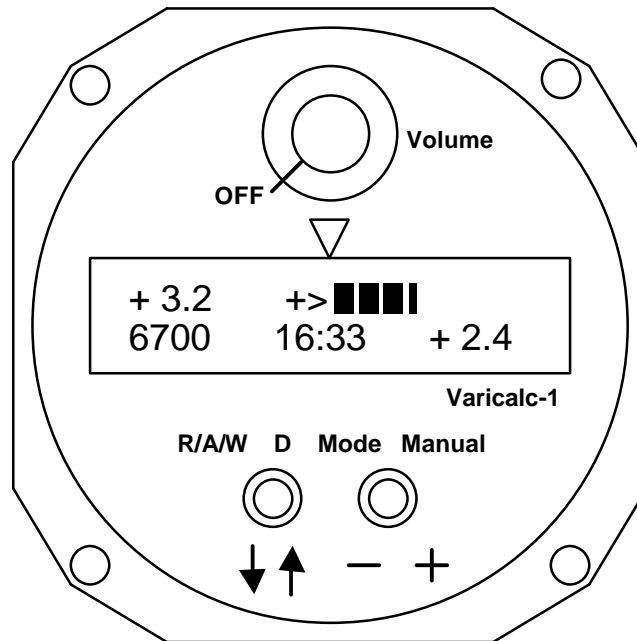


# Varicalc-1

## Variometer & Final-Glide Calculator



## Owner's Manual

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# CHAPTER I - Introduction to the Varicalc-1

## **Overview**

The Varicalc-1 is an electronic Variometer that uses a pressure sensitive transducer to measure Static pressure directly. There is, therefore, no need for a capacity (bottle) to be connected to the Varicalc-1. The Variometer reading is derived from the rate of change of Static pressure. The Static pressure is converted to altitude, which is used to compensate the Variometer reading to eliminate errors due to altitude. The altitude reading is also used in Final-glide calculations.

## **Description of Display**

The display is a dot matrix Liquid-Crystal-Display (LCD) capable of displaying 2 lines of 16 characters of text. The Variometer is displayed as a bar-graph on the top line of the LCD (see figure 1). The bar-graph is centred and will grow right if the variometer is positive (lift) and will grow left if negative (sink). Each bar indicates 0.2 knots. Bars are grouped in blocks of five; each block, therefore, represents one knot. The display on the top line will, therefore, indicate at a glance a value of up to 8 knots of lift or sink. On the opposite side of the bar-graph, the actual digital value of the variometer reading is indicated (see figure 1).

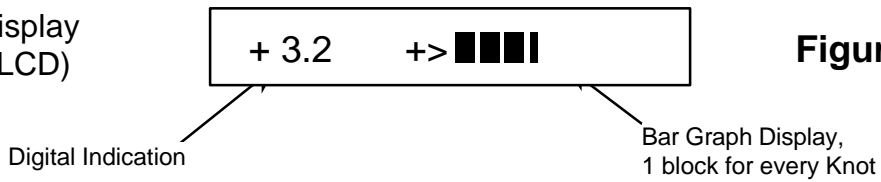
The second line of the display is used to display different types of information depending on the mode of operation. For example, the altitude, time and speed to fly are indicated during a glide, while altitude, time and averager are displayed in a thermal (see figure 2).

The second line of the display is also used to display a 'MENU' or list of options that can be adjusted by the user (see figure 3). For example, the ring-setting can be changed or the variometer damping can be adjusted.

## **Description of controls and connections**

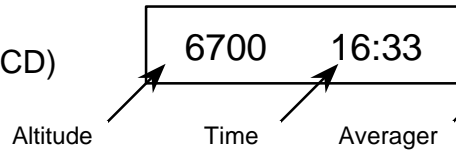
The Varicalc-1 has only three controls located on the front panel: the Volume control with an on/off switch, and two switches to select the mode of operation (see figure 4). Only 2 connections are required on the back-panel: a pneumatic connector to a Total-Energy (T.E.) probe, and an electrical connector for battery connection, a speaker, and other options (see figure 5).

Bar Graph Display  
(Top Line of LCD)



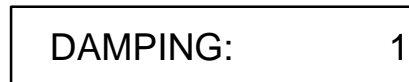
**Figure 1**

Information Line  
(second Line of LCD)



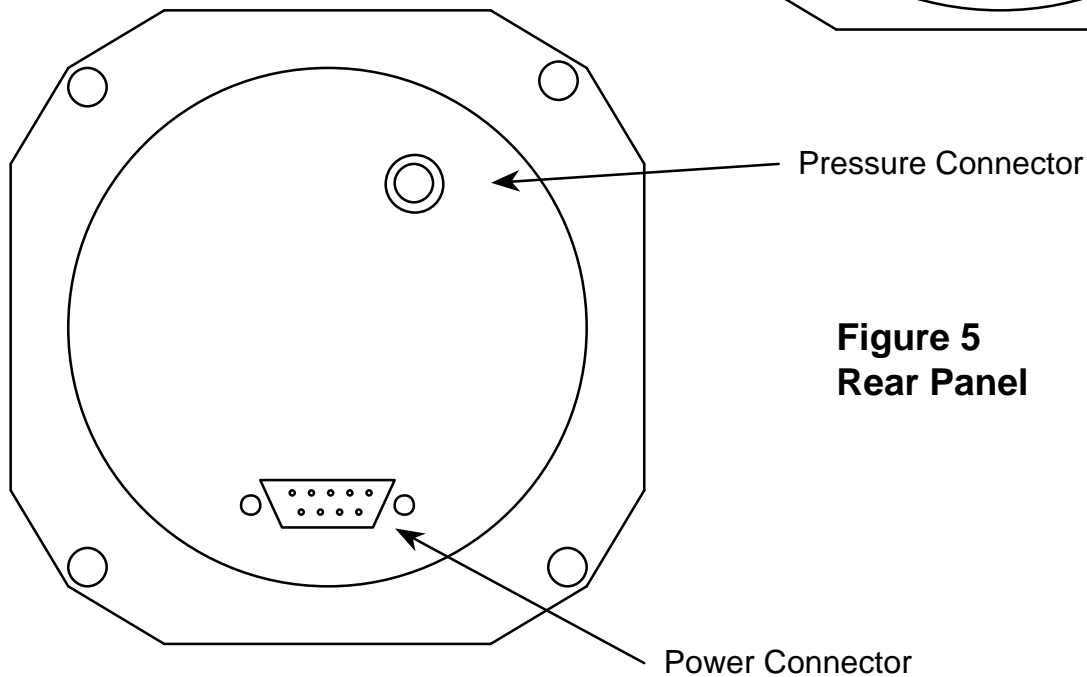
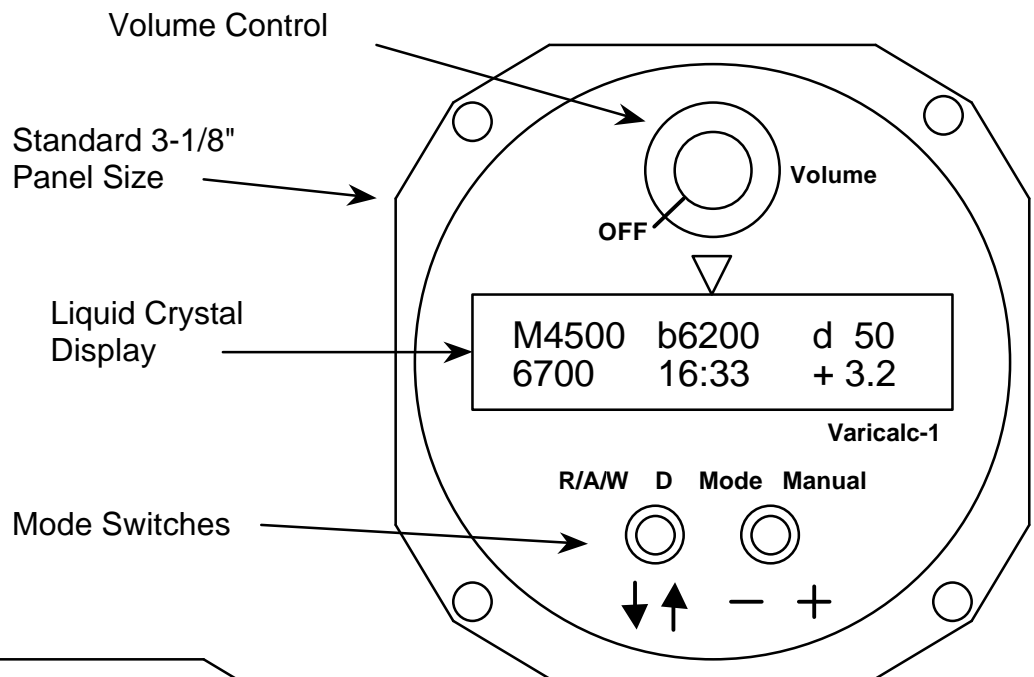
**Figure 2**

