CONTENTS

Lee

INSTALLATION

A. GENERAL:

1. MOUNTING

The instrument mounts in a standard 3-1/8" diameter hole. Behind the panel the instrument is 3-1/4" square by 5-5/8" deep.

2. EXTERNAL SPEAKER (OPTIONAL)

If desired, an external audio speaker can be added for additional volume. This will only be required if the instrument is completely enclosed in a pedestal. See Figure 1 for detailed hook up information.

3. REMOTE METER (OPTIONAL)

The remote meter mounts in a rectangular panel cutout 3/4" x 2-9/16". Be sure to leave sufficient front panel space for the black trim bezel which is 1-1/4" x 3-1/16". The following steps detail the procedure for mounting the meter.

a. Lay out and cut panel opening;

b. Position bezel in opening;

c. Insert meter in bezel;

d. Slip aluminum bracket onto meter from the side and attach with the furnished 2-56 screws through the meter body. Use washers and nuts furnished;

e. Thread the #6 screws through the threaded bezel holes and tighten to clamp meter in place.

4. FLASKS (2 REQUIRED FOR TOTAL ENERGY MODELS)

Firmly mount the flask or flasks by means of the furnished straps or other secure method. It is important that they are not free to flop around in flight as this will cause erratic operation.

The system is calibrated for a 12" length of 1/8" I.D. tubing between flask and instrument (furnished). If this length is insufficient for your installation, keep the additional length to a minimum.

5. LEAKS

One of the principle causes of error in sailplane instrumentation is leaks. Assure that all connections in your system are tight. If it is desired to use 3/16" or 1/4" tubing with the RICO system, place a short length (1/2" or so) of 1/8" tubing on the brass fitting, then slip on the larger tubing. A short length of suitable tubing is shipped installed on models VA, VAC and VAS where direct connections to the brass fitting with larger tubing is likely. The nylon "T"s furnished with the models VAS and VACS will normally fit the larger tubing.

6. CAUTION

It is recommended that you re-swing your compass after installation of the RICO Variometer. Magnets in the meter and internal speaker can affect compass calibration.

7. REMOTE MODE CONTROL (OPTIONAL)

The cruise control option on models VAS and VACS may be activated either by "Cl-D-W" switch on the front panel or by a remotely located switch perhaps mounted to the flap linkage. The switch should be mounted and wired so as to close a circuit between pin D and the battery negative terminal when in the climb position.

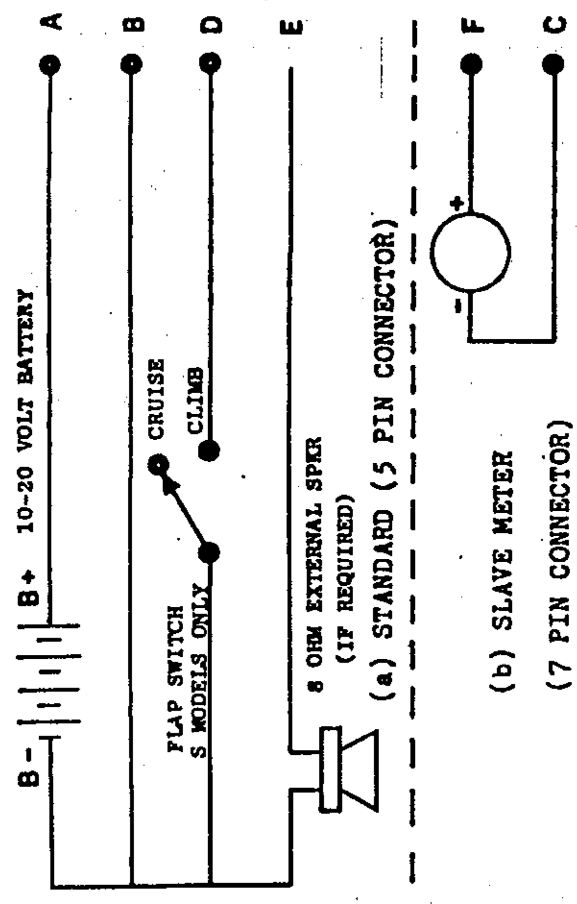
IF MOUNTED TO THE FLAP LINKAGE, CYCLE THE FLAPS THROUGH THEIR ENTIRE RANGE TO ASSURE THAT THE SWITCH INSTALLATION DOES NOT INTERFERE WITH FLAP OPERATION.

B. ELECTRICAL INSTALLATION PROCEDURE:

1. POWER SOURCE

The RICO variometer may be powered from any D.C. source ranging between 10 and 20 V.D.C. Best

Figure 1a, b



SAILPLANE WIRING FOR ALL RICO VARIOMETERS

results will be obtained with either a ni-cad or gel-cell type battery. Stranded 20 ga. wire should be used for the power circuit. Use caution in soldering the wires to the connector so as not to create shorts between pins. Do not use solid wire as it will workharden and eventually break.

