



Hardware & Software Development

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WSTech Classic Sound Variometer Manual

Technical Data & Specifications

Dimensions	67x27x18 mm (2.6x1.1x0.7 in)
Weight	27 g (0.95 oz)
Sensitivity	5 cm/s (10 ft per minute)
Voltage	4.8V to 7V (4 or 5 cell NiMh or NiCD receiver battery)
Current	60 mA at 5V
Range	2 km (1.2 miles)
Transmit power	10 mW
Frequency	433.0625 to 434.7875 MHz in 12.5 kHz steps. See appendix 1.
Bandwidth	+/-2.5 kHz
Antenna	17 cm (7 in) flexible wire

Advantages of a Variometer

The variometer, commonly shortened to vario, helps the model pilot to find thermals and to make best use of them. The vario is most useful at height or when the plane is overhead, because here it is particularly difficult to see if the model is in lift. For full size gliders the vario is considered an indispensable instrument, and its use is taught from the first lesson. After flying with one in a model glider you will appreciate the benefits are just as strong when flying from the ground using R/C. However it does take a little patience to learn how to fit and use a vario, so please read these instructions with care.

Technical Characteristic & Features

The WSTech Classic Sound II Vario's analogue circuitry has been designed to indicate lift or sink with a maximum of sensitivity and accuracy, while not adding appreciably to the pilot's workload. By concentrating on this main task, and not adding other unnecessary features we have been able to engineer the smallest and lightest quality variometer currently available, while keeping the price down to a level affordable to most modellers.

At the heart of the vario is a very sensitive temperature compensated pressure sensor. This converts vertical movements of the model into a variable audio tone which is transmitted to the receiver. Height changes as small as 5 cm/s (2" per second, or 10 ft per minute) will be indicated immediately by a change in tone. Sinking produces a continuous tone which becomes deeper with increasing sink rate. Climbing gives a pulsed rising sound. The pulse frequency rises as the rate of climb increases, so for increasing rates of climb the vario output will sound like: duut, duut, dut, dut, dit, dit, etc.

The audio signal is transmitted to the pilot on the ISM 433Mhz band by a fully legal telemetry transmitter. The crystal controlled transmitter conforms to all UK and EU regulations including BAPT 222 ZV 125 / I-ETS 300 220u and ETS RES 0908. No telecommunications license is required by the user. The vario is fitted with an 8 pin DIP switch to allow the exact transmitted frequency to be selectable within the legal range. Any one of 69 channels can be used, allowing many modellers to be flying with variometers simultaneously without them interfering with each other.

Because this product uses analogue circuitry it is particularly sensitive to small changes in rate of climb or sink, which would be lost in the analogue to digital conversion process in a digital device. Normally analogue circuits are sensitive to unwanted external inputs, especially RF radiation. However by designing the circuit board layout optimally and screening sensitive components the vario is totally unaffected by high frequency radiation, whether it comes from the vario's telemetry transmitter, or the modeller's R/C transmitter.

Groundstation

To hear the audio tone the R/C pilot needs a suitable radio receiver to pick up the variometer's 433 MHz signal. We supply and recommend LPD (Low Power Device) handheld radios designed for the ISM (Industrial, Scientific, and Medical) radio band. These radios can pick up all 69 channels and include belt mounts and headphone outputs, so the pilot can privately listen to the tone without any encumbrances. Please see en.wikipedia.org/wiki/Low-power_communication_device for more info about the band. Handheld radio scanners or 70 cm amateur radio receivers can also be used with the vario. However do not use PMR (Personal Mobile Radio) devices for the 448 MHz band.

Installation Directions

The vario can be powered by an external 4.8V - 7V battery, or by the R/C power system. The most convenient is to plug it into a free servo output on the receiver. Should no free plug be available, a dual aileron servo extension lead (or Y-lead) can be used in to connect the vario. As the Classic Sound 139-Channel does not use the R/C signal only the positive and negative supply wires need to be connected.

In fuselages that don't use carbon fibre the antenna can be fastened to the body wall. The antenna should be as straight as possible. When mounting the antenna ensure it is not parallel to other cables or metal parts, as this decreases the aerial's effectiveness and thus the range. (Incidentally this is also true for the receiver's R/C aerial.) Finally, the vario's antenna should not be parallel to the R/C receiver aerial.