Option Selection Line  
(Second Line of LCD)



**Figure 3**

**Figure 4  
Front Panel**



**Figure 5  
Rear Panel**

## CHAPTER II - Modes of operation

The Varicalc-1 has two modes of operation and each one is sub-divided into two sub-modes as follows:

- 1) Variometer Mode:
  - Thermal sub-mode
  - Glide sub-mode
- 2) Final-Glide Mode:
  - Thermal sub-mode
  - Glide sub-mode

Each of the four sub-modes dictates what will be displayed on the front panel LCD.

### ***Variometer mode***

In the Variometer mode of operation, the following information is displayed on the LCD (see figure 6):

#### Thermal sub-mode

- Top line:
  - bar-graph of variometer reading
  - digital reading of variometer
  
- Bottom line:
  - altitude
  - time of day
  - averager reading

#### Glide sub-mode

- Top line:
  - bar-graph of variometer reading
  - digital reading of variometer
  
- Bottom line:
  - altitude
  - time of day
  - averager reading

### ***Final-Glide Mode***

In the final-glide mode of operation, the following information is displayed on the LCD (see figure 7).

#### Thermal sub-mode

- Top line:
  - Minimum altitude
  - Best (suggested) altitude
  - distance-to-go
  
- Bottom line:
  - altitude
  - time of day
  - averager

#### Glide sub-mode

- Top line:
  - Minimum altitude
  - suggested ring- setting
  - distance-to-go
  
- Bottom line:
  - altitude
  - time of day
  - speed-to-fly

### ***Changing the modes***

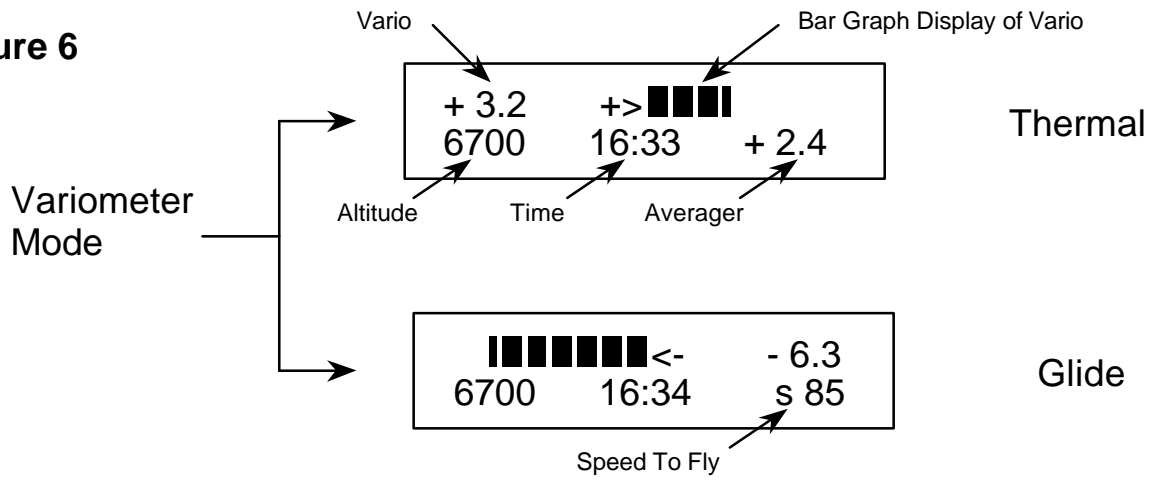
The selection of 'Variometer mode' or 'Final-glide mode' is done by the right front panel switch. This is indicated on the top left of this right switch as 'MODE'.

The selection of 'Thermal sub-mode' or 'Glide sub-mode' can be done automatically, by a front panel switch or, optionally, by an externally connected flap switch or remote switch. If a flap switch is connected, it overrides the automatic mode selection and the front panel switch selection (see 'other options' for more details).

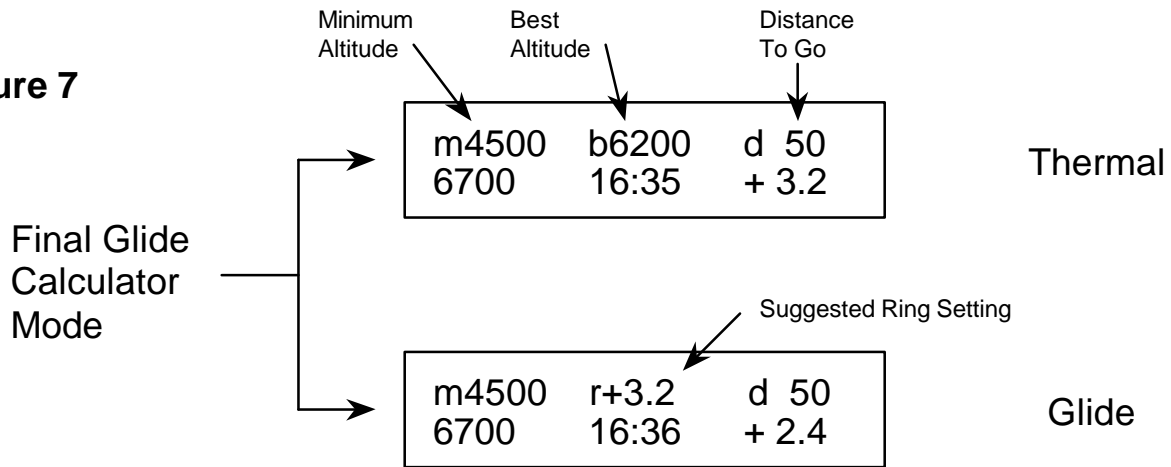
When in 'Automatic mode', the thermal sub-mode will change to glide sub-mode after five seconds of continuous sink and inversely with five seconds of lift (see AutoVario option description).

When in 'manual mode', (see 'Long Menu') the right front panel switch will toggle the thermal/glide sub-mode when depressed to the right. This is indicated on the top right of the right switch as 'MANUAL'.