2. POWER CONSUMPTION

Current required by various models at 12 V.D.C. is as follows:

Model V	(vario only)	20 ma.
Model VA	(vario & audio)	35 ma.
Model VAC	(vario, audio & compensator)	55 ma.
Model VAS	(vario, audio & cruise option)	55 ma.
Model VACS	(vario, audio, compensator & cruise option)	75 ma.

3. Figure 1a shows electrical connection details. Pin A of the furnished connector is connected to battery positive. Pin B is connected to battery negative. Pin D is not used unless a remote switch is desired for models with cruise option. Pin E is not used unless an external speaker is required. Pin C is never used.

4. REMOTE READOUT

Models designed to accommodate a remote display have a 7 pin connector rather than the standard 5 pins. The external meter should be connected between pins F and C (positive meter terminal to pin F). If the remote meter is not to be used, a jumper must be connected between pins F & C. (See Figure 1b.)

C. GENERAL HINTS - SOLDERING

1. Strip the wires 3/16" and tightly twist the strands.

2. Use a small iron (25-35 Watts) and rosin core solder.

3. Tin the wire by melting a small amount of solder onto the stripped end.

4. Disassemble the connector and thread all wires through the metal and plastic hoods. Note the order so the connector can be assembled after the wires are installed.

5. Hold the nut shaped connector body in a vise or perhaps slip it on the mating half on the variometer. Do not have your wife hold it in her fingers unless you are extremely stable both with a soldering iron and in your marriage.

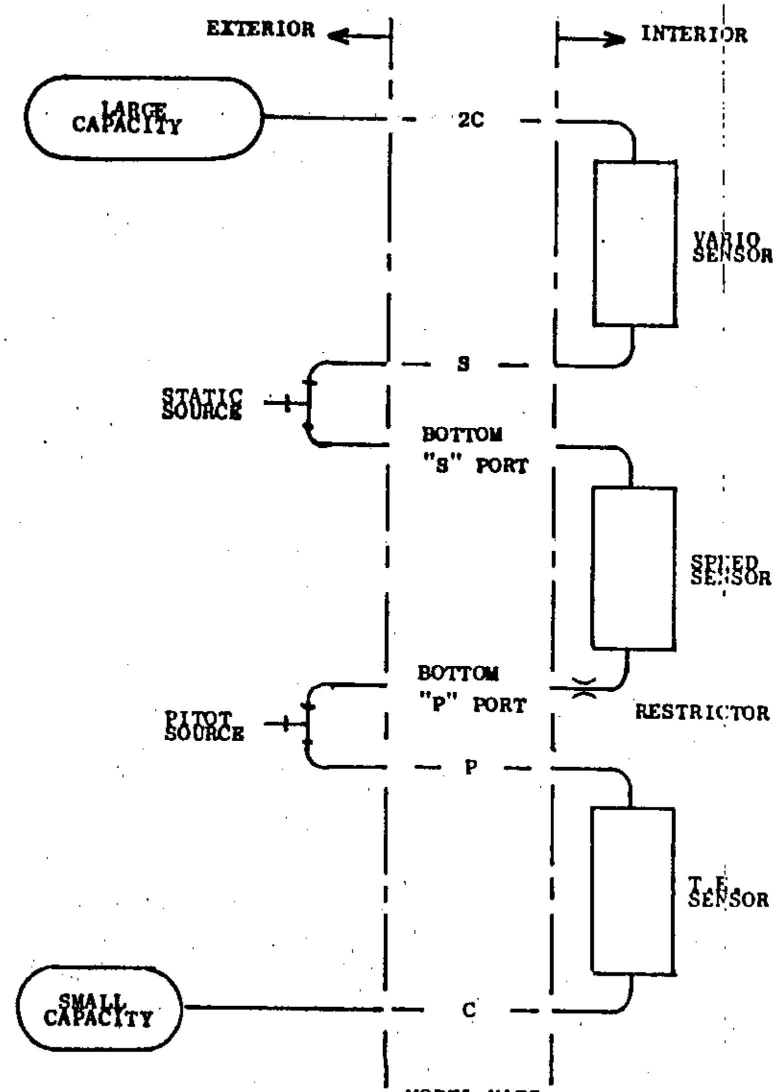
6. Tin each of the solder cups to be used. Fill them approximately half full with solder. Slip a short (3/8" to 1/2") length of sleeving onto each wire. Slide them well up the wire so that they do not interfere with your soldering.

7. Starting at the most central pin to be used, remelt the solder in the cup. Then insert the appropriate wire while continuing to apply heat. When the solder on the tip of the wire melts, remove the heat and allow the solder to cool while being careful not to move the wire. If the wire moves, a "cold" solder joint may be formed. This is indicated by a dull crystaline appearance rather than a bright shiny surface. If one forms, all is not lost, simply reheat the joint and let it cool again.