In fuselages that contain carbon fibre (even if only for local reinforcement) the antenna should be led out of the fuse immediately, and either supported to make a whip aerial, or allowed to hang free in the airstream.

Adjusting the Climbing Threshold

Important: The vario has been correctly adjusted for a zero sink (0 fpm) climbing threshold before delivery. We recommend new users do not immediately change this setting.

The climbing threshold can be adjusted using the multi turn potentiometer. This is useful for tuning the response of the vario to the model and your style of flying.

1. Place the model on the table or on the ground and power-up the vario (using the same battery as will be used in flight).
2. Wait 1 minute for the vario to warm up.
3. When you have continuous tone, turn the multi turn potentiometer with a screwdriver clockwise in half turn steps. After each step wait at least 20 seconds until the sound frequency is stable.
4. Repeat step 3 until the interrupted sound starts, don't forget to wait a minimum of 20 seconds after each step. Be patient. You may have to repeat step 3 many, many times.
5. Now turn the potentiometer in quarter or smaller steps anticlockwise till the continuous tone starts.
6. Check the threshold now by moving the vario slowly up and down at approx 10 cm/s (4" per second). You should hear a change in the sound after a small delay of 0.5 to 1 second.

This adjusts the vario to give the interrupted climbing sound when the model is in weak lift and just sustaining altitude (zero sink). This is the as-delivered setting. However the threshold can be manually set to a slow rate of climb or sink if required. By rotating the potentiometer *anticlockwise* one turn the threshold is set to a climb of approx 1 m/s (200 fpm). Alternatively rotating the potentiometer *clockwise* one turn sets the threshold to a sink speed of 1 m/s (200 fpm).

By knowing the sink speed of your glider you can set the vario's threshold to indicate air movements rather than glider movements. For example most high performance R/C gliders have a minimum sink speed of about 0.5 m/s (100 fpm). This can be set by turning the potentiometer clockwise half a turn. Now a continuous tone will indicate the air is descending, and an interrupted tone will indicate the air is rising. Of course the glider will only rise if the air rises faster than the glider's sink speed.

R/C Range Test

When the vario is first fitted to a model a range check must be conducted to verify the variometer's transmitter does not interfere with the reliable operation of the R/C. This is very important.

To check the R/C link retract the transmitter antenna completely. Then ask a friend to hold the model and to clearly indicate control surface movements. (If the model is electric powered warn him not to obstruct the propeller arc.) Walk away from the model and ensure that good control is attained with a range of at least 60m (66 yards). Ask your friend to turn round, and check the control link remains solid when the model is at all attitudes.

Operation

Switch on the vario and allow it to warm up and stabilise before launch. The time this takes will depend upon the storage temperature of the vario and the outside air temperature.

Learning to make best use of the vario in flight takes many hours and can initially be frustrating as the tones can distract you from concentrating fully on controlling the glider.

- If you hear the interrupted tone slow down the glider and explore the area. Start circling in the strongest lift.
- If part of the circle is in lift and part in sink open up the circle in the lifting part, and tighten it in the sinking part.
- If you enter sink increase speed and fly straight out of the area. The optimum speed increase varies with the type of glider and the strength of the sink, but for strong sink increase the speed of a built-up structure glider by at least 50% and double the speed if flying a moulded glider.
- If you hear lift and sink and can't gain height in it you may be flying a "stick thermal". Fit a Total Energy (TE) tube and learn to circle at constant speed and bank angle.
- If you find the quality of your flying is deteriorating or you are not enjoying the flight switch off the LPD receiver and take a break from using the vario. Especially on windy days the tones can be confusing, and add to the pilot's workload.
- If the model enters a fast dive the vario frequency will drop below its minimum and the sound will cease.
- If you hear the tone repeatedly dropping away and rising again the vario may be reinitialising. This happens if the vario's voltage source drops below 4.5V. If your vario is powered from the R/C battery this is a low battery condition and indicates you should land immediately.
- If you hear a low frequency sound (the R/C frame rate) coming from the walkie-talkie when the R/C transmitter is switched on the likely cause is too low a voltage getting to the vario from the R/C. This can be caused by a high resistance or low voltage receiver battery, by too long extension leads, by poor contacts in the extension leads (especially Y leads), or by the electric speed controller's BEC circuit being near its operating limit.