**Figure 6**

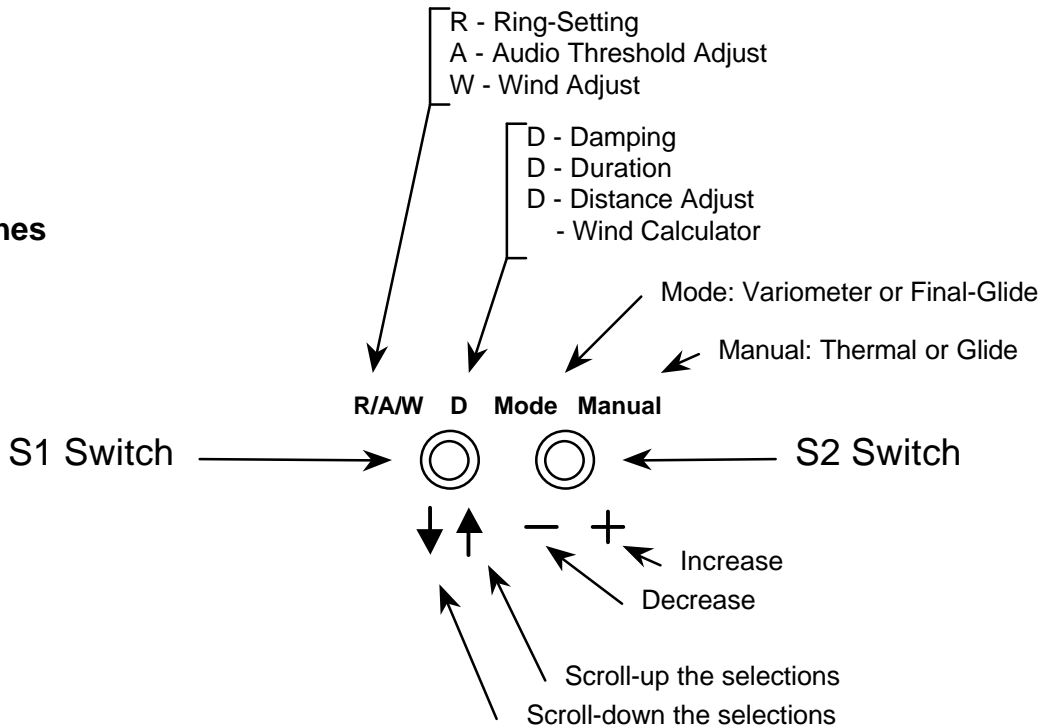


**Figure 7**



**Figure 8**

**Mode Switches**



## Chapter III - Option Selection

### Front Panel Switch Operation

To keep the number of switches on the front panel to a minimum, only two switches are used: S1 on the left and S2 on the right (see figure 8). Each switch has many functions. The function of each switch will vary according to the mode of operation described earlier. This was done to make the most-used selections easily and quickly accessible.

Both switches are toggle switches with centre-return spring action. Each switch can be pushed left or right and will return to the centre when released. S1 is used to select options. When it is pressed, the option display mode is entered and the options are shown on the second line of the display. R/W/A and D refer to quick access options. (See Short Menu below). The arrow symbols indicate direction for scrolling through the menu options.

Once an option has been selected, its value can be changed using S2: '+' to increase and '-' to decrease. Five seconds after operation of either S1 or S2 the options mode is terminated and the display returns to normal.

When a switch is depressed, a 'click' will be generated by the speaker to confirm that you have pressed a switch.

The selection of menu items has been divided into two different categories: the Short Menu and the Long Menu. The Short Menu is a list of options that are relevant to the current mode of operation and can be accessed quickly. The Long Menu, on the other hand, is a list of items that are less likely to need changing.

### Short Menus

The short menus can be accessed by depressing S1 to the right or to the left once. Successive depressions will show the next item in the list.

In the Variometer mode, the following options are accessed:

LEFT: - Ring-setting (R)	RIGHT: - Duration of window Averager (D)
- Audio + threshold (A)	- Damping of Variometer (D)

In the Final-glide mode, the following options are accessed:

LEFT: - Ring-setting (R)	RIGHT: - Distance-to-go (D)
- Wind component (W)	- Distance/Wind-Calculator (D)

### Long Menu

The long menu can be accessed by depressing S1 to the right or to the left and keeping it depressed for two seconds. The Short Menu will show up first and is replaced by the Long Menu after two seconds. Once in the Long Menu, you can scroll up or down the list of options by depressing S1 to the right (scroll-up) or to the left (scroll-down). If the switch is kept depressed, the items will start scrolling automatically. The small arrows below S1 indicate the scrolling direction (up-arrow - scroll-up, down-arrow - scroll-down).

The following options can be found in the Long Menu:

- Altitude:	- (Altimeter Setting)
- AutoVario:	- (Manual, Auto)
- Set Time:	- (Hours, Minutes)
- Field Elev:	- (Field Elevation)
- Averager:	- (Window, Both, Cont.)
- Ballast:	- (Dry, Wet)
- Bar Graph:	- (Vario, Final, Both, None)
- Tone:	- (Pulse, Tick, Continuous)
- Auto Ring:	- (None, Avger, Sugg., Both)

## ***Elapsed-Time Option***

This option is selected by pressing S2 to the right when the Manual option is not used.

### ***Option Description***

- Altitude: used to set the altimeter reading prior to take-off.
  - AutoVario: to set the mode of operation (thermal or glide) manually or automatically. If automatic, the mode changes to thermal after 5 seconds of continuous lift and changes to glide after 5 seconds of continuous sink; if manual, S2 pressed to the right toggles between 'thermal' and 'glide'.
  - Time: sets the time (hours and minutes) of the clock displayed on the front panel.
  - Field Elev: elevation of airport where you intend to land on your final-glide.
  - Averager: to select the type of averager to be displayed: a window averager, a continuous averager or both. The window averager, whose duration can be adjusted from 10 to 60 seconds, simply averages the variometer reading over the selected period. The continuous averager averages the variometer reading starting from the time the mode is changed to 'thermal'. When both are selected, the time display is replaced by the continuous averager.
  - Ballast: to select dry (no ballast) or wet (water ballast loaded).
  - Bar Graph: allows the selection of either a bar-graph display of the variometer reading or other useful information. The default selects a bar-graph in the variometer mode but not in the final-glide mode.
  - Tone: allows the selection of three audio tones: the default provides a burst of tone of variable duration, pitch and repetition rate, the second only provides a 'tick' with a variable repetition rate, while the third provides a continuous tone of variable pitch.
  - AutoRing: In thermal mode, this option enables the continuous averager to be transferred to the ring-setting automatically when the mode changes from thermal to glide. In final-glide mode, it enables the greater of the Suggested-ring or the ring-setting to be selected for the indication of the speed to fly.
  - Ring-set: programmable from 0 - to 10 knots to offset the speed-to-fly calculations appropriately.
  - Wind: adjustable from -30 knots (tail wind) to +30 knots (head wind); used in final-glide calculations.
  - Distance: distance from present position to desired landing location; used in final-glide calculations.
- W.Calc: the wind calculator is a useful feature to improve the wind component estimate. When the distance to go does not correspond to your estimated distance remaining, the wind estimate can be adjusted until they do correspond.
- Audio +: provides an audio dead-band. Adjustable from 0 to +8 knots. The audio tone is disabled until this threshold is exceeded.
  - Audio -: adjustable from 0 to -8 knots. A pulsing warning tone is generated when below this threshold.
  - Damping: adjusts the responsiveness of the variometer from a fast 1 second to a slow 6 seconds. A fast vario responds quickly to changes but can be erratic, while a slow vario dampens out gusts but will take more time to show the true strength of the thermal. The default setting is 3 seconds.
  - Duration: the window averager response time. This can be adjusted from 10 seconds to 60 seconds in 1-second increments. The default setting is 30 seconds.
  - Elapsed-time: this option allows a stop watch type elapsed time display. The elapsed time can be displayed and reset to zero if desired. This is independent of the time-of-day display.