8. When all wires are installed, inspect to be sure no shorts have occurred.

9. Slide the short sleeving lengths down over the solder connections. If you feel brave, shrink each one in place by heating with the soldering iron side or a heat gun if you have one. Be careful not to melt the connector or the wire insulation. The sleeving will work just fine without being shrunk.

Figure 2



MODEL VACS
BACK PANEL CONNECTIONS

10. Slide the hood and backshell into place and screw the assembly together. Tighten the metal strain relief screws so that the inside connections are protected from pulls and tugs.

PNEUMATIC INSTALLATION PROCEDURE (See Figure 2)

1. A GENERAL NOTE ABOUT STATICS

Modern sailplanes are often equipped with more than one static system. In general, each is a compromise with its own shortcomings or errors. For electronic total energy, the magnitude of the error is unimportant provided that it is constant over the normal speed range. Contrary to popular thinking, nose statics such as those of the ASW-20 may be quite good for this purpose. Static ports located under or immediately aft of the wing such as those of the Standard Cirrus are normally poor. If good total energy compensation is not obtained with one system, try the alternates. Providing there are no kinks or restrictions in the line, any number of instruments may be tied to the same static source.

2. MODELS V & VA

Connect the sailplane static system to the port marked "S". The flask should be connected to the port marked "2C" by means of the furnished 12" length of 1/8" I.D. Tygon tubing. A longer length may be substituted if necessary. However, additional length should be minimized to avoid introducing a calibration error. To maintain calibration, use only the flask provided.

If a total energy probe is to be used, it should be connected to the static "S" port.

Standard diaphragm total energy compensators designed to work with 1 pt. flasks cannot be used with the RICO vario because of the small flask.

3. MODEL VAC

Two flasks are provided for the model VAC. Connect the smaller flask to the port marked "C" and the larger to the port marked "2C".

The port marked "S" should be connected to the static system and the remaining port marked "P" to the pitot system. Additional tubing between flask and instrument should be kept to a minimum to preserve calibration.

WITH ELECTRONIC COMPENSATION, OTHER FORMS OF COMPENSATION SUCH AS DIAPHRAGMS AND PROBES SHOULD NOT BE USED. THEY WON'T WORK!!!

4. MODEL VAS

One flask is provided for the model VAS. Connect it to the port marked "2C". Note that there are two "S" ports and one "P" port. If a venturi type total energy probe is used, remove the supplied "T" connecting the "S" ports together. Connect the probe to the upper "S" port. Connect the conventional static system to the remaining "S" port. Connect the pitot system to the "P" port. The "T" will not be used in this installation.

If total energy is not used, connect the static system to the two "S" ports using the furnished "T".

5. MODEL VACS

Two flasks are provided for the model VACS. Connect the smaller flask to the port marked "C" and the larger flask to the port marked "2C". Note that there are two "S" ports and two "P" ports on the instrument. Connect the two "S" ports to the static system by means of the furnished "T" connector. Connect the two "P" ports to the pitot system in a similar manner.

To preserve calibration, additional flask tubing should be kept to a minimum.

WITH ELECTRONIC COMPENSATION, OTHER FORMS OF COMPENSATION SUCH AS DIAPHRAGMS AND PROBES SHOULD NOT BE USED. THEY WON'T WORK!!!

OPERATION

1. GENERAL COMMENTS:

1. POWER AND RANGE SWITCH

Power on-off and meter range selection are combined in a single 3-position switch. The Audio range is independent of meter range selection. It will function up to 18 knots on either range.

2. AUDIO

For many pilots, the audio presentation is far more important than the meter display. Both the obvious safety feature of being able to look outside the cockpit and the ease of thermaling with a good audio are real advantages. If one cares to learn the sound for 1, 5 or 10 kts of lift, he can read the instrument that way. However, most of us choose to use the audio for trend information only, i.e., is the climb rate increasing or decreasing when thermaling? One soon trains himself to tighten up the turn as the audio pitch increases and to roll out a bit as it drops off (providing you belong to that school for centering thermals).

The audio has two concentric threshold controls, the front control for lift and the back control for sink. The scale on the panel is marked in 2 knot increments. Setting the back control at the second mark, C.C.W. from Zero, will result in the sink indicator beginning to come on at approximately 4 knots sink. In a similar manner, setting the front control at the second mark clockwise from Zero will result in the lift indication coming on at 4 knot climb. Each threshold control has a range of 10 knots.

3. ELECTRONIC TOTAL ENERGY COMPENSATION

The object of Total Energy (T.E.) is to remove the effects of airspeed changes on the vario display. What remains is the lift or sink that would be seen if you were actually holding a constant air speed.

