



Variometer

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Instructions for installation and use of the variometer system for
model aircraft

LinkVario and LinkVario Duo

for JETI duplex EX with DC/DS-16 Transmitter



The three available versions of the LinkVario:

On the left you see the normal version, in the centre the Duo version with two pressure sensors and on the right the mini version without Total Energy Compensation (TEC) port with low design height for very narrow fuselages.

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1 Pictures of the LinkVario



LinkVario with current sensor for monitoring of electric engines (voltage, current and capacity)

2 Advantages of a variometer

„Es geht auch ohne Variometer, mit eben nur besser“ (soaring works without variometer - just better with), a quote from: „Das Thermikbuch für den Modellflieger“ (the thermals book for model glider pilots) from Lisken / Gerber.

The advantages of a variometer are multiple. The core functions of a variometer i.e. the acoustic signaling of climbing or sinking helps the RC-pilot to considerably simplify soaring in thermals and to improve the yield of his flights i.e. his flight times. It enables to find even weak thermals and to use them adequately and properly center the thermals in order to get the best climb rate. This is particularly valid in great heights and in lowlands where an optical detection of thermals is quite difficult. In the mountains the variometer helps in finding thermals when the glider has hit a downdraft. It also turns out helpful where climbing can hardly be traced due to reduced visibility of surroundings or due to an unusual view onto the glider. Thus the variometer is a perfect support in situations where slight panic makes reflected action difficult. (=glider below starting point).

With the use of a precise acoustic variometer RC gliding turns into a totally new fascination and opens doors to a completely different world of RC soaring.

3 Technical specifications of the LinkVario for the JETI DUPLEX EX system

The **LinkVario for the JETI DUPLEX EX system** is a variometer system for the telemetry channel of the JETI DUPLEX EX system.

The entire **data transfer** takes place via the telemetry channel of the JETI DUPLEX EX system.

The LinkVario for the JETI DUPLEX EX system has only one so-called board unit in the model – the **variometer sound generation, voice announcement** and the **logging** of the JETI DUPLEX EX system in the transmitter are used.

The **variometer acoustic** of the LinkVario has similar sound characteristics to the variometers used for real flying.

It is configured in an own menu point **“Vario”** in the DC/DS-16 transmitter.

Units can be set either to metric or imperial.

In combination with the JETI DUPLEX EX system **altitude variations of about 1 cm/s** are perceptible thanks to an altering vario sound.

For data **transfer** the contents of data packages have been optimized to a point that despite the **maximum of 19 telemetry values** a **fluidly changing variometer sound** is guaranteed.

Just like in real flying the variometer function can be improved further by the use of a **TEC-Tube**.

Next to the core functions of a variometer the basic functions of the LinkVario **are altimeter, integral variometer** and its **supply voltage control**.

With the **optional modules** GPS, current sensor, temperature and pitot speed (air speed) sensor additional functions such as speed and distance measurements are available as well as the optimization and monitoring of electric power systems.

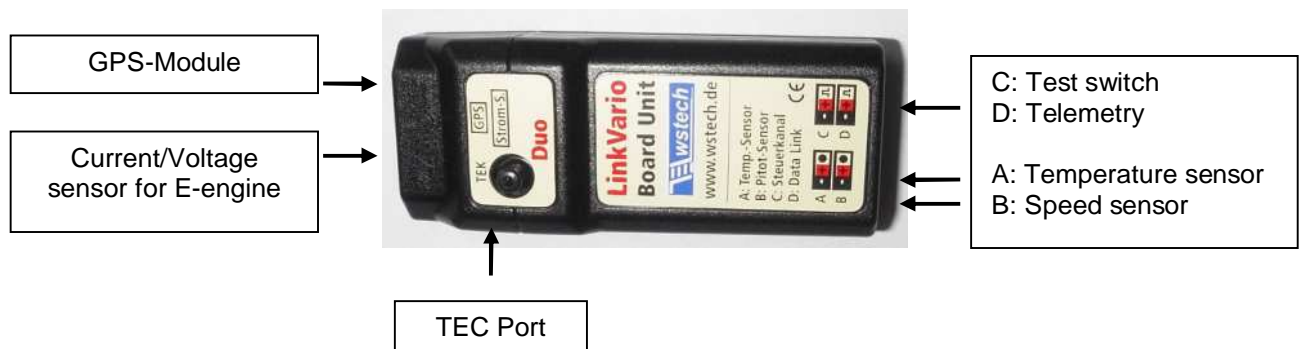
The LinkVario is a system, which in particular traces all required parameters of an **electric powered glider** in one single unit.

The **data logger** in the JETI DUPLEX EX system in combination with the LinkVario enables multiple options for the monitoring and the optimization of a model.

The **data output of the LinkVario** must only be connected to the **telemetry input (EXT)** of the JETI DUPLEX receiver.

For **audio output** the earphone (3.5) jack or the integrated loudspeaker of the TX is used.