## Chapter IV - Using the Varicalc-1 as a variometer

### **General Adjustments**

After the Varicalc-1 is turned on, it is advisable to add some of the items appearing in the Long Menu to the Pre-take-off check list, such as 'Altimeter', 'Time' and 'Field Elev.'. The altimeter setting is 29.92 in Hg and must be adjusted for the local pressure. This can be done by entering the Long Menu and pressing S1 (to the left or right) until the bottom line changes to 'Altitude:'. If "----" is shown, it means that the altitude is less than zero. Press S2 ('+') until the correct field elevation is shown. If it indicates too high, press S2 to the left to decrease ('-') the altitude.

The time display on the Varicalc-1 starts at 00:00 when you first turn it on. To adjust the time, you must access the Long Menu by pressing S1 until "Time: 00:00" is displayed. The minutes can be adjusted by pressing S2 to the right. The hours can be adjusted by pressing S2 to the left.

### **Bar-Graph Display**

Unlike a regular variometer that uses a needle to indicate the rate of climb, the Varicalc-1 displays this information as a horizontal bar-graph. The bar-graph display has a range of +/- 8 knots. The value of the variometer reading is also displayed as a digital value which has a range of +/- 12.8 knots at sea level.

### **Variable Damping**

The response (Damping) of the Variometer can be adjusted to suit weather conditions. This adjustment can be made by pressing S1 to the right (towards 'D' for damping). The bottom line on the display will show: 'DAMPING:3'. This indicates 3 seconds damping. To change the damping, simply press S2 to the right ('+') to increase the damping, or to the left ('-') to decrease the damping. The range of adjustments is from 1 second to 6 seconds in 1-second increments.

### **Averagers**

An added feature of the Varicalc-1 is a digital averager that can be adjusted to suit your needs. The averager can be one of two types - a continuous averager or a window averager of variable duration. The averager will average the variometer reading over the desired time.

The type of Averager can be selected by pressing S1 until 'AVERAGER:' is displayed on the second line. Press S2 to select 'WINDOW' for the window averager, 'CONT.' for the continuous averager, OR 'BOTH' if you want to see both (see Other Options).

The duration of the window averager can be adjusted by pressing S1 twice to the right (towards 'D') for duration. The bottom line on the display will change to 'DURATION : 30'.

This indicates an averaging period of 30 seconds. Simply press S2 to the right ('+') to increase the duration or to the left to decrease ('-') the duration; the range of adjustment is from 10 seconds to 60 seconds in 1-second increments.

The continuous averager is, as the name indicates, continually averaging the variometer reading. This is useful when you want to determine the average climb achieved in a thermal. The continuous averager is automatically initialized to zero whenever the mode changes from 'glide' to 'thermal'.

### **Audio mode**

Three types of audio tones have been provided on the Varicalc-1. Press S1 until 'TONE: PULSE' is displayed and use S2 to select the desired tone to 'TICK' or 'CONT.' (continuous).

The audio on the Varicalc-1 has two thresholds that can be adjusted. The positive threshold, or 'AUDIO +', determines the lowest level at which an audio tone is generated. If the 'AUDIO +' threshold is set at + 2.5 knots, the audio will remain silent until the rate-of-climb exceeds 2.5 knots.

The negative threshold ('AUDIO -') operates in a similar manner. If the 'AUDIO -' threshold is set at - 5.0, the vario will remain silent until the rate of descent exceeds 5 knots, at which time a warning tone will be generated.

The thresholds can easily be adjusted by pressing S1 to the left two or three times, and the value of these thresholds can then be adjusted by S2. ('+' or '-').

## ***Ring-setting***

On the Varicalc-1, instead of adjusting a ring, the ring-setting is adjusted by the front panel switches. The ring-setting, the present variometer reading, and the ballast selection are used to calculate the speed-to-fly. This speed-to-fly is printed as 's 85' on the lower right level of the LCD (see figure 6) to indicate a speed of 85 knots when in glide mode. The ring-setting can be adjusted by pressing S1 to the left. The second line will change to 'RING : 3.0' for example. To change this ring setting, use S2 to increase ('+') or decrease ('-') the setting. Note that the Ballast selection is also used in the calculation of the speed-to-fly.

The ring-setting can be done automatically if desired by using the Auto-Ring option. Press the switch S1 until 'AUTO RING: NONE' is displayed on the second line of the display. Change it from 'NONE' to 'AVGER' if you want the averager to be transferred to the ring-setting when you leave a thermal.

To change the ballast selection, press S1 until 'BALLAST: DRY' is displayed and use S2 to change to 'WET' when water ballast is loaded, or change back to 'DRY' when the water ballast is dumped.

## ***Elapsed-Time***

Press S2 to the right to access the Elapsed-Time function. The present time will be displayed on the left, and the Elapsed-time on the right. Press S2 to the right again to return to the normal display. To reset the Elapsed-time, simply press S1 to the right and the time will start at zero.

## ***Automatic mode***

To make the operation of the variometer as hands-off as possible, an automatic mode was incorporated for selecting the mode of operation, as follows:

- if the variometer indicates lift for more than 5 seconds, it will switch to thermal mode and display the averager.
  
- if the variometer indicates sink for more than 5 seconds, it will switch to the glide mode and display the speed-to-fly.

If you prefer to do this change of mode manually, it can be done by accessing the Long Menu 'AUTOVARIO' by pressing S1 to the left until 'AUTOVARIO' is displayed on the bottom line of the LCD. You can then select manual or automatic by pressing S2 to the left (or right). If 'MANUAL' is selected, S2 can be used to change to thermal or glide mode by pressing this switch to the right. Using this AutoVario option, however, will remove access to the Elapsed-Time option. S2 can only be used in this way when no menu selections are active, since S2 has normally the function of increasing or decreasing the selection.

An alternate method can be provided for selecting the mode of operation. A flap switch can be externally connected to the Varicalc-1. This flap switch could be used to select the mode of operation by detecting the Flap position (Thermal Flap or Cruise Flap). For gliders without flaps, a mode selection switch can be mounted on the control stick or any other convenient location. (See Other Options).

## ***Altitude Readout***

The use of a T.E. probe (for Variometer Total Energy Compensation), as opposed to static pressure, causes a small but predictable altitude error. There is an additional height factor, approximately equal to one-half the airspeed squared divided by the acceleration of gravity. This height factor is created by the probe to compensate the variometer reading.

At 40 knots, the altimeter display over-reads by about 70 feet, which is barely noticeable. However, at 80 knots, the error is about 270 feet. Therefore, it is better to interpret the altitude display as the altitude achieved after a pull-up.

## Chapter V - Final-Glide Operation

The Final-Glide feature of the Varicalc-1 replaces the need for glide tables, circular mechanical calculators, or even hand calculators. The Varicalc-1 uses glider Polar information, ballast status, present altitude, distance and wind to provide the status of your Final-Glide run.

Normally, you would change to Final-Glide when heading for home after the last turn-point; you can, however, switch to Final-Glide any time you want to know if you can make it home, or how much height you need to get home. To change from Variometer Mode to Final-Glide Mode, press S2 to the left towards 'MODE'.

The Final-Glide calculations require some initial input as follows:

- 1) Field Elevation
- 2) Distance to go
- 3) Wind component estimate

The other parameters used are ballast, altitude, and averager.

### **Field Elevation**

This parameter is used as the final height desired on the Final-Glide. For example, if the field elevation of the airport is 300 feet and you wish to reach it with nothing to spare, you'd set the field elevation to 300 feet. If, on the other hand, you want to get there with a 500 foot safety margin, key-in 800 feet for the field elevation.