The Rico Electronic T.E. compensator makes use of a separate air flow sensor and reference flask connected to the pitot. This is essentially a second variometer which measures the rate of change of kinetic energy. Signals from the compensator sensor and from the vario sensor are combined electronically to cancel the affect of kinetic energy changes. The compensator is adjusted once for the sailplane by doing a series of zoomies some early stable morning and it is left alone from then on. The procedure is described in the adjustment section.

4. CRUISE OPTIONS

The Cruise Option has two basic modes: CLIMB and CRUISE. In either mode the Audio is a separate but complementary method of presenting the pilot with information.

Modes are selected by a 3-position toggle switch located on the lower-left side of the panel. When the switch is in the "CL" position, the CLIMB mode is selected and the system operates as a normal variometer. When the switch is in the "D" or "W" position, the CRUISE mode is operational with either the dry or wet polar selected.

The CRUISE mode has two sub modes: NETTO and SPEED DIRECTOR. Each of these sub modes require information about the polar to operate, i.e., is the sailplane dry or wet? NETTO is selected by rotating the lower-left hand control into the "N" detent. The polar information is selected by the "D" or "W" switch position. In this mode, the instrument measures the air speed then, by means of the polar, arrives at a rate of sink which it adds to the variometer reading in order to display what the air outside is doing. For example: If you are gliding at 80 kts through air which is sinking at 2 kts and according to your polar, your rate of sink for this speed in still air is 4 kts; in the CLIMB mode the meter will indicate 6 kts of sink and in the CRUISE-NETTO mode will indicate 2 kts of sink. Note that this is dependent upon the accuracy of the polar programmed into the instrument.

This is why we give you the option of two polars (wet or dry), and the capability to trim each, in flight, to fit your individual sailplane.

The second CRUISE mode is a method of presenting MAC CREADY SPEED TO FLY information. This is selected by rotating the control out of the "N" (NETTO) detent and setting in the anticipated climb rate for the next climb (remember to include time spent searching for and centering lift in predicting this rate). In this mode, the instrument computes the best speed to fly from the measured air speed information, the selected wet or dry polar and the pilots guess as to the next climb rate. The result is presented in the following manner: If you are going too slow, the meter will indicate down (sink) and if you are going too fast, the meter will indicate up (lift). If the speed is proper, a zero reading is obtained. You can switch between CLIMB or the selected CRUISE mode at any time either by the front panel toggle or an external flap switch. (See Figure 1.)

A few words of caution may be in order. The speed to fly presentation is just another form of the old speed ring, an easier to follow presentation! Unfortunately, it's so easy to follow that it tends to dominate common sense. It should be ignored to the same degree that we have been ignoring the speed ring. The whole thing is no better than our guess at the strength of the next thermal and our faith that lift will be encountered before the ground.

What's more, the speed to fly presentation is not a substitute for an air speed indicator. It will often tell you to slow down below stalling speed which simply means you should be thermaling instead of cruising. It can also tell you to fly faster than redline in strong sink and that should obviously be ignored.

GETTING TO KNOW THE INSTRUMENT ON THE GROUND:

1. BASELINE SETTINGS

To establish a baseline, set the controls as follows:

Power/Range Switch - off

Volume - 12 o'clock

Threshold - Both controls to zero

R/C Control - NETTO (counter-clockwise detent)

CL/D/W Switch - CL (CLIMB mode)

2. TURN ON

Turn instrument on and select the 5 kt (500 FPM) range. The instrument needle should deflect momentarily and return to zero. Selecting X2 or X3 as applicable changes the range of the meter but does not affect the audio.

If the meter doesn't return to zero, check that you have really performed Step 1. If you are in the CLIMB mode and it doesn't zero, see the adjustment section.

When your sailplane is pulled out of the box into warm sunlight, the cockpit and instruments gradually change temperature. This means that vario reference flasks gradually heat up. Since they are well insulated, this can take up to an hour, depending on the particular installation. As the flasks warm, a small air flow is forced out through the vario and any sensitive vario will show a slight offset -- don't rezero these little shifts every morning -- just be patient and they will go away. True instrument zero can only be determined by plugging the instrument ports or by sealing both the pitot and static ports of the sailplane. Remember to unseal them before flying.

3. AUDIO THRESHOLDS

The audio has two concentric threshold controls, the front is for lift and the rear is for sink. The panel is marked in 2 knot increments. Setting the sink control at the second mark below zero will result in the audio sink indication beginning to come on at 4 knots sink. The lift control functions similarily. This allows you to set the lift and sink thresholds to be contiguous, to have a dead band between sounds for cruising, or to set the sink threshold as a sink alarm at 10 knots down whichever is desired. The settings are repeatable so they may be changed and restored in flight.