3.1 Connections of the LinkVario Board Unit



3.2 Functions of the LinkVario in the JETI DUPLEX EX system

- The **LinkVario** variometer system is an acoustic variometer with altimeter for the JETI DUPLEX EX system.
- Variometer with selectable **zero lift suppression** and **sinking threshold**. Both can be configured in the **Vario setup** of the transmitter.
- **Connection** for a **TEC tube**. (not for the mini version)
- **External sensors** such as a combined current and voltage sensor for electric power systems, a temperature sensor, a pitot speed sensor and the wsTech GPS module are directly connectable to the **LinkVario**.
- In combination with a current, voltage and temperature sensor the LinkVario provides important information about the operational status of the electric power system thus enabling its monitoring.
- All alarm thresholds and announcements for the LinkVario telemetry data (e.g. LinkVario voltage, power system voltage, current, used capacity, speed, distance, temperature, etc.) are defined and configured in the transmitter.
- **Settings** concerning the sensor directly (current sensor type and pitot speed range) are made as usual for all JETI DUPLEX EX sensors via the **Jetibox** menu in the transmitter.
- All **sensors** (current, temperature and pitot speed) except the GPS module are supplied by SM-Modellbau/Germany, the GPS module is available from wsTech.
- Observation of a **switch contact (test switch)** for the control of retractable engines or the like.
- With the **GPS module** the location coordinates, the course, the speed above ground, the distance to starting point, the cardinal direction and the location for the search of a model can be shown on the display of the JETI DUPLEX EX system. Even the last detected location of a model destroyed in a crash can be stored and displayed on the JETI DUPLEX EX transmitter.
- The externally identical **LinkVario Duo** is an extended version with a second high definition pressure sensor. This pressure sensor works independently from the variometer sensor and therefore is not being influenced by the TEC tube and the added negative dynamic pressure.
- The **data logger** of the JETI DUPLEX EX system can store the LinkVario data internally on its SD card.

- The **visualization** of the collected data is possible with the TX internal data-viewer or with the adequate PC programs of the JETI DUPLEX EX system just like it is done for original JETI DUPLEX EX sensors.
- Despite the multiplicity of functions the focus has been set on simple and straightforward installation and use.

4 Installation instructions for the LinkVario

4.1 LinkVario connection to the receiver

The LinkVario is being delivered with a connection cable.

The plug **D: Data Link** must be connected to the telemetry input **EXT** of the JETI DUPLEX receiver with the male to male servo lead.

Important notice for the use of other sensors with the JETI Expander EX:

The LinkVario could also be used with the JETI Expander in parallel to other sensors. But this would cause the drawback of a slower data rate for the vario signal resulting in slower vario sound changes which would consequently become more volatile

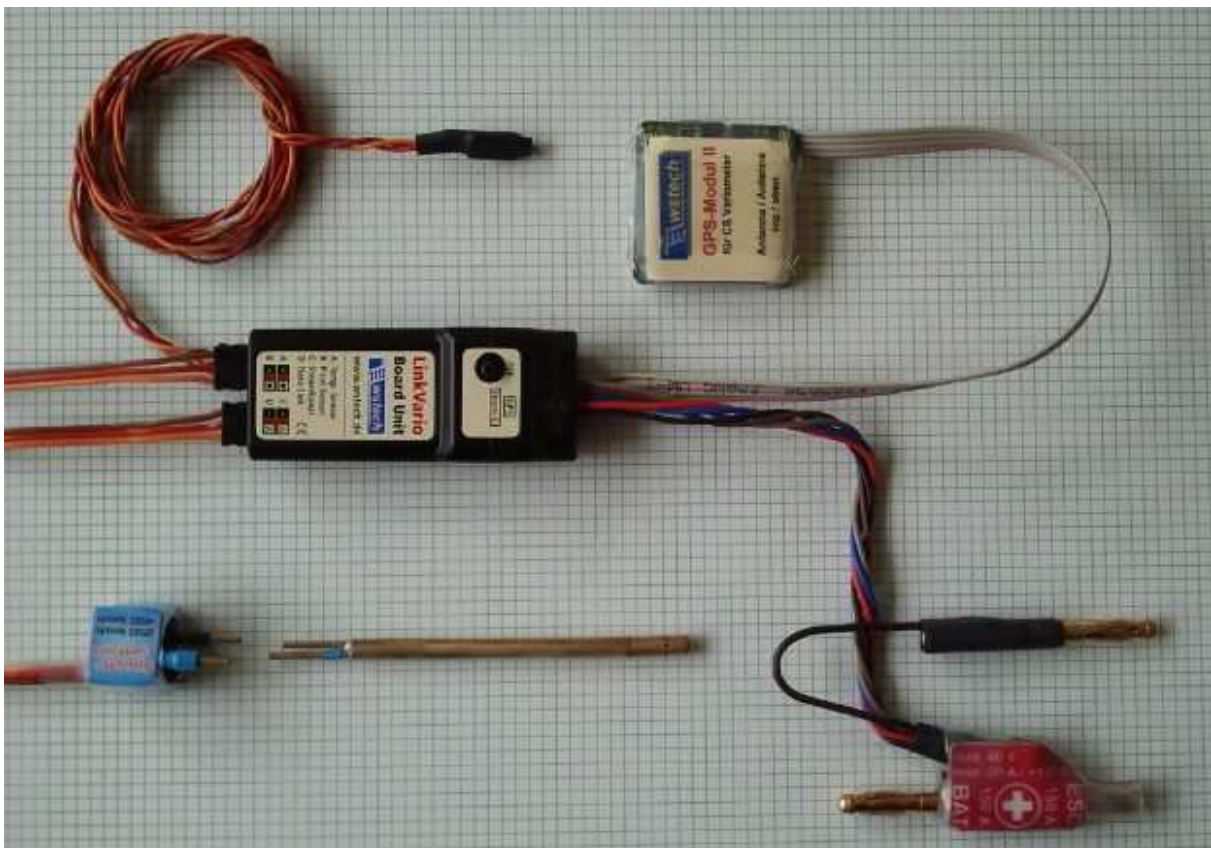
Important notice for the installation:

Pressure sensors used in variometers are sensitive semiconductors. The pressure port of the sensor also serving as the connection point for the TEC tube must not be obstructed and is to be kept free of dirt, water and dust.