The field elevation can be adjusted by pressing S1 to the left or right until 'FIELD ELEV.' is displayed on the bottom line of the LCD display; use S2 to increase ('+') or decrease ('-') the setting.

### **Distance**

The distance parameter can be adjusted to your present distance from the Final-Glide destination or to any distance you might want to use to determine the minimum height required.

A distance of 50 kilometres, for example, would be displayed as 'd 50' (see figure 7).

- The distance decreases when in glide sub-mode as you get closer to your destination. The rate of decrease is determined by the speed-to-fly indication. If a wind component is also selected, the rate of decrease will change according to the wind speed. For example, if you have a 10 knot tail-wind, and the speed-to-fly indicates 60 knots, the distance will decrease at a rate of 70 knots or approximately 1 km in 30 seconds.

- When in thermal sub-mode, the distance is adjusted only by the wind component so that a head-wind of 10 knots will increase the distance by approximately 1 km every 3 minutes.

### **Wind**

Wind is an important parameter of the final-glide calculations. It is very difficult to determine a good wind estimate and this is where the wind-calculator will help. An initial wind component should be selected by pressing S1 to the left twice. S2 can then be used to adjust the wind component - a positive wind is a head-wind; a negative wind is a tail-wind. A head-wind will decrease the resulting glide ratio of the glider, while a tail-wind can significantly increase the glide ratio.

### **Minimum Altitude**

The most essential parameter desired is the height needed to get home! The minimum height. The Varicalc-1 uses the distance, field elevation, and the wind component to calculate this height. This parameter is displayed as 'm4500', for example, to indicate a minimum height of 4500 feet to get home. You can adjust the distance and wind to see the effect on the minimum height (see figure 7).

An altitude greater or equal to 10,000 feet will be displayed as follows: 15K2 indicates 15,200 feet. The 'K' indicates 1000 and the trailing digit is hundreds of feet.

## ***Suggested Altitude***

Another useful parameter is the suggested height. This parameter is based on the fact that in a strong thermal, you're better off to climb a little higher than the minimum height because you'll be able to fly faster in the glide and make better time overall! If you stay too high, though, you'll waste time. The suggested altitude is, therefore, the optimum height needed for best speed. This suggested altitude is calculated by using the averager reading and optimizing the overall time of climb versus the glide time. This calculation doesn't attempt to consider dolphining flight on the final leg which could reduce the suggested altitude. When in thermal mode, this parameter is displayed as 'b9600' for a "best" height of 9600 feet (see figure 7).

## ***Suggested ring-setting***

When you have more than the minimum height, it would be nice to know at what speed you should fly to get home in the best possible time. If you go too fast, you'll land short! But if you go too slow, you'll get to the destination with excess height. The Varicalc-1 provides a suggested ring-setting that you can use if desired.

The ring-setting can be adjusted manually by pressing S1 to the left once and using S2 to adjust the value.

Once the ring-setting is set, the speed-to-fly indicator will show the optimum speed to fly.

If the present altitude is lower than the Minimum Height, 'LOW' will be indicated instead of a Suggested Ring-setting.

Note: In the speed-to-fly calculation, the suggested ring-setting will be used if it is greater than the ring-setting when the Auto-Ring option 'AUTO RING: SUGG.' is used. If the 'AUTO RING: BOTH' is used, the averager will be transferred to the ring-setting when leaving a thermal, and the greater of the ring-setting or suggested ring-setting will be used for the speed-to-fly calculation.

## ***Wind-Calculator***

With the distance, wind and ring-setting all set, once on glide, the distance will decrease proportionately to the speed-to-fly and the wind speed. As you check every 5 or 10 kms and you notice that the distance indicated by the Varicalc-1 is not correct, it is likely that the wind component estimate is incorrect. You can now go to the Wind Calculator option by pressing S1 to the right twice. The second line will indicate the following, for example: 'W.CALC: + 10 d 35'. This indicates that you are in the Wind-Calculator mode, with a 10 knot head-wind and a remaining distance of 35 kilometres. If the actual distance is 30 kilometres, you can adjust the wind component until a distance of 30 kilometres is indicated. This can be done by pressing S2 to the left to decrease ('-') or right to increase ('+') the wind component; the distance will then be corrected and displayed.

The Wind-Calculator works by calculating two distances separately; 1) the distance change due to airspeed (Speed-to-fly), and 2) the distance change due to the wind component.

Distance Travelled = (Airspeed \* Time) + (Wind speed \* Time)

As you adjust the wind component, the distance travelled will therefore change.

For the Wind-Calculator to work properly, you must fly a good average of the indicated Speed-to-fly. If desired, adjust the ring-setting until the Speed-to-fly indicates your preferred average Speed-to-fly.

To reset the Time to zero and therefore re-start the Wind-Calculator, you can change the distance directly, change the wind directly or change the mode from Variometer Mode to Final-Glide Mode.

## Chapter VI - Other Options

### ***Alternate Display Modes (Bar Graph)***

The top line of the LCD display can be a Bar-Graph indicating the value of the variometer reading. If this feature is not wanted, it can be disabled by accessing the 'BAR GRAPH:' long menu. By default, the Bar-Graph is displayed in the Variometer mode, but not in the Final-Glide mode. This can be changed to 'NONE', 'VARIO' only, 'FINAL' only or 'BOTH'.

The normal Variometer mode display shows the Bar-Graph on the top line (see figure 6). If disabled, the Bar-Graph is replaced by the present ring-setting and the digital value of the variometer reading (see figure 9).

The normal Final-Glide display (see figure 7) does not show a Bar-Graph display but displays altitude, distance, etc.

If you want to keep the Bar-Graph display when in Final-Glide mode, you can do so by selecting the long menu item 'BAR GRAPH:' and changing 'VARIO' or 'NONE' to 'FINAL' or 'BOTH'. The result is shown in figure 10. The top line is the bar-graph display as before, but now the bottom line will flash the Final-Glide information. Since there isn't enough space to show all the information at the same time, the information is split into 2 sets and each set is displayed 2 seconds at a time (see figure 10). The first set of information shows the present altitude and minimum altitude, while the second set displays the distance remaining and suggested altitude/ring-setting.

### ***Dual-Averagers***

In the thermal sub-mode of operation, the averager is normally displayed in the lower right of the LCD display (see figures 6 and 7). This averager can be the continuous averager or the window averager.

If you'd like to display both averagers at the same time, you can do so by selecting 'AVERAGER' in the long menu, and changing the selection to 'BOTH'. The result is shown in figure 11. The time display is replaced by the continuous averager, and the window averager is shown in the lower right of the LCD display.

### ***Flap/Mode Switch***

To make full use of the Varicalc-1 features, the mode of operation must be selected as 'THERMAL' or 'GLIDE'. This can be done automatically with a 5-second time-out as described earlier. However, there are instances when this automatic mode is undesirable (in dolphin flight, for example). As an alternative, an external switch can be connected to the Varicalc-1 as follows:

- Basic Flap Switch:

If your glider has flaps, you can connect a switch to the Varicalc-1 which will determine the mode of operation as 'THERMAL' when thermaling flaps are selected, or 'GLIDE' when speed flaps are selected. This can be done with a micro-switch and a 10k ohm resistor as shown in figure 14.

- Flap Switch with AUTO select:

If you wish to be able to select 'AUTO' mode or 'FLAP' mode, an extra panel-mounted switch can be installed (see figure 14). In this configuration, the flap switch is only enabled when the panel switch is closed. This would be useful if you sometimes wish to use less than normal flap for thermaling.