4. TRIM ADJUSTMENTS

Operation of the five screwdriver adjustments is seldom required and is discussed in the adjustment section.

5. CRUISE MODE CONTROLS

The remaining two controls are for the CRUISE mode. Position the switch to "D" or "W". (Dry or Wet polar selection). The meter should remain at zero. If it does not, check to be sure you are still in NETTO detent. If it still doesn't zero, see the adjustment section.

Rotate the R/C control clockwise out of the detent slightly. The meter should now indicate between 2 to 4 knots sink (the exact amount is a function of sailplane type). Note this amount. It should not change over the life of the instrument. Rotation of the control further clockwise will produce additional indication of sink by the amount of rotation. For example, if the meter reads 3 knots sink at the CCW end, it will read 9 knots sink at the clockwise end. This is a good opportunity to experiment with the sink threshold control on the audio.

NOW IT'S TIME TO FLY IT:

1. INITIAL FLIGHT

Prior to take off, select "CL", set the "TR" control for an audio output and adjust the volume control to suit. Then set the "TR" controls at zero (9 o'clock).

With "CL" selection, the CRUISE functions are disabled so the position of the R/C control does not matter.

2. AFTER RELEASE FROM TOW

Fly around a bit, find a thermal and climb. Get the feel of the response when entering and leaving a thermal. After familiarity is obtained, leave the thermal and select NETTO mode (control in detent, wet or dry polar selected as applicable). Here you may encounter some conflict between the instrument reading and your "model" of what the air is doing. Unfortunately, it will take a glide in stable air to find out which is correct.

After you are comfortable with this mode, rotate the control out of the "N" detent and adjust airspeed as indicated by the meter, speeding up for sink, slowing down for lift. With the control set at zero, you should have to fly at your max L/D speed in still air to get a zero reading. As you input higher climb rates in the R/C control, the instrument will demand a higher airspeed per the MacCready function. You may find it convenient to set a dead band on the audio as was mentioned earlier.

If the polar set into the instrument is too optimistic for your sailplane, you probably will be unable to fly fast enough to bring the meter to zero. In that case, see the adjustment section.

ADJUSTMENTS

A. GROUND ADJUSTMENTS:

1. ZERO ADJUSTMENTS

There are two zero adjustments on the basic Variometer and a third for instruments with the cruise option. A mechanical Zero control in the form of a lever on the right-hand side of the meter movement is provided.

a. With power off, position the mechanical lever so that the meter needle indicates Zero rate of climb.

b. Assure battery voltage is above 10 volts. A low battery will cause the meter to drift off scale.

c. Turn the instrument on and select CLIMB mode, 5 knot scale, and position "0" on the meter time constant switch (located thru cover on top of instrument).

d. Temporarily cap the sailplane pitot and static ports; a piece of tape works fine.

e. Adjust the "VZ" control for a zero indication on the meter. There will be a slight time lag due to the 1.5 sec. time constant of the instrument. This is a multi-turn potentiometer.

Caution:

Large adjustments of the Zero control should not be required. If a major Zero shift is experienced, check for another problem. Two most likely are low battery voltage and for the Cruise Option Models, the instrument may be switched to CRUISE mode.

f. Select NETTO mode (R/C control in detent) either "D" or "W" selected.

g. Adjust the NETTO Zero Control "NZ" for zero indication on the meter. This is a multi-turn potentiometer.

h. Zero adjustment is complete, return the meter time constant switch to the chosen position and remove the plugs or tape from the pitot and static ports.

2. METER TIME CONSTANT

As delivered, both the meter and the audio have a nominal time constant of 1.5 sec. The meter time constant may be increased up to 30 seconds, where it will serve as an averager, by resetting the internal switch, accessible through the top cover. The nominal time constant (time required to indicate 63% of a step input) for each position is as follows:

Switch Position	Time Constant
0	1.5 Sec.
1	2.6 Sec.
2	5 Sec.
3	7 Sec.
4	20 Sec.
5	22 Sec.
6	26 Sec.
7	30 Sec.
8	Uncalibrated
9	Uncalibrated

The longer time constants allow the instrument to be used as an averager, since the audio remains functional at the fast rate.

Experimenting with the various positions will determine which is best for you.

FLIGHT ADJUSTMENTS:

1. POLAR ADJUSTMENT

a. The same polar information is used for both NETTO and SPEED DIRECTOR. Therefore, all polar adjustments are accomplished with the instrument in the NETTO cruise mode.

b. Ballast the sailplane to the desired wet wing loading, then take a high tow in stable air. Early morning, before convection, works best. Select the NETTO Mode (R/C Control in detent), the wet polar "W", and set up a steady 85 kt glide. Adjust the "NW" control until the meter indicates "zero". Clockwise rotation will move the needle in a positive direction. This is a multi-turn potentiometer.

c. Dump the ballast and select the dry polar "D" position. Set up a 65 kt glide and adjust the "ND" control until the meter indicates "zero". Be careful not to disturb the wet control. Unless you know how to get that water back, it will cost you another tow! The "ND" control is a multi-turn potentiometer.