Furthermore these sensors are **photosensitive**. The pressure port should not be exposed to direct light as measured values would be distorted. For the practical use this means that in the model no light should enter through the pressure port. A light-tight tube may be used whenever necessary.

4.2 Connection of the sensors to the LinkVario

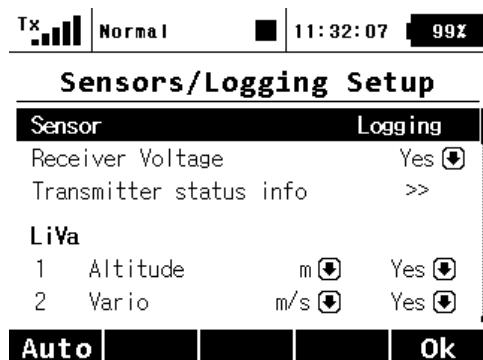
The optional sensors can now be connected to the LinkVario on demand. In the picture below you can see the LinkVario connections with almost all available options. Only the test switch is missing on this picture.



5 Visualization of the telemetry values on the DC/DS-16 Display

5.1 Recognize the LinkVario sensor

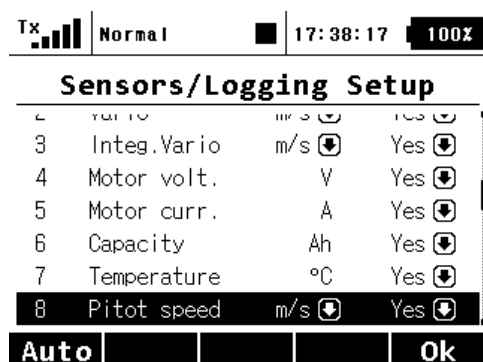
Bring transmitter and receiver in a combined state into operation together with the LinkVario.



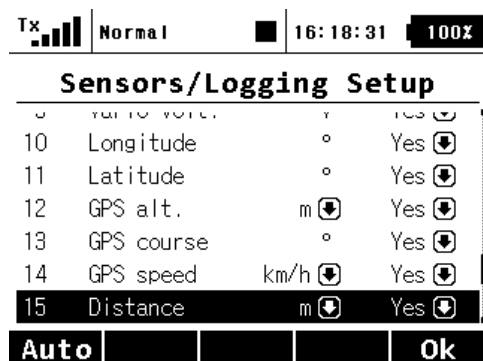
Under the menu point **Timers/Sensors** select **Sensors/Logging Setup**.

Press the **Auto** key in order to avoid that previously connected sensors and their parameters are being dragged along.

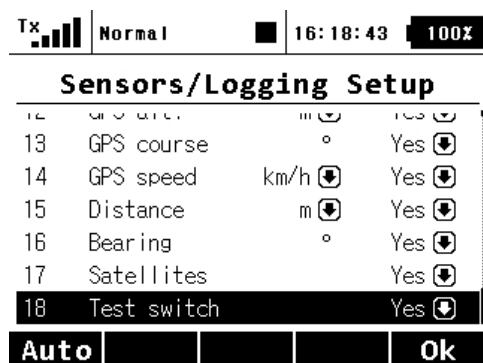
Now all parameters given by the **LinkVario** are newly been read. The screen name for LinkVario is **LiVa**.



Using the **LinkVario without GPS** the following parameters are displayed (1 to 9 and 18).



Using the **LinkVario with GPS module** the following additional parameters are displayed (10 to 17).



Measure units of some telemetry values may be altered according to the available options in the telemetry menu. E.g. change speed from default **m/s** to **km/h, ft/s, mph or kt**.

Note:

This may take approx. 40sec. until all parameters are identified and displayed on the slowly built-up list.

5.2 LinkVario telemetry display

Each pilot can set up and arrange the display windows according to his needs and habits. Below some samples of how LinkVario data may be displayed.

Tx Normal 17:39:02 100%

Displayed Telemetry

	Telemetry	Double
1	Vario [m/s] Telem Yes	
2	Integ.Var [m/s] Telem Yes	
3	Altitude [m] Telem Yes	
4	Motor vol [V] Telem Yes	
5	Motor cur [A] Telem Yes	

↓ ↑ Add Del. Ok

Under the menu point **Timers/Sensors** select **Displayed Telemetry**.

Detailed instructions of how user blocks can be created are to be found in the manual of the DC/DS-16 transmitter.

Note:

The larger display windows contain min/max values and are set with **Zoom "yes"**, the smaller with "no".