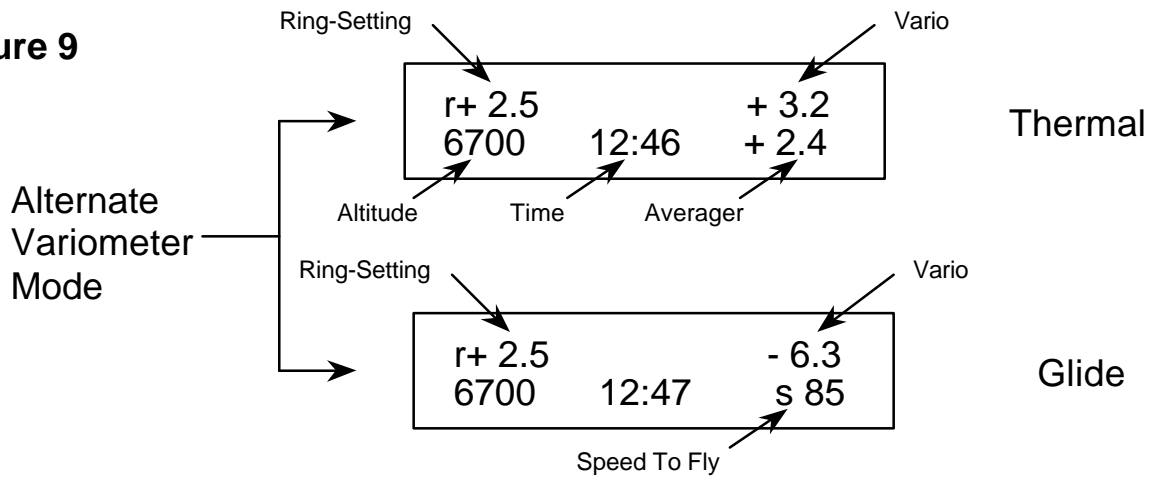
- Flap Switch with GLIDE Override:

If you want to use the flap switch but also want to be able to force the Varicalc-1 to the 'GLIDE' mode, regardless of the flap position, you can do so by connecting the panel-mounted switch between the flap switch and the resistor (see figure 14). This switch arrangement may be preferable if you are concerned about unwanted switch operations during dolphin flight.

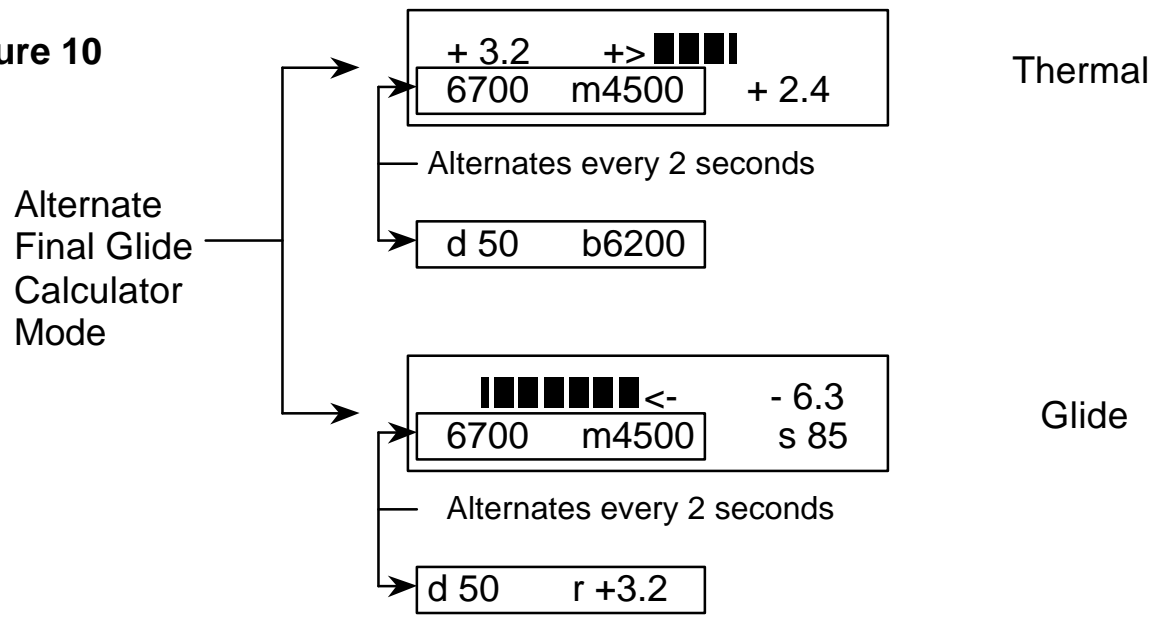
- Mode Switch:

If you do not have flaps, you can use a Mode-Switch which can be panel mounted to allow 'AUTO' mode or force the Varicalc-1 into 'GLIDE' or 'THERMAL' mode. This can be done by using a three-position switch (SPDT with centre-off) and connecting the resistor as shown in figure 14.

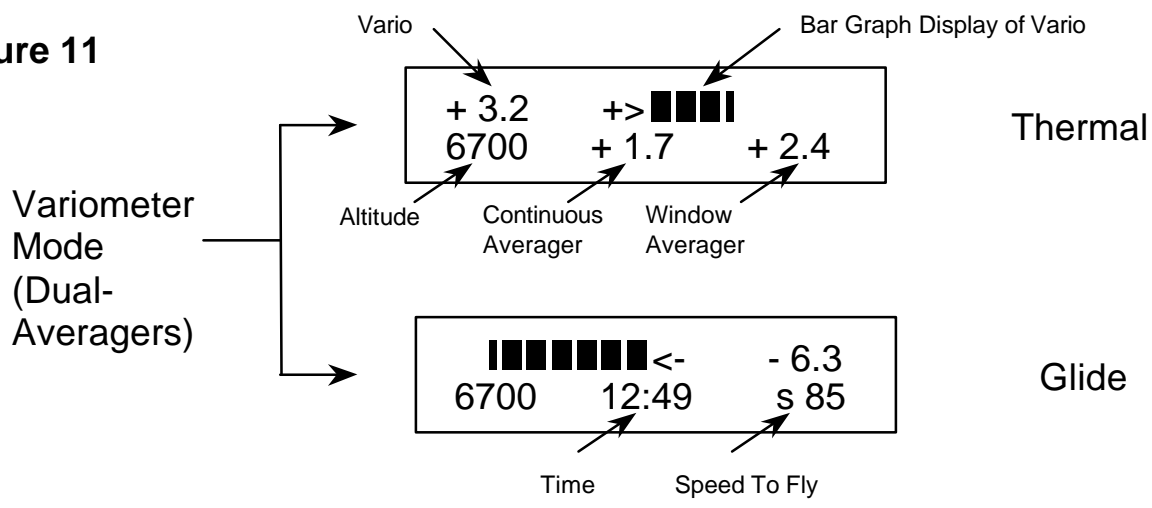
**Figure 9**



**Figure 10**



**Figure 11**



## Chapter VII - Installation

### ***Mounting***

The Varicalc-1 can be installed in a standard 3 1/8" panel opening. Insert the Varicalc-1 from the back of the panel and install the 4 screws provided through the front panel and into the Varicalc-1 case. There are captive nuts in the Varicalc-1 case for ease of installation. Refer to figure 12.

The Total-Energy (T.E.) probe can then be connected to the pneumatic connector at the back of the Varicalc-1. Refer to figure 13.

The Electrical connector can then be connected and secured with the washers and nuts provided. Refer to figure 13.

The Electrical connector provides a connection to the Battery, the Speaker, and the Flap/Mode switch. Refer to figure 14.

NOTE: The Varicalc-1 MUST BE FUSED EXTERNALLY!! There is no internal fuse in the Varicalc-1.

