Borgelt B21 Variometer

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Table of Contents

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BORGELT INSTRUMENTS
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1 B21 VARIOMETER INSTALLATION

1. Install the instrument into any standard 58mm or 80mm panel hole, as appropriate, using the 3mm bolts provided.

2. Install the attached mini toggle switch, which is used to select between Fast and Slow response settings, in a convenient location using a 1/4" diameter hole.
Switch closed = Slow response;
Switch open or disconnected = Fast response

3. Connect the tube leading from your Total Energy Probe to the aluminum fitting on the rear of the B21 labelled T.E. Probe. The tubing must be in good condition and should be a very tight press fit over the fitting, to avoid air leaks. Even a small leak will compromise any variometer's performance. For extra insurance against air leaks, we supply small, thick walled elastic 'donuts' which you may install over tubing several inches past the end. After the tubing is properly attached to the fitting on the instrument, slide the 'donut' back toward the end of the tube so that it supplies extra squeeze around the tubing/fitting area. If you are installing another variometer (with capacity flask) in the panel and wish both to be total energy compensated, it is going to be necessary to place a T-piece somewhere in the total energy line. Where access is available, it is best to place this T-piece as close as possible to the probe end of the line. This is often necessary to minimize interaction between the two instruments.

4. Installation of a small paper element petrol filter into the T.E. line is highly recommended. It is essential that you select a paper element type of filter with suitable fittings for your hoses to insure no leakage. This precaution will keep exposure to dust and moisture to a minimum. (appropriate filters are available from auto parts stores)

5. Electrical connections to the aircraft battery system may be made using the supplied polarized mating connector. The input connector for the B21 has red and black wires. USE EXTREME CAUTION to apply only the correct polarity power to the variometer, as the instrument may be instantly and permanently damaged by even a momentary reverse voltage connection. The B21 must have positive (+) polarity (11 to 16 volts) to the RED wire and ground (-) to the BLACK wire. A 500mA fuse should be installed in the positive supply line to the instrument. Run vario and radio power from battery with separate cables. If a common cable is used to the instrument panel, voltage drop due to power drawn from the transceiver may cause the internal voltage regulator in the vario to deregulate resulting in spurious signals appearing on the vario.

6. This concludes the installation of your B21 variometer. Before applying power please DOUBLE CHECK that the polarity to the battery connection is correct.

2 USING THE B21 WITH OTHER INSTRUMENTS:

1. When using the combination of a B21 + B24, be sure to use the red and black wired power connector that runs from the B24, NOT the power input connector from the B21. In this combination the B21 input power connector is not used, as the B21 now receives power from the B24.

2. When using the B21 alone or with either a B20 audio or B29, a short loop of green wire that connects two of the feedthrough capacitors on the rear of the B21 must be intact. The green wire loop is cut to allow operation with the B24 speed command/ netto/ averager/ audio module.

3. If used with a B21 audio unit, B29 or on its own the B21 may be provided with standby power using two 9 volt batteries in series. Alkaline batteries are recommended and these will provide at least 20 hours of use of a B21 and at least 8 hours use of a B21 with B20 audio or B29.

3 Some characteristics of the B21 Variometer:

1. On power up the needle will go up momentarily before going full scale down for a few seconds and then slowly return to zero. This is the normal warmup cycle.

2. The vario is of fast response with an electronic gust filter to provide smooth response and easier interpretation. The variometer reads true rate of climb/descent up to 22,000ft. Above this altitude the sensitivity will decrease as the air density decreases.

4 General Notes:

1. Extremely effective radio interference protection is built into the B20 series instruments and no difficulties should be experienced. However it is good practice not to run the antenna coax and power leads in close proximity for any great length.

2. All aircraft instruments contain glues, paints and plastics. Their life may be extended by not subjecting them to extreme heat. It is good practice to use a canopy cover if the sailplane sits in the sun before and after flying and also to insulate under the black antireflection cover. Space blanket material works well. Make sure the material does not short any electrical connections.

5 B24 SPEED COMMAND/NETTO/AVERAGER/AUDIO MODULE INSTALLATIOM:

1. Install the instrument into any standard 80mm instrument panel opening, using the 3mm bolts provided.

2. Install the separate mini toggle switch which is used to select between climb and cruise modes, in a convenient location e.g. on control column beside the press-to-talk . The attached connector mates to the connector with purple and grey wires from the B24.
With the switch closed - climb mode is selected.
Note also, that the grey wire is connected to GROUND. CAUTION: WHEN MOUNTING THIS SWITCH USE EXTREME CARE NOT TO INTERFERE WITH FULL CONTROL MOVEMENT. We strongly suggest that you have a qualified person install or check your installation before flight.