2. TOTAL ENERGY ADJUSTMENT

Compensation provided by the total energy compensator is adjusted by means of the small screwdriver adjustment in the upper-left hand quadrant of the face plate marked "TE". The instrument is calibrated at the factory with this adjustment set to mid range. (Slot Horizontal). Small adjustments may be necessary to compensate for static system errors in individual sailplanes. The "TE" control is a single-turn potentiometer.

No adjustments should be made until after several flights under varying conditions, including stable air, confirm that adjustment is required.

A correctly compensated variometer will generally not read Zero during a pull up. Instead, in calm air, it will track the sailplane polar by reading the rate of sink appropriate for each airspeed. If, during a pull up, the instrument reads higher than the polar (maybe even lift) it is under compensated. Compensation is increased by a clockwise rotation of the control. Conversely, if the indicated sink is greater than the polar, the instrument is over compensated and the control should be rotated counter-clockwise.

If an abrupt pull up or push over is performed, then the variometer will indicate a transient (downward with a pull up, upward with a push over) at the beginning and end of each zoomie. This is caused by the inefficiency of the maneuver, i.e., energy is lost. When making adjustments of the total energy, attempt to repeat the zoomie maneuver between the same airspeed limits and with the same degree of pitch up. Grease pencil marks on the canopy may help to mark the horizon during the pull up. This will help in judging whether more or less compensation is required. Then only make small adjustments with zoomies in between to verify results.

IT IS VIRTUALLY IMPOSSIBLE TO ADJUST A TOTAL ENERGY SYSTEM UNDER SOARING CONDITIONS. IF ADJUSTMENT IS REQUIRED, IT SHOULD BE PERFORMED DURING A SMOOTH GLIDE FROM A HIGH TOW SOME EARLY STABLE MORNING.

A properly adjusted NETTO will facilitate the following steps. If your instrument has this option, select it before performing the following steps:

a. Practice zoomies a few times until you can perform a repeatable maneuver. Each maneuver should span the same range of airspeed and pitch up the same angle.

b.1. INSTRUMENTS WITH NETTO MODE

Note the deflection of the meter during the middle portion of the pull up. If sink is indicated, reduce compensation by rotating the "TE" control C.C.W. slightly and repeating the maneuver. If lift is indicated, rotate the control clockwise. This control is rather sensitive so make small (5°) adjustments with each trial.

b.2. INSTRUMENTS WITHOUT NETTO

Before the flight, study the polar for your sailplane and note the rates of sink for various airspeeds. In flight, do a pull up, and note how the variometer needle tracks the polar. If it indicates a larger sink rate than the polar for the appropriate airspeeds, reduce the compensation by rotating the "TE" control C.C.W. slightly. If less sink or lift is indicated, increase the compensation by a clockwise rotation of the control. The control is rather sensitive so make small (5°) adjustments with each trial.

c. If you wish to start over, return the control to its original position - screwdriver slot horizontal.

TROUBLE SHOOTING

Problem: Meter reads off scale on ground.

Possible Cause: Battery low providing insufficient voltage to instrument.

Problem: Radio can be heard in vario speaker during transmissions.

Possible Cause: Battery wires too small, aging battery or nearly discharged battery - causing voice modulation of battery voltage.

Problem: Reads up all the time in flight

Possible Cause:

1. Zero adjustment off - see calibration section;
2. Leak in "C" bottle or associated tubing;
3. If venturi is used, leak in 2C bottle or associated tubing.

Problem: Total Energy badly off - cannot be adjusted.

Possible Cause:

1. Kink or other blockage in tubing to one of the bottles or the pitot or static lines;
2. Bad static ports. Blocked or disconnected tubing preventing a free flow of air to equalize pressures.

If you are unable to adjust the instrument to obtain adequate Total Energy, the following test will allow you to test the instrument on the ground. It is similar to the method used at the factory to initially set the instrument. It assumes perfect static and pitot systems.

Replumb the instrument as shown in Figure 3. A syringe provides a convenient method of pressurizing the system. It can be done by mouth with some risk to the airspeed indicator.

Select CLIMB mode and pressurize the system until approx. 85 knots is indicated on the airspeed. Adjust the T.E. control for a Zero meter indication. If unable to Zero, something is amiss and the manufacturer should be contacted.

Reconnect the plumbing per the pneumatic installation instructions. (See Figure 2.)