Samples of the telemetry display

Tx Normal 11:34:32 99%

LiVa: Vario 0.01m/s -0.01 0.08m/s	LiVa: Integ.Vario 0.00m/s 0.00 0.00m/s
Elvira-res USB Page 1/7	LiVa: Altitude 1m 1 1m

Opt. ← → Start

Tx Normal 17:37:31 100%

LiVa: Motor volt. 10.1V 0.0 10.1V	LiVa: Motor curr. 76.7A 0.0 76.7A
Elvira-res USB Page 2/7	LiVa: Capacity 1.34Ah 0.00 1.34Ah

Opt. ← → Start Clr

Tx Normal 11:35:19 99%

LiVa: Temperature 16.0°C 15.8 16.2°C	LiVa: Distance 38m 29 38m
Elvira-res Charging Page 3/7	LiVa: Vario volt. 4.98V 4.97 4.98V

Opt. ← → Start

Tx Normal 16:19:03 100%

Rec: Voltage Rx 4.97V 4.97 4.97V	Rec: Antenna A1 9 A2 9 100%
Elvira-res Page 4/7	LiVa: GPS alt. 447m
	LiVa: GPS course 257°
	LiVa: Longitude 9°28.461'E

Opt. ← → Start Clr

Tx Normal 16:19:20 100%

LiVa: Latitude 47°43.416'N	T: Flugzeit 00:00.0
LiVa: Bearing 85°	
Elvira-res Page 5/7	LiVa: Satellites 8 6 8

Opt. ← → Start Clr

Tx Normal 16:19:58 100%

LiVa: Test switch 0	LiVa: GPS speed 0km/h 0 0km/h
Tx Battery 283mA 4.11V	
Elvira-res Page 6/7	LiVa: Pitot speed 0.0km/h 0.0 0.0km/h

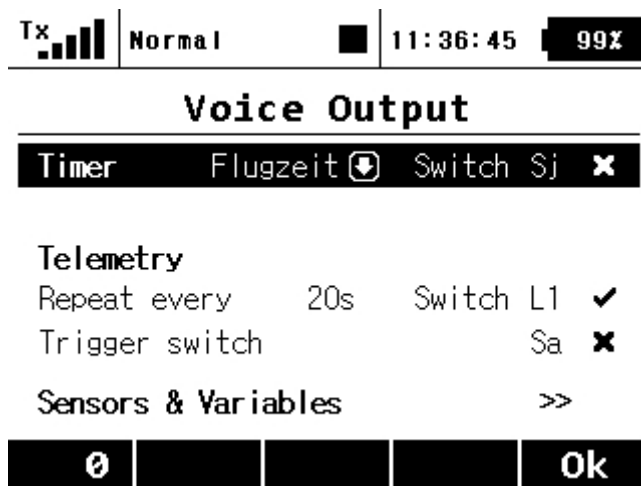
Opt. ← → Start Clr

Note:

The **Clr** key (F5) resets the min/max values. The **right/left** arrows are used to scroll the pages.

6 Voice outputs with DC/DS-16

6.1 Configure announcements via the voice output menu



Under the menu point **Timers/Sensors** select **Voice output**.

Citation from Jeti DC/DS-16 manual FW2.00 p.102
“Voice output for telemetry

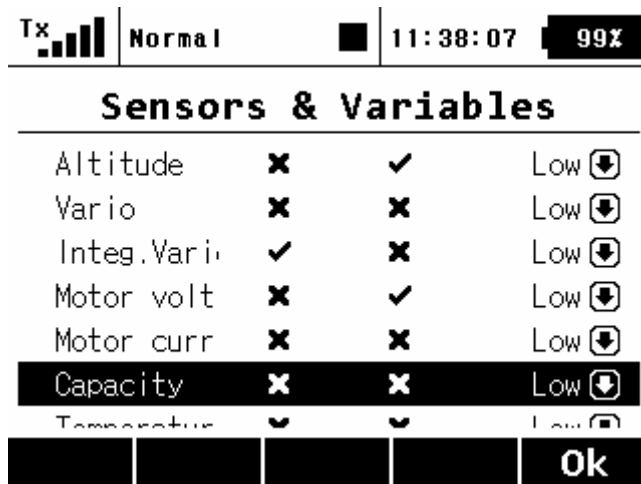
There are two independent queues dedicated to output telemetry values. The first queue repeats its message every x seconds (number of seconds elapsed is displayed over the F(1) button). You can also assign a switch to enable or disable the repeating of the countdown.

Every time this switch is activated, the appropriate variables are reported by voice and then the countdown starts a new round until a timeout is reached.

The second voice queue specifies which variables are reported only once, after a single press of a switch. You can select a trigger switch and a list of variables that are reported when the switch is activated.“

Note:

The integral variometer value is here set to the interval of 20sec.



The trigger switch e.g. to altitude, power system voltage and capacity

Important:

How single values can be selected for announcement either once or constantly via various keys and switches is described in the chapter „Configure alarm announcements“ A higher flexibility is given to the selection of voice announcements set onto particular switches.

Note:

In the right column the voice output order can be influenced according to the priority settings.

6.2 Configure alarm announcements



Alarms			
1	Voltage Rx	X < 4.90V	✓
2	Altitude	X > -400.0m	✓
3	Motor volt.	X > -10.0V	✓
4	Temperature	X > -50.0°C	✓
5	Motor volt.	X < 19.0V	✗
6	GPS speed	X > -10m/s	✓
7	Distance	X > -2m	✓

Add Del. Edit Ok

Under the menu point **Timers/Sensors** select **Alarms**.