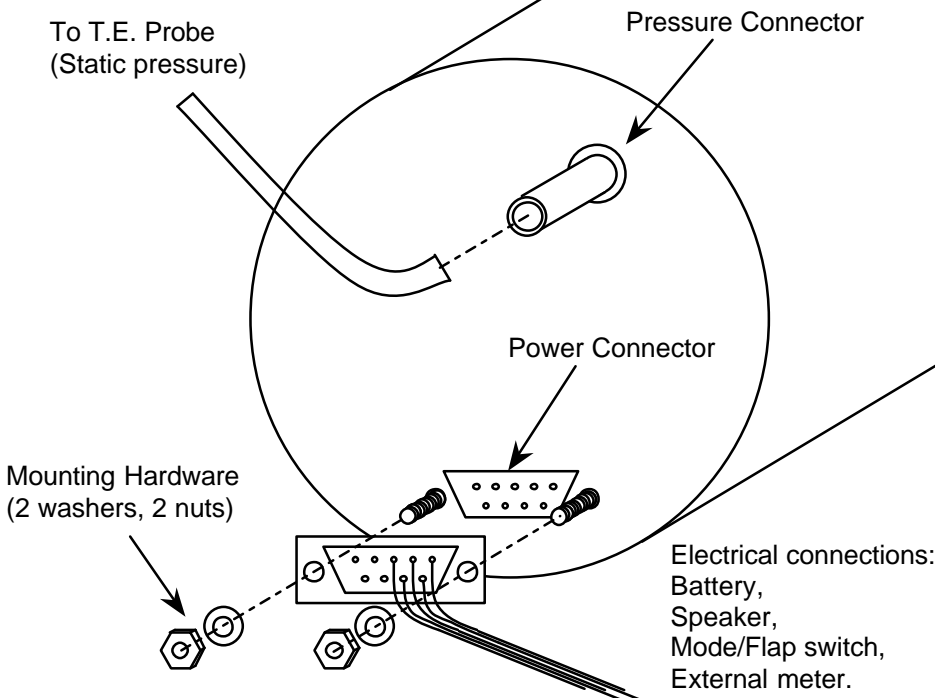
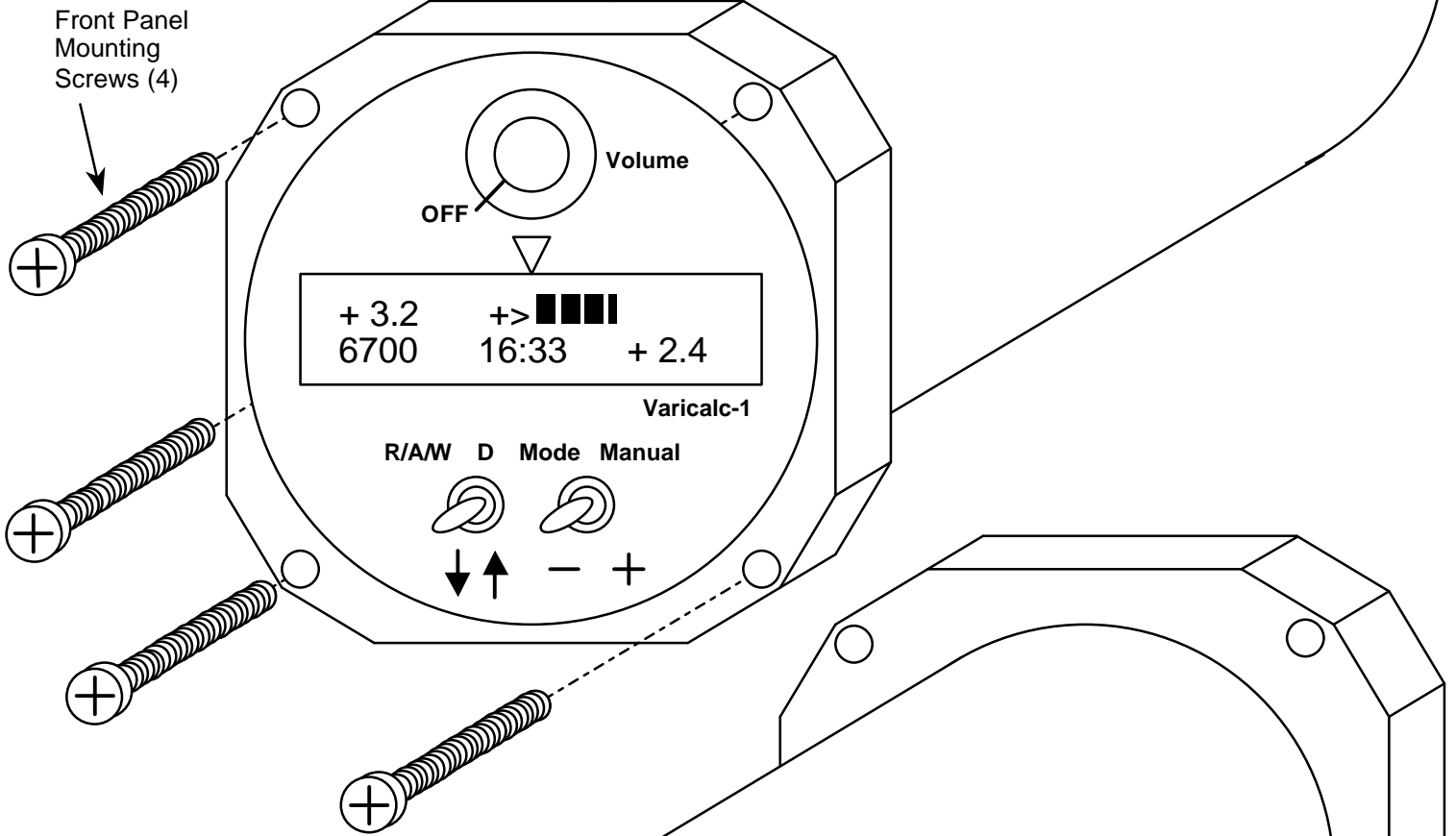
To protect against short-circuiting, any unused wires should be adequately insulated.

### ***Power-up***

Turn on the power (clockwise on the volume control) to the Varicalc-1; the front panel LCD display should turn on and indicate "Varicalc-1" on the top line and the sailplane polar on the second line. After about 4 seconds, the Varicalc-1 will start to operate and will display a bar-graph on the top line and altitude/time/etc. on the bottom line. The Variometer reading will take a few seconds to warm-up and stabilize at zero. If the Varicalc-1 doesn't operate as indicated above, turn it off immediately and check your wiring!! Refer to figure 14.