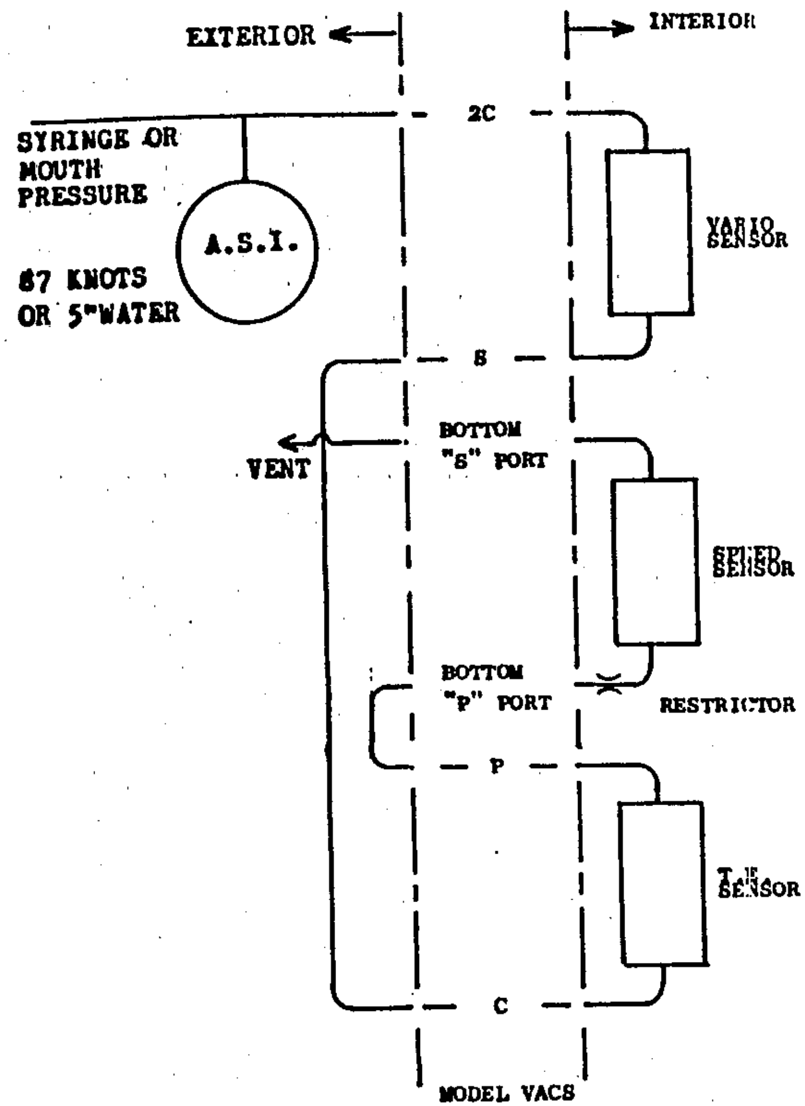
Problem: Doesn't agree with mechanical vario.

Possible Cause: Response of RICO is faster than the pilot is used to. Slow the display down per the adjustment section if desired. You may lose valuable information about the thermal shape.

CAUTION:

External restrictors will interfere with the Total Energy compensation. They should not be used to slow the response of models with Electronic Total Energy.