Next to the standard announcements of values in the voice output menu single values can be announced by setting alarms triggered by dedicated buttons or switches

2 different approaches:

- 1- alarm set as an alarm - e.g. RX-voltage below limit
- 2 - announcement of an actual value for information triggered manually

Example: altitude announcement



Alarm	
Sensor	Altitude [m] ↓
Enabled	✓
Condition	X > ↓ -400.0m ↓
File	... ↓
Activation Switch	Sk ✗
Repeat	✓

▶ ■ Ok

Sensor value altitude

Set as active.

In altitudes higher than -400 m an alarm is being generated which means this alarm is almost always on. The announcement „altitude“ could further be selected under „File“. This has been neglected as the type of announcement is known when manipulating the relevant switch.

In this example the Sf switch -which ideally is a momentary (spring loaded) or toggle switch- has been selected as the activation switch.



Alarm	
Condition	X > ↓ -400.0m ↓
File	... ↓
Activation Switch	Sk ✗
Repeat	✓
Announce current value by voice	✓
Set Throttle Idle	✗

▶ ■ Ok

Note:

As long as the function is active the actual values will be announced.

A brief tip on the key or toggle switch generates a single announcement.

Important:

The voice output for the actual value must be set.

This method can be used accordingly for all values like speed, distance, etc...

7 Setup and data control in the Jetibox menu

Setup of the current sensor and pitot sensor can be done here.

Moreover control of sensor data is possible in three further screens.

Tx Normal 11:41:26 99%

Jetibox

LinkVario EX
V1.01 Setup v

Ok

Tx Normal 11:41:33 99%

Jetibox

Current se. type
< 150A >

Ok

Tx Normal 11:41:39 99%

Jetibox

Pitot sens. type
250km/h >

Ok

Tx Normal 11:41:45 99%

Jetibox

2.4m 0.08m/s
10.10V 511mAh

Ok

Tx Normal 10:24:43 100%

Jetibox

75.6A 4.90V
15.8°C 30 kmh

Ok

Tx Normal 10:24:53 100%

Jetibox

GPS-B N4743.412
GPS-L E00928.462

Ok

Main screen

Under the menu point **Applications** in the transmitter select **Jetibox**. Then with the right arrow keys go to M and then with the down arrow select **LinkVario**.

Press up/down keys to move between the pages.

Page 2: Select current sensor type

Select the type used by scrolling with the right/left keys.

(Default 150 A)

Page 3: Select the measuring range of the pitot sensor

Select the used measuring range of the sensors' value (250/450 km/h) by using the right/left keys.

(Default is 250 km/h - set the sensor accordingly with the solder bridge - explained in the sensors manual)

Page 4: Sensor values 1

rel. barometric height	variometer signal
Power system voltage	used capacity of power system

Page 5: Sensor values 2

Engine current	LinkVario supply voltage
Temperature	Pitot speed

Page 6: GPS coordinates

When a GPS module is connected to the LinkVario the GPS coordinates are shown here to check GPS activity.

In this example a GPS is connected to the LinkVario.

8 General information about the variometer and altimeter function

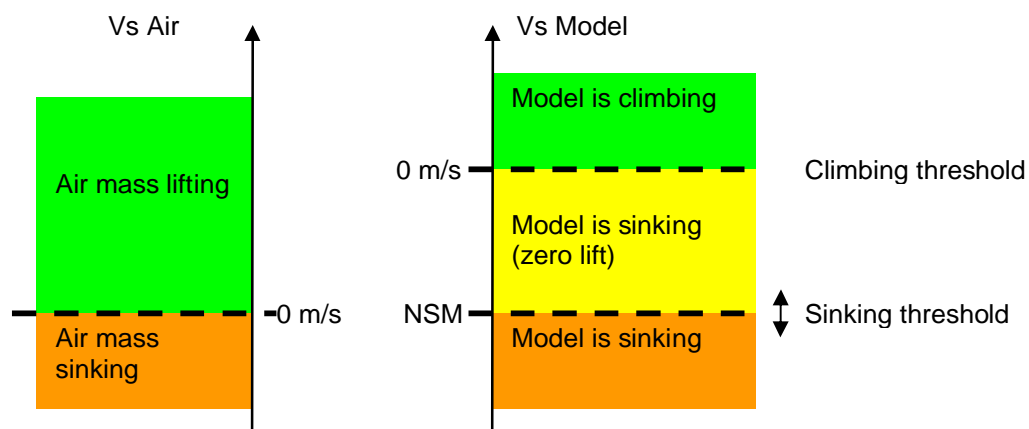
To measure the altitude a temperature compensated and calibrated pressure sensor is used.

Because the static pressure decreases with increasing altitude this physical effect is being used for the altitude measurement and the derived variometer signal. Therefore the variometer signal indicates a change of pressure within a defined time interval (m/s).

In the JETI DUPLEX EX transmitter the variometer signal is converted into a corresponding sound –the variometer acoustic. Altitude changes of only a few cm can therefore be recognized through a sound changing almost without any delay. The pleasant and proven sound characteristics of the wsTech variometers are found here as well.

Just like for full scale soaring sinking generates a continuous tone which decreases in frequency with increasing sink rate. Climbing on the opposite generates an intermittent tone with increasing frequency for increasing climb rates. In case of an increasing climb rate you would therefore hear: beeeep, beeeep, beep beep, bip, bip, ...and so on.