Appendix 1

The transmit frequency of the WSTech Classic Sound 139-Channel Variometer can be configured between 433.0625 to 434.7875 MHz in 12.5 kHz steps by setting eight DIP switches on the side of the vario.

You can choose a channel at random, or use the UHF-Handy's Scan mode to identify a suitable free channel.

Once you have chosen the required channel number use the chart (opposite) to set the DIP switches **S1** to **S8** on the variometer.

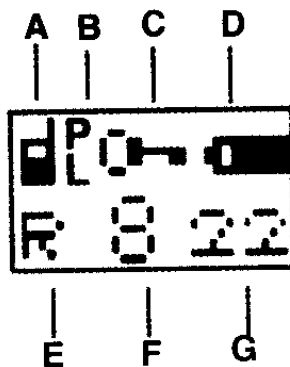
1 = On (DIP switch up)


0 = Off (DIP switch down)

Channel	Frequency	S1	S2	S3	S4	S5	S6	S7	S8
1	433.075	1	0	0	0	0	0	0	0
2	433.100	1	1	0	0	0	0	0	0
3	433.125	1	0	1	0	0	0	0	0
4	433.150	1	1	1	0	0	0	0	0
5	433.175	1	0	0	1	0	0	0	0
6	433.200	1	1	0	1	0	0	0	0
7	433.225	1	0	1	1	0	0	0	0
8	433.250	1	1	1	1	0	0	0	0
9	433.275	1	0	0	0	1	0	0	0
10	433.300	1	1	0	0	1	0	0	0
11	433.325	1	0	1	0	1	0	0	0
12	433.350	1	1	1	0	1	0	0	0
13	433.375	1	0	0	1	1	0	0	0
14	433.400	1	1	0	1	1	0	0	0
15	433.425	1	0	1	1	1	0	0	0
16	433.450	1	1	1	1	1	0	0	0
17	433.475	1	0	0	0	0	1	0	0
18	433.500	1	1	0	0	0	1	0	0
19	433.525	1	0	1	0	0	1	0	0
20	433.550	1	1	1	0	0	1	0	0
21	433.575	1	0	0	1	0	1	0	0
22	433.600	1	1	0	1	0	1	0	0
23	433.625	1	0	1	1	0	1	0	0
24	433.650	1	1	1	1	0	1	0	0
25	433.675	1	0	0	0	1	1	0	0
26	433.700	1	1	0	0	1	1	0	0
27	433.725	1	0	1	0	1	1	0	0
28	433.750	1	1	1	0	1	1	0	0
29	433.775	1	0	0	1	1	1	0	0
30	433.800	1	1	0	1	1	1	0	0
31	433.825	1	0	1	1	1	1	0	0
32	433.850	1	1	1	1	1	1	0	0
33	433.875	1	0	0	0	0	0	1	0
34	433.900	1	1	0	0	0	0	1	0
35	433.925	1	0	1	0	0	0	1	0
36	433.950	1	1	1	0	0	0	1	0
37	433.975	1	0	0	1	0	0	1	0
38	434.000	1	1	0	1	0	0	1	0
39	434.025	1	0	1	1	0	0	1	0
40	434.050	1	1	1	1	0	0	1	0
41	434.075	1	0	0	0	1	0	1	0
42	434.100	1	1	0	0	1	0	1	0
43	434.125	1	0	1	0	1	0	1	0
44	434.150	1	1	1	0	1	0	1	0
45	434.175	1	0	0	1	1	0	1	0
46	434.200	1	1	0	1	1	0	1	0
47	434.225	1	0	1	1	1	0	1	0
48	434.250	1	1	1	1	1	0	1	0
49	434.275	1	0	0	0	0	1	1	0
50	434.300	1	1	0	0	0	1	1	0
51	434.325	1	0	1	0	0	1	1	0
52	434.350	1	1	1	0	0	1	1	0
53	434.375	1	0	0	1	0	1	1	0
54	434.400	1	1	0	1	0	1	1	0
55	434.425	1	0	1	1	0	1	1	0
56	434.450	1	1	1	1	0	1	1	0
57	434.475	1	0	0	0	1	1	1	0
58	434.500	1	1	0	0	1	1	1	0
59	434.525	1	0	1	0	1	1	1	0
60	434.550	1	1	1	0	1	1	1	0
61	434.575	1	0	0	1	1	1	1	0
62	434.600	1	1	0	1	1	1	1	0
63	434.625	1	0	1	1	1	1	1	0
64	434.650	1	1	1	1	1	1	1	0
65	434.675	1	0	0	0	0	0	0	1
66	434.700	1	1	0	0	0	0	0	1
67	434.725	1	0	1	0	0	0	0	1
68	434.750	1	1	1	0	0	0	0	1
69	434.775	1	0	0	1	0	0	0	1

