displayed.

It is necessary to select DTA and ENT mode to display or enter the DH value or change a DH value, once you have returned to operate mode (ENT Extinguished). Repeated activation of the DH button in operate mode will alternately enable or disable the DH mode, without changing the display.

CAUTION

Due to possible inaccuracies that may exist in using the Altitude Selector/Alerter, the DH Mode should not be used as sole means of determining missed approach altitude.

Operation

The Altitude Selector/Alerter System is engaged (coupled to the autopilot) by use of the VS and ALT switches on the regular autopilot programmer. For VS selector operation, select "**VS**" Mode on the selector alerter and set desired vertical speed, then depress the "VS" Mode switch on the autopilot programmer to activate the "**VS**" Mode.

> **NOTE:** When using the VS Selector and VS Mode on the autopilot, the selector will still automatically reduce the VS as the aircraft approaches the altitude in the selector's altitude display, even though you may not want to capture that altitude. Therefore, when desiring to use only the VS select function, it may be desirable to select an altitude well above or below the altitude range you expect to be working in.

For Altitude Preselect, set the desired altitude and vertical speed on the Altitude Selector/Alerter and simultaneously depress both the "VS" and "ALT" switch buttons on the autopilot programmer. The autopilot mode annunciator will display both VS and ALT, indicating that the autopilot is operating in VS mode with altitude armed for the altitude intercept. When the aircraft arrives at the selected altitude, the autopilot "VS" annunciator will extinguish leaving the autopilot in altitude hold mode (ALT).

> **NOTE:** When selecting a climb vertical speed, be sure the selected vertical speed is within the capability of the aircraft under the existing conditions. Monitor the aircraft speed during the climb and reduce the selected vertical speed if the aircraft airspeed falls below the best rate of climb speeds.

Preflight

The following preflight procedure provides an operational test of the entire system, including the encoder, the Altitude Selector/Alerter and the autopilot. A successful test is indicated by the autopilot switching from VS Mode to ALT Hold Mode as the selected altitude is matched to field elevation.

1. Autopilot Circuit Breaker - IN, ALT Select Power - ON.

2. Transponder with Altitude Encoder - ON.

NOTE: If the Altitude Selector/Alerter is not receiving a valid encoder signal, the altitude (ALT) display will read three dashes (--.-) followed by three "ding dong" chimes. A period of time (sometimes several minutes) should be allowed for the encoder to come on-line which will be indicated by encoded altitude being displayed on the Altitude Selector/Alerter. At this time, recycle power to the Altitude Selector/Alerter and continue with the pre-flight test.

3. Altimeter -Set to local altimeter setting or field elevation, as appropriate.

4. Altitude Selector/Alerter -

A. Observe self test cycle complete - when first powered, the system will display all annunciations for approximately 5 seconds ending with the audio tone. Thereafter, it will display a baro setting of 29.9 with the baro annunciator flashing.

B. Rotate selector input knob to set baro setting to the nearest .1 in. Hg. (for millibars push baro switch).

C. Push ALT Switch to display ALT SEL with flashing “SEL” annunciator. Rotate selector knob to input an altitude 300-400 ft. higher than the indicated altitude on the Altimeter.

D. Push VS Switch to activate VS Selector and rotate selector switch knob to input desired climb (+) vertical speed.

E. Push ALT Switch to address altitude set mode - ALT SEL.

F. Push DTA switch to exit data entry mode.

5. Autopilot -

A. Engage HDG Mode.

B. Simultaneously depress VS and ALT switches on the autopilot programmer Computer (VS and ALT annunciations will both illuminate).

C. Rotate altitude selector knob CCW to change selected altitude to match field elevation. VS annunciation on autopilot programmer Computer should extinguish when the ALT SEL setting on the Altitude Selector/Alerter is within 100' of the indicated altitude on the altimeter. Extinguishing of the VS annunciation with the ALT remaining on indicates the altitude hold mode has been engaged.

NOTE: Due to tolerances of the Encoder/Altimeter, altitude engagement may not occur within +/- 100 ft of indicated altitude. If altitude engagement does not occur within 100' of indicated altitude, readjust the BARO CAL or calibrate the Encoder/Altimeter.

6. Disengage Autopilot - Adjust Altitude Selector/Alerter for desired altitude and vertical speed used after takeoff and during climb out.

7. Conduct autopilot preflight per the FAA/DAS approved Pilots Operating Handbook and Airplane Flight Manual Supplement for the autopilot system installation.