Face to face are two scales, one showing the vertical movement of the air (Vs air) and the other showing the vertical speed of the model (Vs model). Both scales are offset against one another by the value „NSM“ („Ve“) representing the nominal sinking rate of the model. Depending on the model the “NSM” is about -0,5 m/s to -1 m/s. You can see 3 regions and 2 thresholds which are interesting for soaring. The **climbing threshold** indicates real climbing of the model. The **sinking threshold** indicates sinking air mass. In between the model also sinks (still) but you can notice that the air mass is already lifting. This area is called the **zero lift area**.



Particularity of the three different variometer sound schemes

It is very important for the pilot to know in which of these three areas he actually is. In order to distinguish these three areas three different tone schemes have been set up. The zero lift area is particularly valuable.

The sinking below the sinking threshold is indicated as usual with a continuous tone the frequency of which becomes lower at increasing sink rate. Climbing is always indicated with an intermittent tone the frequency and pulse rate of which increases with increasing climb rate.

In the zero lift area you will hear no tone.

This way real climbing, start of climbing within the zero lift area as well as sinking can easily be distinguished one from another.

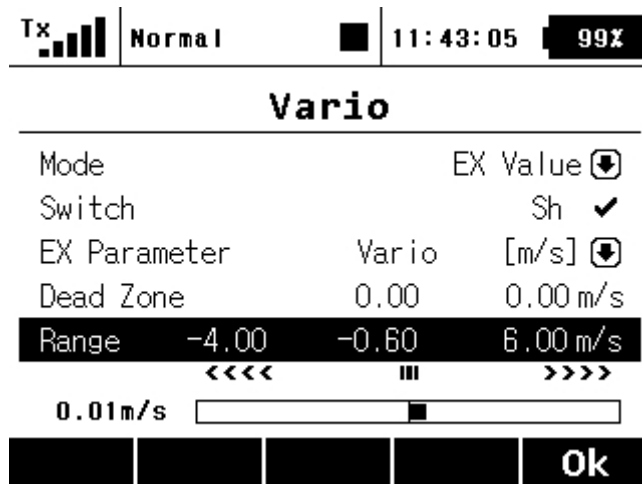
This particularity has been adopted from wsTech variometers by Jeti for the transmitters.

Nonetheless the thresholds are configurable per model by the user in the vario menu.

8.1 Sinking threshold and zero lift suppression in the Vario menu of the DS/DC-16

8.1.1 Variometer settings for an indoor test

To get a first impression of the sensitivity of the LinkVario it is recommended to use the following setting with sinking threshold at 0 m/s in the menu Vario under Timers/Sensors.



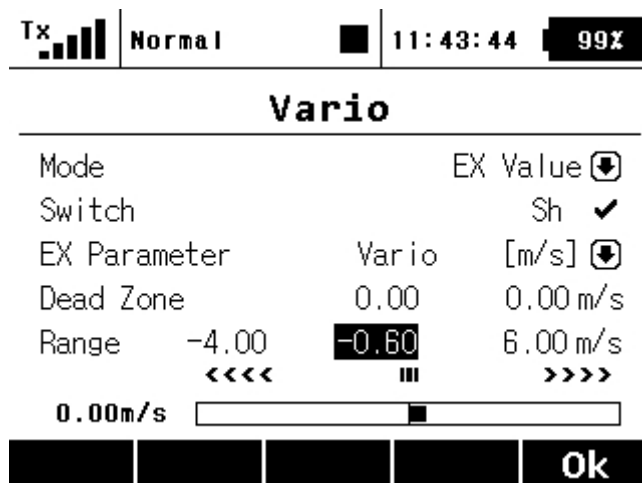
Note

- A **sinking threshold of 0 m/s** only makes sense when testing the variometer as to its stability and sensitivity.

8.1.2 Vario menu settings of the sinking threshold (without zero lift suppression)

The **sinking threshold** can be adjusted to the normal sinking rate of the model. In this example a value of around **-0.5 m/s** depending on the model is being suggested for the first flights. This means that the continuous sinking tone starts turning into an intermittent climbing tone as from -0.5 m/s.

Some helpful tips and explanations can be found on the homepage www.wstech.de under **Variometerkunde (in German)**.

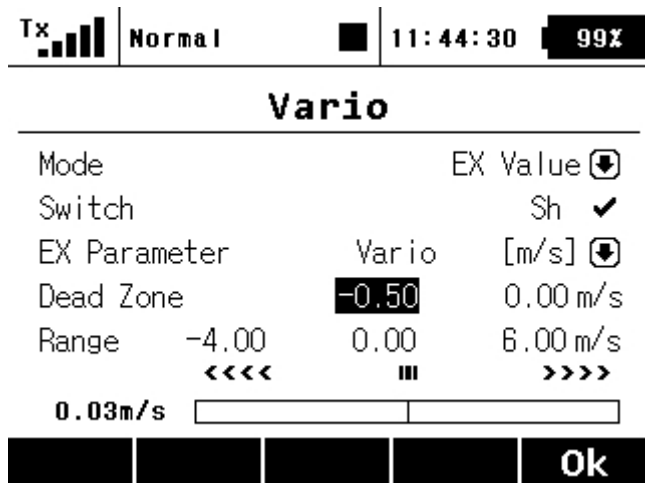


8.1.3 Vario menu settings with zero lift suppression

When a zero lift suppression is intended between e.g. -0.5 m/s and 0 m/s it can be obtained with the settings below. The sinking tone can even be suppressed completely by using an adequately large negative dead zone.