Instructions for the TEAM UHF - Handy LPD

UHF-Handy LCD Display



A - Shows the walkie-talkie  symbol when transmit is manual (by pressing the PTT key) or a microphone if transmit is voice operated (VOX mode). *Should show the walkie-talkie symbol when set correctly.*

B - Shows **P** when set to PMR band (448 MHz) or **L** when set to LPD band (433 MHz). *Should show L when set correctly.*

C - Shows a key if the keypad is locked.

D - Battery state.

E - Shows **T** when transmitting, or **R** when receiving. *Should show R when the vario is switched on.*

F - Channel number. *Should show the channel the vario has been configured to when set correctly.*

G - Squelch Code Number. *Should be blank when set correctly.*

UHF-Handy Buttons

Left Green Arrow button	Select volume adjust
Up & Down Black Arrow buttons	Increase or decrease volume, move to above or below menu option.
Right Red button	Confirm sound level, select menu option.
PTT button	Transmit.
Call button	Sound bell on other LPDs set to same configuration.

Battery Installation

Loosen the belt clip screw, remove the cover, and fit four 1.5V AAA disposable batteries. Four AAA size NiMH or NiCd cells can also be used.

Switching On & Off

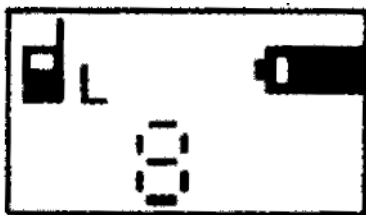
To switch the unit on press the right hand red button for 3 seconds. To switch the unit off press the right hand red button again for 3 seconds.

Setting Band and Operation Mode

The UHF-Handy is a general purpose walkie-talkie that can transmit and receive on two bands. In order to work with the WSTech Classic Sound 139-Channel Variometer it has to be setup to use the LPD band, use the same channel as the variometer has been set to, and squelch must be switched off. These settings only need to be made once, and can be done as below:

1. Switch the unit on.
2. Press Up arrow key till **CH** is displayed, and select with the red key on the right.
3. Select **Band** using the arrow keys, and select with the red key on the right .
4. Select **LPD** using the arrow keys, and select with the red key on the right.
5. Now use the arrow keys to choose the channel (1 to 69) and selected with the red key on the right.
6. The selected channel number should now be displayed in the **F** field on the display (shown as channel 8 in the illustration).
7. Select *no squelch* by pressing the Up arrow key till **Code** is displayed, and select with the red key on the right. Then use the up or down arrow keys to change to code **00**, and select it with the red key on the right. This is indicated by the **G** field on the display being blank.

Once setup correctly the display will look like this:



This shows the UHF-Handy set to receive on LPD channel 8, with the vario not currently transmitting. Once the vario is switched on an **R** will be displayed in field **E** (below the walkie-talkie icon), and the vario's sound will be heard from the loudspeaker. For private operation remove the jack socket's protective cover next to the antenna, and plug in the earpiece's jack plug.

Adjusting the Volume

To adjust the volume press the left green key and use the arrow keys to increase or decrease the loudness. Press the green key again when finished.

Other Options

- For the UHF-Handy to work correctly with the WSTech Classic Sound 139-Channel Variometer it must not be in **Scan** mode, instead the band and channel must be explicitly set, as explained above. In **Scan** mode any small transmission interruption by the vario will cause the UHF-Handy to restart the scan, which will cause a long break in vario reception.
- The **Squelch** sensitivity can be set in the menu option **SQ**. The unit is most sensitive when all four bars are shown (default adjustment).
- The keyboard can be disabled (indicated by displaying a **key** symbol on the display in field **C**) by almost simultaneously pressing the right key and then the upper arrow key. Unlock the keyboard by repeating the key combination.
- **VOX** mode must be deactivated, or loud sounds will switch the walkie-talkie into transmit mode. When **VOX** is active a microphone symbol is shown on the display in field **A**.