In-Flight

1. Encoder and Transponder ON (Altitude portion of the selector will not operate unless the Altitude Encoder is ON and operating).

2. Check baro setting, adjust as necessary.

3. Select desired altitude.

4. Select desired vertical speed.

5. Engagement: simultaneously depress the VS and ALT Switches on the autopilot programmer computer. This will engage VS Mode and arm the altitude hold mode for activation by the altitude selector.

NOTE: Vertical speed can be controlled either by using the VS selector or by using the manual VS modifier knob on the autopilot programmer computer. When using the VS selector, SEL will be highlighted on the remote annunciator to remind the pilot that the VS selector is in use. Automatic VS reduction, for a smooth capture, will occur as the target altitude is approached. If desired, the pilot can push the MAN button to transfer VS control to the autopilot VS knob. SEL on the optional remote annunciator will extinguish and automatic VS reduction will not occur as the target altitude is approached.

IMPORTANT

When using the altitude selector portion of this system, always be sure the selected vertical speed direction (sign) matches the direction required to achieve the selected altitude. The system includes safeguards that, under normal conditions, will advise the pilot of an altitude/vertical speed compatibility problem. It will also automatically change the sign of the vertical speed as required, however, it is possible to setup an incompatible altitude vertical speed combination, so always check that the selected altitude is correct.

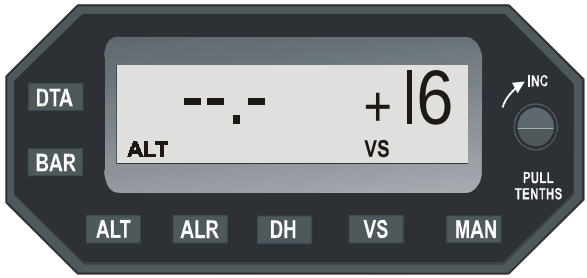
Rate of climb performance typically diminishes with increases in altitude.

> **NOTE:** Always be sure the selected vertical speed is within the capability of the airplane for the existing conditions. Reduce the commanded vertical speed when the indicated airspeed falls below the best rate of climb speed for the altitude you are passing through.

Emergency Procedures

The Altitude Selector/Alerter provides only switching information to the autopilot and cannot contribute to an autopilot malfunction. If for any reason, the Altitude Selector/Alerter does not function properly, push the MAN (Manual) button on the Altitude Selector/Alerter. This will completely remove the Altitude Selector/Alerter from the autopilot system. Do not attempt further use until the fault has been corrected. The Altitude Selector/Alerter is a low power device which is essentially dormant unless actually in use (by selection of the VS and ALT modes on the autopilot simultaneously). It is powered by the autopilot circuit breaker. The autopilot altitude hold mode (ALT) will override the Altitude Selector/Alerter when the ALT mode is manually selected by depressing the ALT switch on the autopilot programmer.

Lost Encoder Data



Anytime the Altitude Selector/Alerter is in use and encoder data is lost, the selected altitude will be replaced by three dashes, which will flash for five seconds then go steady. This is accompanied by three chimes. The last selected Vertical Speed will still be displayed (example: +16).

This action informs the pilot that a malfunction has occurred and the selected target altitude is no longer displayed or attainable by using the Altitude Selector/Alerter. The pilot should push the "MAN" (manual) button and control the pitch axis via use of the autopilot VS and ALT Modes.

If encoder data is restored during the flight, the encoded altitude will be displayed instead of the three dashes (example: 5,200 = 5.2). The Altitude Selector/Alerter can now be reprogrammed and used again, if desired.

SYSTEM SPECIFICATIONS

Altitude Selector/Alerter

Power Required:	14/28 VDC
Weight:	1.25 lbs
Dimensions:	1.6 X 3.42 X 6.75 in.
TSO:	C9c

LIST OF ACRONYMS

ALR	Alert
ALT	Altitude
AMPS	Amperes
ASA	Altitude Selector/Alerter
BARO	Barometric
CCW	Counter Clockwise
CW	Clockwise
DAS	Designated Alteration Station
DH	Decision Height
DTA	Data
ENT	Entry
FAA	Federal Aviation Administration
FL	Flight Level
FPM	Feet Per Minute
FT	Feet
HDG	Heading
HG	Mercury
IN	Inches
LBS	Pounds
MAN	Manual
SEL	Selected
VDC	Volts Direct Current
VS	Vertical Speed

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