- **Drawbacks of the zero lift suppression**

When the vario sound is suppressed i.e. the variometer stays mute e.g. in a frame between 0 m/s and -0,5 m/s the pilot may glide in weak lifts without noticing it.



8.1.4 Vario menu settings with total suppression of the sinking tone

The sinking tone can be suppressed completely by setting an adequately large dead zone e.g. from -0.5 to -4.0 m/s.

- **Drawback of the sinking tone suppression**

Increasing downdraft areas during flight are not acknowledged.

8.2 Integral variometer function

The integral variometer is an ideal add-on for the variometer acoustic which indicates the actual sinking or climbing instantly whereas the integral variometer is continuously indicating the average value of climbing or sinking within the last 20 seconds.

This function is particularly helpful while thermalling and centering a thermal.

Experiencing with this function you will soon be able to recognize downdraft areas and decide between weak thermals and good thermals especially when they are very narrow.

Since the integral variometer function does the computation for you in its regular interval it is freeing brain resources.

Patience and calm weather conditions presumed the minimal sink rate for various flap positions can easily be determined.

A periodic announcement e.g. every 20 sec can be configured via the menu point **Timers/Sensors** and Voice **output** - see Chap. 6.1.

8.3 LinkVario supply voltage and alarm

The supply voltage of the **LinkVario** is continuously observed and sent to the transmitter as parameter **Ub-Vario**. In systems with regulated RX power supply the **LinkVario** can be supplied directly from the RX battery (up to 10V) to monitor its voltage.

Announcement and alarm can be set in the **Alarm** menu of the transmitter.

8.4 Total energy compensation (TEC)

With the LinkVario it is possible to connect a TEC tube (Total Energy Compensation). This technique has been adopted from full scale gliders. The tube is usually mounted to the vertical stabilizer and is connected to the TEC port of LinkVario with a flex tube.

The TEC tube has the advantage to compensate user induced altitude changes and therefore to only indicate real climbing.

More info can be found on www.wstech.de under "TEK-Kompensation" (only in German).



Note:

Tips and explanations about the TEC can be found under **Variometer-Kunde** and **TEK Düse** on the Homepage www.wstech.de.

The use of the TEC tube is highly recommended to any ambitious pilot because it considerably facilitates distinguishing real climbing from user induced climbing.

A drawback of the TEC tube is the speed induced indication errors of altitude (approx. 15 m in normal flight). This can be avoided by using the **LinkVario Duo** which has a second pressure sensor (1 for altitude & 1. for Vario).

8.5 Accuracy of the altitude measurements

Since the LinkVario uses a pressure sensor for altitude and variometer signals the quality of results is influenced by various factors. Pressure changes for instance due to weather changes are causing errors of altitude indications. In less than an hour pressure changes of 1-3 hPa (mBar) can occur causing indication errors of about 10 to 25 m. 1 mBar corresponds to approx. 8 m.

Speed induced pressure changes in the fuselage can also cause slight indication errors. Values of +/-10 m have to be considered as normal and are neglectable in practice.

These indication errors can be checked by manually calling the altitude announcement when flying 1-2m above starting point compared to a further call just after landing.

When using the TEC tube with the **LinkVario** slightly increased altitude is being measured. This results from the fact that with the TEC tube total energetic altitude of the glider is measured which consists of the actual altitude + the kinetic energy of the glider. In normal flight though (with approx. 15 m/s) this additional portion only represents about +15 m.

To obtain a speed independent altitude indication while using a TEC tube it is recommended to use the **LinkVario Duo**.

9 Using the optional GPS module or pitot speed sensor

In combination with the LinkVario the GPS II module from wsTech enables indications of speed above ground, course, distance, direction and position of the model

9.1 Instructions for the installation and use of the additional GPS module

The GPS II module is to be connected to the **GPS** port of the **LinkVario**.

The GPS II module also gets the required electrical supply over this cable

The aerial of the GPS II module must have an unobstructed view of the sky. This means that the top of the module is not to be shielded by conductive materials. A greatest possible angle must remain open as that the aerial should also capture satellites close to horizon

The GPS II module can therefore not be used behind carbon fiber laminate or metal coated laminate.

Perhaps a fiberglass window of about 3 x 3 cm needs to be laminated into a carbon fiber canopy. Another solution would be to order the canopy from the model manufacturer in a version made out of fiberglass without any metallic coating, Laminates made of pure fiberglass or aramid fibers however do not cause any problems. No problems either with canopies made of Plexiglas.

The GPS II module should not be placed at the bottom of the fuse but highest possible above the cabling in order to get an unobstructed view of the sky. The flat top should be aligned as parallel to the lateral and to the transversal axis of the model as possible.

- When the GPS II module is being switched on at a new location it may take a few minutes before the GPS module is ready. Exceptionally it may take up to half an hour when only few satellites are visible at the time.
- The GPS II module is ready when the green LED in the module starts blinking once a second. Without reception the green LED is lit continuously.

The GPS module calculates the 2D speed above ground. A horizontal flight of only one second is enough to be able to measure the speed. The GPS receiver will provide accurate measurements if you avoid too steep dives followed by abrupt changes to horizontal flight. If you do not avoid that it may happen that the GPS module delivers *indication errors* because with suddenly changing viewing directions it captures other satellites. This would also be the case when flying steep turns or aerobatics.

9.2 Mounting example for the pitot speed sensor

In order to measure the true airspeed (TAS) the pitot speed sensor from SM-Modellbau is required. It can be connected directly to the LinkVario.