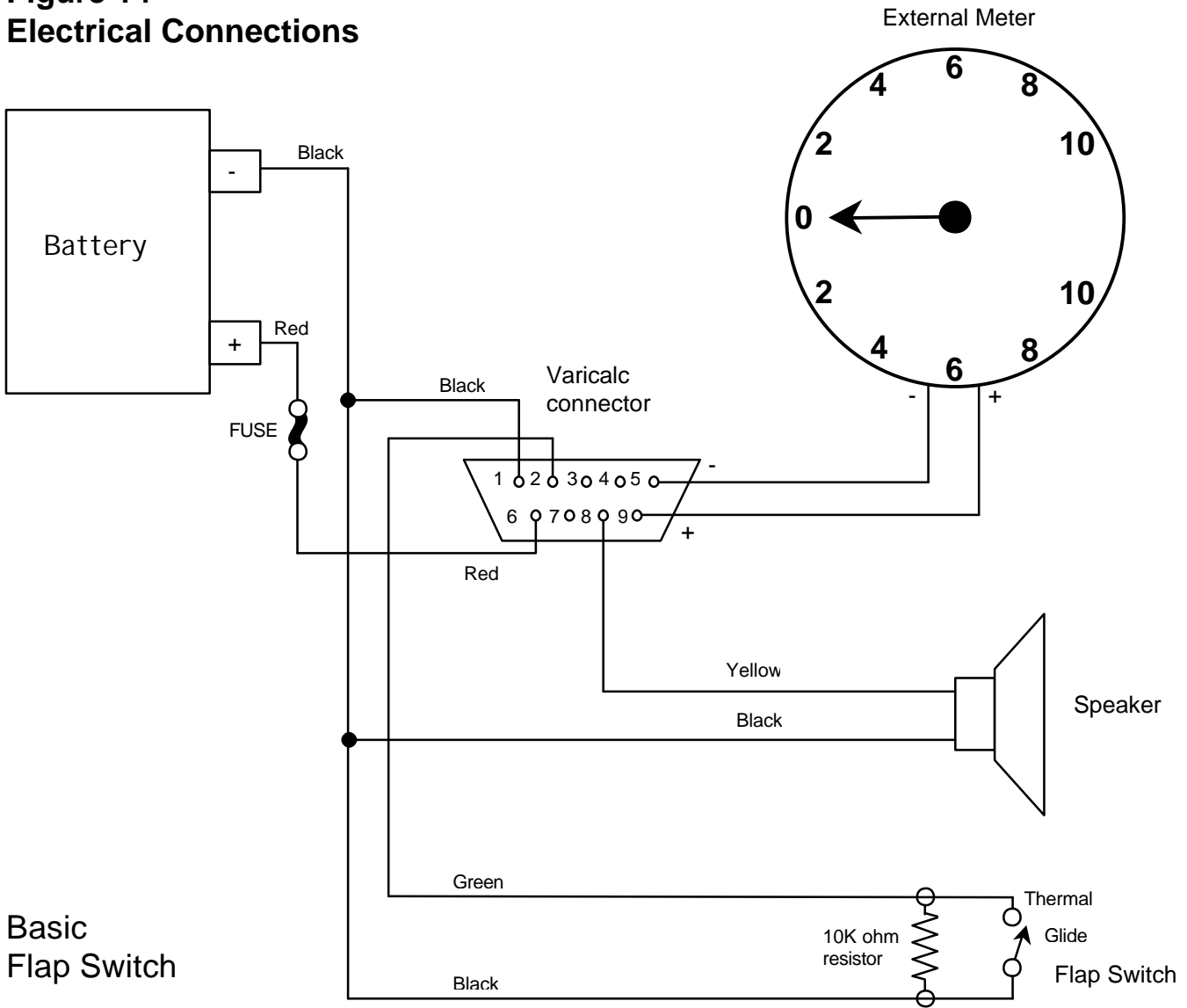
NOTE: the case of the Varicalc-1 is GROUNDED to the negative side of the battery.

**Figure 12  
Panel Mounting**



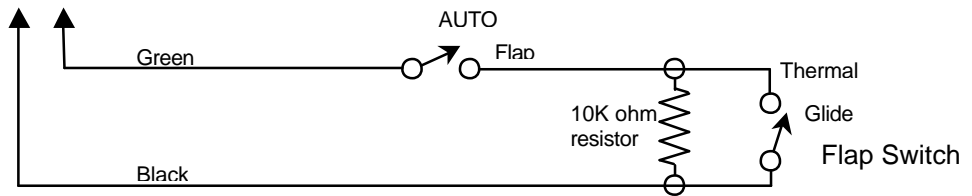
**Figure 13  
Connections**

**Figure 14**  
**Electrical Connections**

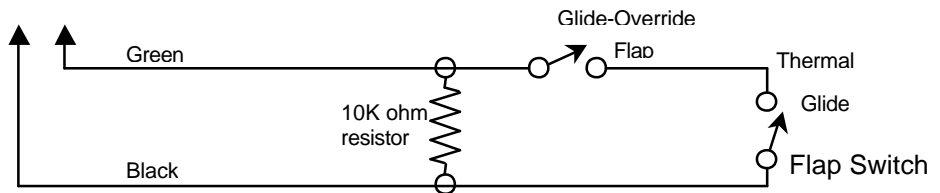


Basic  
Flap Switch

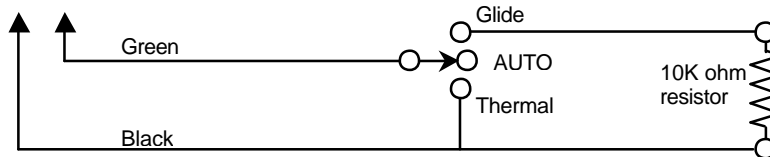
OR:  
Flap Switch  
With AUTO  
Selection



OR:  
Flap Switch  
With GLIDE  
Override



OR:  
Mode Switch



## Chapter VIII - Trouble-Shooting

The following table is provided as a guide to find faults in the installation of the Varicalc-1:

PROBLEM	CHECK
1. No display on front panel	<ul style="list-style-type: none"> <li>- Battery Polarity</li> <li>- Fuse blown</li> <li>- Broken wires</li> <li>- Loose connector</li> </ul>
2. No audio	<ul style="list-style-type: none"> <li>- Audio thresholds set too high</li> <li>- Bad speaker connection</li> </ul>
3. No variometer reading or erratic readings	<ul style="list-style-type: none"> <li>- Bad T.E probe connection</li> <li>- Low battery</li> </ul>
4. Display not changing or scrambled	<ul style="list-style-type: none"> <li>- Low battery</li> <li>- Computer reset (turn off then on again)</li> </ul>
5. Altitude indicates '----'	<ul style="list-style-type: none"> <li>- High pressure; adjust altimeter setting</li> </ul>
6. Flap Switch doesn't operate	<ul style="list-style-type: none"> <li>- Bad connection/switch; refer to figure 13</li> </ul>
7. Variometer & audio erratic when radio transmitter keyed	<ul style="list-style-type: none"> <li>- Low/weak battery; voltage drops too low</li> </ul>
8. Display not changing or scrambled after radio transmitter is keyed	<ul style="list-style-type: none"> <li>- Low/weak battery; voltage drops too low</li> </ul>
9. Very erratic variometer readings	<ul style="list-style-type: none"> <li>- Leaky connection somewhere in run to T.E. probe</li> </ul>
10. Under-reading variometer reading	<ul style="list-style-type: none"> <li>-Compressed or blocked tubing</li> </ul>

## Chapter IX - Technical Specifications

Power Requirements:	12 or 14 Volts 50 ma
Size:	3 1/4", 3 1/4", 8 1/2" Standard 3 1/8" panel mount
Weight:	20 oz.
Speaker Output:	4 to 100 ohms; 500 mW
External Meter Output:	+/- 100 micro-amps, 3 second damping, +/- 10 knots
Front Panel Display:	2 rows of 16 characters
Controls:	Volume control with on/off switch 2 mode selection switches (optional Mode/Flap switch)
<b>Limits:</b>	
Variometer Range:	+/- 12.8 Knots, (at sea level) 0.1 Knot resolution
Altitude:	-1,000 to 20,000 feet, 100 foot resolution
Distance:	0 to 100 Kilometres 1 Kilometre resolution
Wind component:	-30 Knots to +30 Knots 1 Knot resolution
Variometer Damping:	1 to 6 seconds 1 second increments
Averager Duration:	10 to 60 seconds 1 second increments
Ring-Setting	0 to 1- Knots 0.5 Knot resolution
Audio thresholds:	Lift - 0 to 8 knots 0.5 Knot resolution  Sink -0 to -8 Knots 0.5 Knot resolution