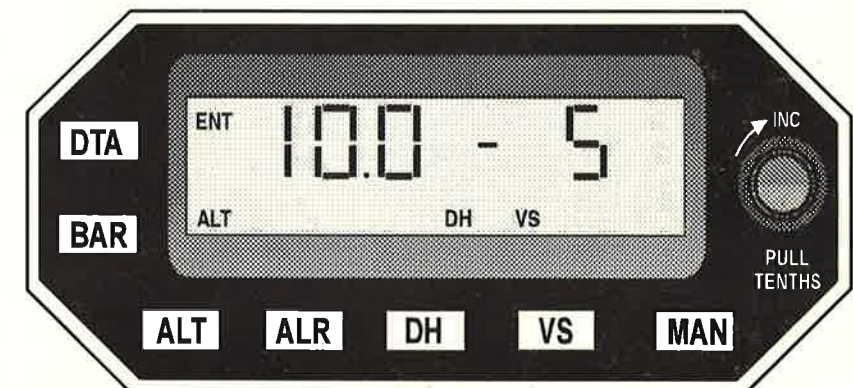


TILL HÖR SE-200



S-TEC Corporation

**Pilot's Operating Handbook
for
ALTITUDE SELECTOR / ALERTER
P/N 0140**



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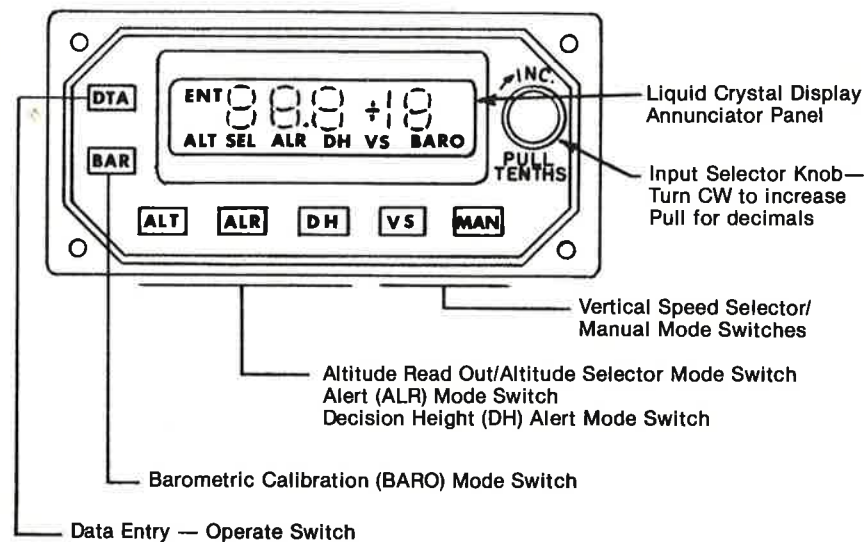
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INTRODUCTION

The S-TEC Liquid Crystal Display (LCD) Altitude and Vertical Speed Selector is FAA-TSO Approved under TSO C9c for use with S-TEC Autopilots. The Altitude and Vertical Speed Selector Sub-System allows the pilot to pre-select altitudes and rates of climb or descent to be used by the autopilot. In addition to these basic functions, the selector provides an altitude 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 system and operating instructions for its proper use.

The LCD Altitude/Vertical Speed Selector 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 utilizes an 8035, 8 bit, microprocessor for all computing and comparative functions. The system was designed to interface the S-TEC Autopilots with an altitude encoder/transponder providing a standard 100 ft. increment altitude output.

Operation of this sub-system with the S-TEC Autopilot is easy and straight forward. 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, and features and functions. Please read this manual carefully before using the system.



FEATURES AND FUNCTIONS

THEORY OF OPERATION

The Altitude Selector Computer reads and decodes the altitude information from the altitude encoder. This decoded altitude information is adjusted by the setting of the barometric calibration (baro) and then compared to 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 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, +500 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 selector system can be disabled by pushing the "Man" (Manual) switch which will cause the autopilot to revert to its normal vertical speed command system (Refer to the airplane-autopilot Pilot's Operating Handbook for basic autopilot operation).

The Vertical Speed Selector portion of the system will function any time the selector is showing a vertical speed (VS Mode) and the vertical speed mode of the autopilot is selected.

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.

FEATURES AND FUNCTIONS

SELF TEST

When power is applied to the system, the system will conduct an internal self test of the computer electronic elements, the display and annunciations and the altitude alerter audio tone. Successful test conclusion is indicated by the display of the barometric setting of 29.9 after the test cycle. The self test cycle will not check the encoder for proper operation, however, the pre-flight check procedures outlined in the pre-flight section of this handbook does provide a check procedure that will determine proper operation at the field elevation during the pre-flight check.

DATA ENTRY — OPERATE (DTA)

The DTA (Data) Switch button is used to select between data entry mode and operate mode. 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 (DH) or Vertical Speed, simply push the desired switch button and rotate the selector knob clockwise (CW) to increase the numbers and counter clockwise (CCW) to decrease the numbers. Pull the selector knob out (detent) to change decimal numbers.

