Hardware & Software Development

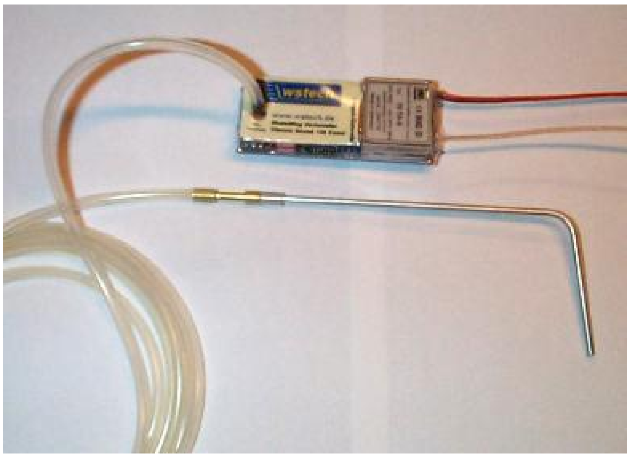
Wolfgang Schreiner Dipl.Ing.(FH)
Rüttlenäckerstr.6
88094 Oberteuringen

web: www.wstech.de

wstech TEK Probe User Manual

Advantages and Disadvantages of Fitting a TEK Probe

With a Total Energy probe (TEK) fitted the variometer senses the vertical movement of the airmass, rather than the vertical movement of the model. The TEK does this by sensing the model's speed, and adjusting the pressure into the variometer appropriately. With a perfect TEK you could dive a model and loop it, and the vario's tone wouldn't change - as long as you didn't fly into lift or sink. Conversely, you could trim a model to high speed to escape an area of sink, and the TEK-fitted vario would continue to sense the vertical speed of the airmass only, without being confused by the higher than normal sink rate of the speeding model. Thus as soon as you had escaped the sink the vario would return to the normal tone - without the TEK you would have to slow the model up before you could rely on the vario's signal.



CS139 vario connected to the TEK probe

The downside of TEK compensation is that fitting the TEK probe and plumbing it into the variometer is not particularly easy. As the TEK probe compensates for airspeed changes in the model the benefit of fitting one is greatly reduced in slow speed models and models with small speed ranges. Also because fitting the TEK probe adds weight behind the model's centre of gravity, it may not be worthwhile for very lightweight models.

The shape and fitting of a TEK probe is a bit of a black art, and the compensation of even the best probes isn't quite perfect, so don't expect all speed induced height changes to be filtered out. This is true even for full size gliders, where it is much easier to evaluate the accuracy of the total energy compensation, and make fine adjustments.

What is a Total Energy Compensated Variometer?

A total energy compensated Variometer is a normal variometer, but with the variometer's pressure sensor fed by a total energy probe, rather than reading normal static (i.e. ambient) pressure.

How Does it Work?

The non TEK compensated variometer senses the static (ambient) pressure of the air. It converts any pressure changes into audio tone changes which are transmitted to the pilot, and recognised as altitude changes.

However a flying plane has both kinetic energy (speed) and potential energy (altitude) and the pilot can swap one for the other, within the aerodynamic and structural limits of the aircraft. The enlightened sailplane pilot is interested in maximising the model's total energy (kinetic and potential), not just potential (altitude) energy.
Total energy = kinetic energy + potential energy

Total energy = ½ mv^2 + mgh

or in flow terms Total Energy = ½ρv^2 + ρgh = dynamic pressure + static pressure

As increasing potential energy is indicated by a reduction in static pressure the TE nozzle is engineered to reduce the static pressure by the dynamic pressure of the airstream.

Installation

The TE probe should be fitted so that it samples undisturbed air, and isn't affected by the air pressure changes of the wing or tail. Secure the variometer in the glider cockpit and use the supplied silicon tubing to connect the TE probe to the vario's pressure nipple. The joints must all be totally air tight, as even small leaks in the plumbing can affect readings.

The TE probe for V tails should be fitted to the fuse centreline, preferably at least ½ a wing chord downwind of the wing root trailing edge. It should be aligned so it is angled towards the flow. To reinforce the mounting glue in a small piece of 2mm plywood inside the fuselage. Then drill a 3mm vertical hole for the TE probe mount.

The TE probe for conventional and T tails should be fitted near the top of the fin. The long part should be aligned with the airflow, and the angled part can point up or down, though full size practice is for it to point down. What matters is the airstream over the tip of the TE probe, not where it is mounted. If necessary use a wooden block inside the fin or microballoons to reinforce the mounting.

The photo shows the probe installed on a 2.3m glider. Because the elevator servo was mounted at the top of the fin the probe mount had to be lower. To compensate for this the tube was angled up rather than down.

First Flights

If you are new to model variometers we recommend first flights are made without the TE probe connected - let the vario sample the air inside the glider's cockpit. Once you are accustomed to using the vario as a simple rate of change of altitude sensor attach the tube to the TE probe to enjoy the advantages of total energy sensing. Note that as the TE probe senses airspeed, gusts of wind may affect the sound on turbulent days. You will probably find that the TE probe slightly under compensates for speed changes - this is considered correct, as overcompensation is very confusing.

Adjusting the Climb Threshold

As supplied the vario is adjusted so that the climb sound isn't given until the model starts ascending. However this won't happen until the lift overcomes the glider's normal sink rate, which is usually approx 0.5m/s (1.5 ft/sec). To adjust the climb threshold to -0.5m/s turn the multi-turn potentiometer ½ turn clockwise. Now the vario will indicate the vertical speed of the airmass the glider is flying through, rather than the ascent/descent speed of the sailplane.

Technical Data

Compensation value: slightly less than 1 (under compensated).
Dimensions of the TE probe: approx. 140mm long, 45mm high.
Dimension of the holder: 20mm long, 3 mm of diameter.
Connecting tube: 2mm ID 4mm OD, 2m long.