3. Connect the tubes leading from the sailplane pitot and static source to the pneumatic connections on the rear of the B24 labelled 'PITOT' and 'STATIC'. Providing a good pitot and static source is very important.

A Prandtl probe works well and has minimal position error. Position error will result in incorrect speed commands and netto computation and will result in incorrect computed winds if using a B25 Final Glide/Navigation Computer.

4. **IMPORTANT**: Installation of a small paper element petrol filter into each line of the B24 to prevent entry of dirt, dust and water is highly recommended.

5. Electrical connection to the sailplane battery system may be made using the supplied mating connector. The input connector for the B24 has red and black wires. USE EXTREME CAUTION to apply only the correct polarity power to the instrument as the instrument will be instantly and permanently damaged by even a momentary reverse polarity connection. The B24 must have positive (+) polarity (11 to 16 volts) to the RED wire and the ground (-) to the BLACK wire. A 500mA fuse should be installed in the positive supply line to the B24. Run the variometer system and radio power from the battery with separate cables. If a common cable is used to the instrument panel, voltage drop due to power drawn from the transceiver may cause the internal voltage regulator in the vario system to deregulate resulting in spurious signals appearing on the vario.
NOTE: The combination of the B21 + B24 modules is always powered through the power input plug on the B24. The power input plug on the B21 is not used in this configuration.

6. Mount the speaker supplied in a convenient location. The first choice would be on the cockpit wall adjacent the pilot's ear. If wire routing is a problem, you may be content to mount the speaker into the instrument panel, facing aft toward the pilot. The speaker attaches to the connector with orange and yellow wires. When mounting the speaker against a surface, do not short input terminals on the rear of the speaker.

7. Connect the 8 pin circular connector from the B21 to the mating connector to the B24. (only one of two will mate, the spare is for the B25) Ensure the 'loop of green wire' on the rear of the B21 is cut.

8. The width of the silent zone is factory adjusted so that during slow cruise a change of ±2Kts in the air causes the audio to start. This increases to ±4Kts approx. at high speeds. The width of the silent zone may be adjusted to suit the customer by a trim pot which is accessible under the B24. Turning the pot anticlockwise increases the silent zone. We recommend that you fly under various conditions with the factory setting before altering.

6 B24 Operating Hints:

With the mode switch in CLIMB position the digital readout is an AVERAGER with a time constant of 23 seconds and the B21 is a vario. The digital averager shows achieved climb rate over the last one to two circles providing a good guide as to when the thermal is weakening. It is also useful in making you work harder (i.e. 3Kts let's try for 3.5). The AUDIO chopped tone for CLIMB has a wide dynamic range (goes over range to about 14Kt so that strong thermals may be centered even with the vario needle pegged.)

In CRUISE mode the B21 becomes NETTO or AIRMASS variometer, showing you what the air you are flying through is doing. You can immediately see the effect of small course changes without changing air being masked by sailplane sink rate changes. The netto is particularly useful when working blue thermals or cloud streets.

The vertical meter is SPEED DIRECTOR in CRUISE mode. The AUDIO is 'slowly alternating tones' for fly slower and 'rapidly alternating tones' for fly faster. The audio dead band increases in width with airspeed.

The change from CLIMB to CRUISE and back again occurs instantaneously with the throwing of the mode switch, so don't feel inhibited about using the switch to get the instrument to give you the most useful information when you need it.

The BALLAST switch provides 3 weights: empty, 1/2 and full. Approximately every 30 seconds a 'click' will be heard which is caused by the solenoid valve in the airspeed measurement auto zero circuitry. Long term drifts are also eliminated by this circuitry, so periodic maintenance by the customer is unnecessary.