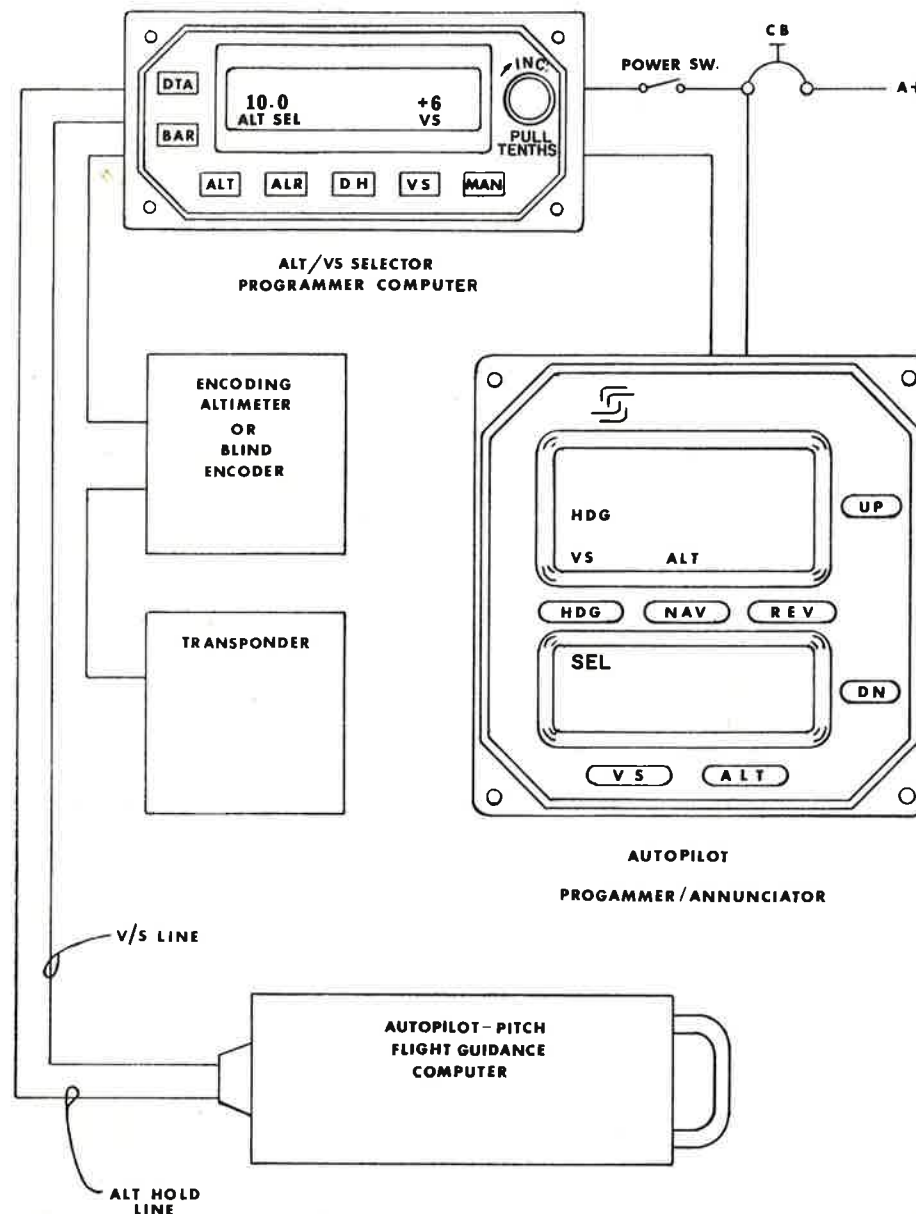
When the system is in entry mode it is decoupled from the autopilot, the autopilot will hold the last vertical speed commanded.

After the described values are selected push DTA to remove the "ENT" Annunciation and return the system to operate mode.

- NOTE:
1. 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. (See "ALT" Section for details).
 2. 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. (See vertical speed mode for details).

BARO CALIBRATION

Encoding altimeters provide altitude information referenced to a standard pressure of 29.92 inches of mercury. Conversion of this information to provide altitude referenced to Mean Sea Level (MSL) is done by the ATC Computer in the Air Traffic Control Centers by applying the local altimeter setting, corrected to sea level. The baro calibration mode allows the pilot to provide a current altimeter setting. This is used in the altitude computer to convert the altitude encoder output to MSL.



ALT/VS SELECTOR SYSTEM BLOCK DIAGRAM

When the system is initially powered, the baro mode will be displayed automatically 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 BAR (Baro) button will cause the displayed baro units to alternate between displaying the baro setting in inches of mercury (in hg) or millibars. When baro is displayed in millibars, the display only shows 3 digits. Therefore a baro setting of 952.4 would display as 952. A baro setting of 1003.8 will display as 003. If any question exists as to the setting in millibars, a quick reference to in. hg. can be made by simply pushing the "baro button once again.