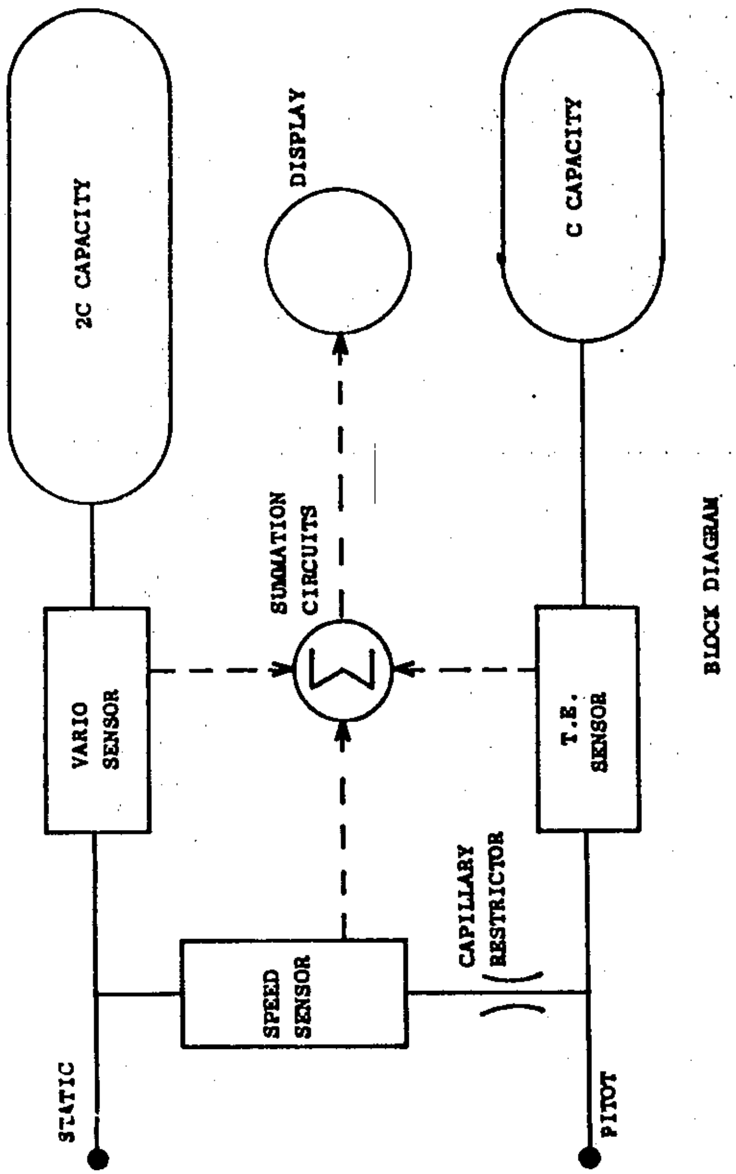
Figure 3



Note the restrictor in the speed director will limit the air flow to a value in the range where the compensator works.

COMPENSATOR TEST PLUMBING

Figure 4



HOW IT WORKS

BASIC VARIOMETER:

The RICO variometer system consists of one, two or three airflow sensors, depending upon the model and arranged as in Figure 4. It is based upon the principle that air will flow from an area of high pressure to one of lower pressure. In the simplest form of variometer, one flow sensor is used to measure the flow into or out of a capacity (bottle) as it is lowered or raised. Flow is caused by the differing pressure at the new altitude. If the sailplane's static system is used as a pressure source, then the measured flow will provide an indication of the rate of change of altitude.

TOTAL ENERGY:

Of course, the altitude of the sailplane may vary for two reasons: it may have changed velocity or it may have encountered a rising or falling airmass. The pilot is normally primarily interested in the latter. All the various Total Energy systems are directed toward removing the influence of changing airspeed from the variometer reading. Pneumatic compensation methods (probes and diaphragms) attempt to adjust the pressure to compensate for changing airspeed. These systems can work quite well but have their disadvantages. Diaphragms are altitude sensitive and probes are subject to position and geometry errors. Protruding from the sailplane, they are easily damaged.

If a second capacity (bottle) is connected to the pitot system, it will see total pressure i.e., static pressure plus the dynamic or airspeed pressure. This total pressure then provides a flow which can be used to correct for airspeed variations. A fortunate result of the law of conservation of energy is that the pressure in the pitot system will vary with airspeed at exactly twice the rate as that in the static system. Therefore, during a pull up, if a bottle of one-half the volume as that in the static system is used, we will measure a flow rate equal to that in the variometer. It becomes a relatively simple matter to electronically subtract the two signals. This basically is how the RICO Electronic Total Energy works.

There is, however, no such thing as a free lunch. This system also has its disadvantages. Large airspeed changes like those encountered while transitioning from high speed to thermaling speeds result in large signals being subtracted. A small percentage error in one or the other can manifest itself as a rather dramatic error in Total Energy compensation. Unfortunately, the static errors encountered in some sailplane systems are sufficient to cause such problems. By providing a gain control, fixed errors can be adjusted out, but if the static error varies significantly with airspeed, the problem becomes more complex. While theoretically possible, it would require a rather expensive correction scheme. It is more practical to select a different static system, perhaps even a probe.

Experience has shown that underwing statics such as those on the Standard Cirrus and Mosquito are poor for the purposes of electronic Total Energy compensation. On most sailplanes, the tail statics provide the best source. However, in some cases, the ASW-20 in particular, better results are obtained with the nose static system. Here, although there is an error, it is constant over the speed range. This is easily compensatable by the adjustable gain control.

CRUISE:

The pitot pressure can also be used to derive a signal approximating the polar of the sailplane. This is accomplished by installing a capillary leak between the pitot and static systems with a flow meter to measure the resulting flow. By electronically adjusting this signal and adding it to the variometer signal, the "NETTO" is obtained. Further

manipulation results in a means for calculating and displaying the Mc Cready function in a rather convenient form. This is accomplished by changing the gain and adding a fixed offset for the polar and a variable offset corresponding to anticipated thermal strength. If the sum of all the input signals is positive, the meter will read up indicating the airspeed is too high. Conversely, if the sum is negative, the airspeed is too low. An increase in airspeed will bring the meter to Zero. This is the manner in which the cruise director option operates.

We hope this manual answers any questions which might arise relative to the installation, operation and adjustment of your variometer system. If you discover any omissions or errors, we would appreciate hearing about them.

Thank you,

RICO