7 B25 FINAL GLIDE/NAVIGATION COMPUTER

7.1 INSTALLATION

1. Install the B25 into a standard 80mm instrument panel opening, using the M3 bolts provided.

2. Connect the 8 pin circular connector from the B25 to the mating connector (only one of the two will mate) to the B24.

7.2 OPERATION

7.2.1 Program as follows:

(a) Position 'reset/run' switch to 'reset position
(b) Select leg to be programmed (1 to 9)
(c) Switch to 'pr'ogram position
(d) Increment/decrement to desired distance, up to 199 units using '+' and '-' switches (left switch does this quickly, running through the numbers, right switch only + or - one unit per switch action.)
(e) Select next leg
(f) Repeat from step (d)
(g) When finished programming, switch to 'op'erate position
(h) Check distances stored in legs

7.2.2 Operate as follows:

(a) Select correct leg number, check the distance.
(b) Input estimated HW/TW (headwind/tailwind) condition.
(c) Upon starting leg, switch to 'run'
(d) Distance to go to end of leg is displayed in distance window.
(e) Upon reaching a visual checkpoint whose actual distance from end of current leg is known, correct the distance shown (if necessary) by using the wind knob. Note that this has the effect of increasing or decreasing the displayed distance value.
(f) Repeat step (e) as often as desired. The position that the wind knob points to after step (e) is the average wind component since beginning that leg.
(g) When you reach the end of that leg, select 'reset, select the next leg, estimate and enter 'HW/TW Component.

(h) Repeat from step (c).

DON'T FORGET TO SWITCH TO CLIMB WHILE CIRCLING, CRUISE WHEN FLYING STRAIGHT.

7.2.3 Using the Height Required Display:

The B25 stores performance data for your individual sailplane in a replaceable 'EPROM' device for 3 ballast conditions, MacCready settings from 0 to 7.5 knots (KT) on 0.5KT increments and wind conditions from a 40KT headwind to a 40KT tailwind in 2.5KT increments. The ballast and MacCready settings are selected from the knobs on the B24. In addition to the preprogrammed performance data, the glide angles may be modified at any time to allow for your experience with your sailplane, rain, bugs etc. The glide angle may be modified to any value between 105% and 70% of the internally stored value by adjusting the 'pol%' knob. The distance in the 'distance' display is divided by the glide angle and the result is displayed in thousands of feet on the height required display. In addition, using the '+ht' knob, an altitude offset representing field elevation plus a safety margin may be added. This margin may be checked by programming zero distance into one leg or going to 'pr' and setting zero into the distance window.

7.2.4 Operating Hints for B25 Final Glide/Navigation Computer:

Course deviation will result in greater distance flown. Distance can be adjusted at any time by switching to 'pr' and entering the new distance required. This facility is useful when you have previously found the correct wind as in the operation instructions and then have to make a course deviation. At the next visual checkpoint the distance will be wrong but the wind will be correct so you don't want to adjust the distance by using the wind knob.

If you attempt to glide into a headwind at a lower MacCready setting than that for best glide over the ground, the B25 will show "1" on the altitude display. Increase the 'Mc' setting(on B24) until an altitude is displayed. The same indication is also present when height required exceeds 19,900ft.

The B25 can be used when flying to an upwind turnpoint. In the last thermal, the altitude that you wish to go around the T.P.at can be set on the '+ht' knob, remembering the effects of terrain elevation and whether you are flying on QFE or QNH. The thermal can then be left at the altitude indicated on the B25altitude display, minimizing the time spent thermalling on an upwind leg.

If merely flying casually with no set task, the leg distance may not be known. In this case program zero distance into a legend when leaving the airfield go to 'run'. The distance flown away from the start point will then be shown preceded by a minus sign on the distance display and wind adjustments may be made as for normal operation.

If flying a leg of more than 199 distance units (Km, st.mi, or nm), split the leg at convenient visual checkpoint(s) into two or more legs. Alternatively program 100 distance units and when zero is reached merely 'reset' and 'run' again until a point is reached where the end of the leg is less than 199 distance units which can be programmed in the usual way.

7.2.5 CAUTIONS

The wind calculated by the B25 is an average over the leg AT THE LEVELS YOU HAVE FLOWN AT. The low level wind on final glide may be considerably different so when visual checkpoints are available use them to update the instrument.

When planning a final glide, the shortest time is given by using a MacCready setting equal to the rate of climb in the last few seconds so use the B24 averager to determine this and set the 'Mc' knob to this value. The B25 will then compute the height required. Remember to set in your 'pol%' and '+ht' first. If you are getting above glide path increase 'Mc' setting. If below glide path, it may be because of sinking air, excess bugs or deficiency in sailplane performance. Slow down with lower 'Mc' setting or take another thermal.

REMEMBER YOUR FINAL GLIDE RESULT IS UP TO YOU, THE WEATHER AND YOUR INPUTS. USE YOUR INSTRUMENTS AS JUST ANOTHER FACTOR IN FINAL DECISIONS.
DO NOT ALLOW THE COMPUTER TO PLACE YOU OR YOUR FLIGHT IN DANGER AT ANY TIME.