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 as follows:

If the altitude at which the selector engages altitude (ALT) on the autopilot is higher than the selected altitude, adjust the baro calibration to a higher number than the current altimeter setting. If the ALT 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 proper 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 which is the required altimeter setting for all flights above 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.

VS SELECTOR

After power up push the VS button to display the vertical speed and enable 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. Turn the selector CW to add 100 FPM increments to the vertical speed. Turn 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 vice 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 autopilot annunciator (System 60-2). Refer to the Pilot's Operating Handbook/Airplane Flight Manual Supplement for the installed autopilot for details on vertical speed control using the basic autopilot without the selector.

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. 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 COMPATABILITY 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

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 climb 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 instance, for a 500 ft. altitude change the maximum selectable Vs is 700 FPM, for a 200 ft. change the maximum selectable Vs is 400 FPM.

ALT/ALTITUDE SEL MODE (ALT) ALTITUDE 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" annunciation will stop flashing and remain steady with the "ALT" annunciation.

ALTITUDE READ OUT

When the "ALT" switch is selected in operate mode, the "SEL" annunciation 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 MSL 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 altitude or the selected altitude.

ALERT MODE (ALR)

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 through 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. Once within 300 ft. the alert will 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 in the display.

DECISION HEIGHT (DH) ALERT MODE

The DH 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.

OPERATION

The Altitude/Vertical Speed Selector 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 and set desired vertical speed, then depress the "VS" mode switch on the autopilot programmer to activate "VS" mode.

NOTE: When using the VS Selector and VS mode only 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. (See Auto VS Reduction, page 8).

For Altitude Preselect, set the desired altitude and vertical speed on the altitude selector and simultaneously depress both the "VS" and "ALT" switch button 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 "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.

PRE-FLIGHT

The following pre-flight procedure provides an Operational Test of the entire system, including the encoder, the altitude selector, 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 Switch — ON
2. Encoder — ON (If provided with separate switch)
3. Transponder — ON (Transponder must be ON and functional for Altitude Selector to function)

NOTE: If the altitude selector is not receiving an encoder signal the altitude (ALT) display will read 99.8 (99,800 ft.)

4. Altimeter — Set to local altimeter setting or field elevation, as appropriate.
5. Altitude Selector —
 - A. Observe self test cycle complete — when first powered 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. lower or higher than the indicated altitude.
 - D. Push VS Switch to activate VS Selector, rotate selector switch knob to input desired climb (+) or descent (-) vertical speed (See note above regarding VS/Aircraft compatibility).
 - E. Push ALT Switch to address altitude set mode — ALT SEL.
6. Autopilot
 - A. Engage HDG Mode
 - B. Simultaneously depress VS and ALT switches on the autopilot programmer (VS and ALT annunciations will both illuminate).
 - C. Rotate altitude selector knob to change selected altitude to match field elevation. Vs annunciation on autopilot programmer should extinguish when the ALT SEL setting on the altitude selector 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: If altitude engagement does not occur within 100' of indicated altitude, readjust the BARO CAL described in the Features and Functions Altitude Selector Section, (Page 8).
7. Disengage Autopilot — Adjust Altitude Selector for desired altitude and vertical speed to be used after take-off and during climb out.
8. Conduct autopilot pre-flight per the POHS/AFMS for the autopilot system installation.

IN-FLIGHT

1. Encoder and Transponder — ON (Altitude portion of the selector will not operate unless the transponder is ON and Operating).
2. Check baro setting — adjust as necessary.
3. Select desired altitude.
4. Select desired vertical speed.

NOTE: The VS MAN/SEL switch allows the use of the VS Selector or Manual VS modification via the UP/DN modifier switches on the autopilot programmer. When VS is selected, SEL will be annunciated in the condition window of the autopilot programmer anytime a roll mode is engaged. The annunciation is to remind the pilot that the VS selector is in use and when the VS mode is engaged the auto pilot will follow the VS selected on the VS Selector portion of the Altitude Selector Programmer.

5. Engagement — Simultaneously depress VS and ALT Switches on the autopilot programmer. This will engage VS mode and arm the altitude hold mode for activation by the selector.

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 of use, will advise the pilot of an altitude/vertical speed compatibility problem or will automatically change the sign of the vertical speed as required, however, it is possible to set-up 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.

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 system provides only switching information to the autopilot and cannot, therefore, contribute to an autopilot malfunction. If for any reason the selector system does not function properly, place the power switch in the off position and do not attempt further use until it has been checked by service personnel. The altitude selector system 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 when the ALT mode is manually selected by depressing the ALT switch on the autopilot programmer. The vertical speed selector may be completely removed from the autopilot system by pushing the MAN switch on the selector programmer to disable the vertical speed selector function. In the manual (MAN) mode and UP/DN modifiers will function normally.