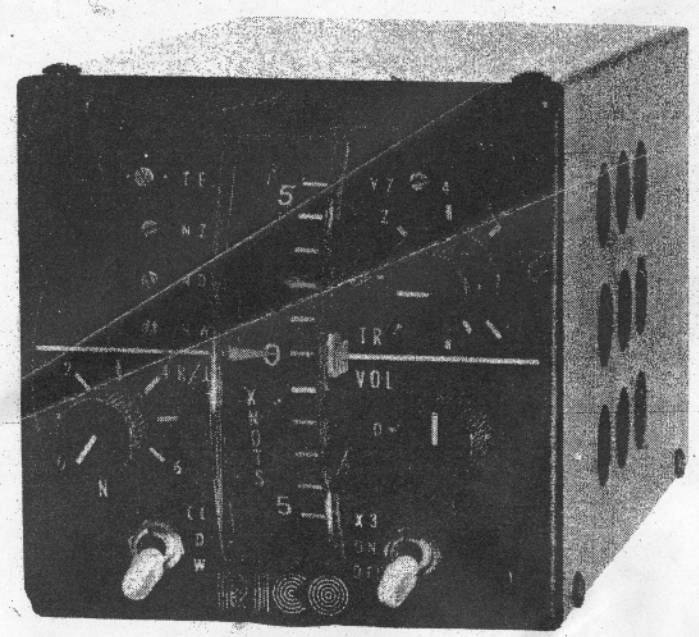
INSTALLATION AND OPERATION



RICO
Variometer Systems

THIS MANUAL APPLIES TO ALL MODELS OF RICO VARIOMETERS. DISREGARD THOSE PORTIONS NOT APPLICABLE TO YOUR MODEL.

WARRANTY

RICO VARIOMETERS ARE GUARANTEED AGAINST DEFECTS FOR TWO YEARS FROM DATE OF ORIGINAL PURCHASE, WHEN USED IN SAILPLANES ONLY. THE WARRANTY IS LIMITED TO PARTS AND LABOR, AND THE UNIT MUST BE RETURNED TO THE FACTORY. THE WARRANTY IS VOID IF THE EQUIPMENT IS MISUSED, OR IF REPAIRS ARE PERFORMED BY UNAUTHORIZED PERSONS.

REDWOOD INSTRUMENT COMPANY
368 Rutherford Avenue
Redwood City, California
94061

CONTENTS

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

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. TUBING LENGTH

The system is calibrated for a 12" length of 1/8" I.D. Tygon tubing between flask and instrument (furnished). If this length is insufficient for your installation, keep the additional length to a minimum. Firmly secure the flask out of direct sunlight. To maintain calibration, use only the flask provided.

4. 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.

5. 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.

6. MODEL VACS

The flap switch provides an alternate method for switching between CLIMB and CRUISE modes. A micro switch should be mounted so that the flap linkage closes a circuit between pin D and the battery negative terminal when in the CLIMB position.

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. A low battery will cause the meter to indicate off scale.

2. POWER CONSUMPTION

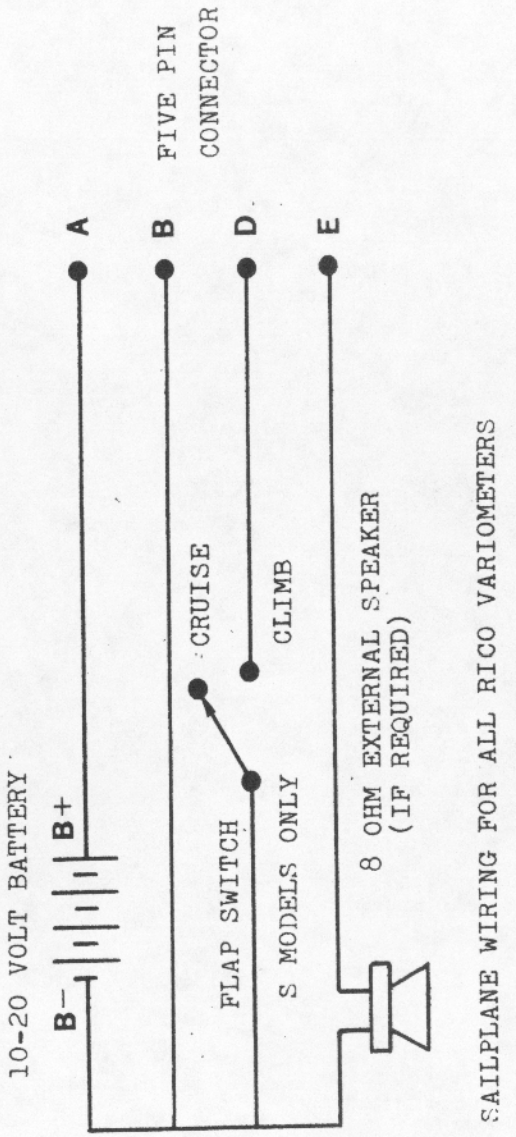
Current required by various models at 12 V.D.C. is as follows:

Model V (vario only)----------20 ma.

Model VA (vario & audio)--------35 ma.

Model VAC (vario, audio & compensator)----------55 ma.

Model VACS (vario, audio, compensator and electronic NETTO and speed to fly option)----------75 ma.



SAILPLANE WIRING FOR ALL RICO VARIOMETERS

FIGURE 1

3. Figure 1 shows electrical correction details. Pin A of the furnished connector is connected to battery position. Pin B is connected to battery negative. Pin D is not used unless a remote switch is desired for the model VACS. Pin E is not used unless an external speaker is required.

PNEUMATIC INSTALLATION PROCEDURE:

1. 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.

2. 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!!!

3. 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

A. GENERAL COMMENTS:

1. POWER AND RANGE SWITCH

Power on-off and meter range selection are combined in a single 3-position switch. The 18 knot Audio range is independent of meter range selection.

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. MODEL VAC - 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 effect 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.

4. MODEL VACS

The Model VACS instrument 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, preset into the instrument, 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 thru 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 an external flap switch or the front panel toggle.

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.

B. 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 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.

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 read 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.

C. 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). As you accelerate on tow (gaining kinetic energy) the total energy compensation signal will cause a down scale reading which will decrease then become positive as flying speed is obtained and the ship begins to climb. As mentioned earlier, with "C" selected, 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 Mac Cready 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.

g. Adjust the NETTO Zero Control "NZ" for zero indication on the meter.

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.

B. 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) and 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.

c. Dump the ballast and select the dry polar, "D" position. 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!

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. Small adjustments may be necessary to compensate for static system errors in individual sailplanes.

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