Here a mounting example for the Antares M1:3

The **wsTech TEC Pro tube** at the top and the pitot speed probe from SM-Modellbau below.

The pitot sensor is fitted into the vertical tail plane.

This way the two connection flex tubes between pitot tube and sensor are optimally short.

An easily fitted extension cable to the cabin will enable the connection to the LinkVario pitot port.

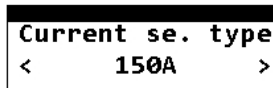
10 Electric power system measurements

In connection with the sensors

- Current sensor from SM-Modellbau. All types with measure range of 20 A, 40/80 A, 150 A and 400 A are supported.
- Temperature sensor from SM-Modellbau (optional)

10.1 Setup of the current sensor in the LinkVario

The current sensor type used must be configured in the transmitter via the **Jetibox** menu under **System settings**. In the **default settings** the **150 A sensor** is activated. Alternatively the 20 A, 40/80 A or 400 A sensor may be selected in the LinkVario setup.



Current sensor type: 20 A, 40/80 A, 150 A or 400 A

10.2 Engine supply voltage alarm

This function is only available while using the current sensor from SM-Modellbau.
A low voltage alarm threshold is being set in the **Alarms** menu of the transmitter

10.3 Power system capacity alarm

This function is only available while using the current sensor from SM-Modellbau.
When trespassing the alarm threshold for the power system capacity set in the **Alarms** menu an acoustic alarm will be triggered.

10.4 Used capacity takeover

This function is only available while using the current sensor from SM-Modellbau.
When the power system battery is meant to be used beyond the last flight it makes sense to takeover the used capacity from the last flight.

10.4.1 Automatic takeover of the used capacity

When the LinkVario detects a power system supply voltage of 2% less than at last connection it assumes that the measurement comes from the last flight and the battery was not replaced. The last value of used capacity will be taken over. The value will be visible on the display.

10.4.2 Delete the used capacity takeover

If you do not want the taken over value of used capacity you must switch the LinkVario off and on while using the identical power supply batteries. Each time an identical battery voltage is being detected the capacity value will be reset.

10.5 Temperature alarm

This function is only available while using the temperature sensor from SM-Modellbau.
This function is ideal to control the temperature of the power system batteries or of the E-engine. Announcement and alarm can be set in the **Alarms** menu of the transmitter.

10.6 Electric power system climb rate measurements

In order to calculate the climb rate the actual altitude is being stored in the LinkVario upon **starting the engine** (current > 5 A)

After **switching the engine off** (current < 5 A) the average climb rate will be calculated from the difference in altitude and the runtime of the power system. For about 5 seconds this value will be sent to the transmitter instead of the integral variometer value.

Thus for 5 seconds after switching off the engine the pilot has the opportunity to obtain the **climb rate** for this climbing via an announcement of the integral variometer value.

This value enables fast optimization of the power system components of E-gliders.

11 Control of a switch (Test switch)

One switch (test switch) at plug C (control channel) of the LinkVario enables the control of a switch contact. It is for instance to be used for self launch systems, landing gear, etc. to control their position. Announcements depending on the position of switches may be configured in the **Alarms** menu.

Important: The switch contact is not to be connected to any other electrical potential.

Function:

Contact between pulse (left pin) and ground (right pin) closed gives a test switch value of 0

Contact between pulse and ground open gives a test switch value of 1

12 Indications for the use of the LinkVario with sensors

Temperature

Sensor unplugged 0°C will be displayed.

Pitot speed sensor

The default configuration of the pitot sensor is at **250 km/h**. This way it will work with the LinkVario until over 350 km/h.

If the measuring range of 450 km/h is being selected at the pitot sensor via the solder bridge and set in the LinkVario setup velocities up to 600 km/h can be measured.

13 Calibration of the LinkVario

A calibration is normally not required. On a windy day climbing variations of up to +/- 0,20 m/s are quite usual. This is caused by pressure changes.

Calibrations are not recommended on days which are not absolutely calm (windless).

Subsequent calibration is done with two jumpers which shorten the pins marked with a dot and a plus at the pitot speed sensor and the temperature sensor ports.

1. Switching on the LinkVario with jumpers installed will start the calibrating routine.
2. Important: wait a minimum of 40 seconds before moving the LinkVario again!
3. After that time remove the jumpers.

Important: During calibration the LinkVario is neither to be touched nor moved. Furthermore you should avoid changing penetration of light into the pressure sensor port while calibration is ongoing. To do so it is recommended to turn the device so that the pressure port faces the table.

14 Range test of the remote control

A range test of your remote control should be a standard procedure for a new model or after having effected major changes: So little time after so much effort just needs to be spent.

Even changes of the electric installation can have an influence on the 2,4 GHz devices.

Please do your range test strictly and conscientiously according to the instructions of your remote control.

15 Update via USB interface

The LinkVario can be updated to the latest firmware via the USB interface cable (identical with the UniLog/UniSens USB cable from SM-Modellbau, Order No. 2550).

The drivers for the USB interface cable must be installed according to its instructions. The links to the drivers as well as the instructions can be found on the homepage of www.sm-modellbau.de. You must use these drivers as drivers from e.g. FTDI cause problems.

The links to the drivers can also be found on the homepage of www.wstech.de > **User Info LinkVario**
The update is done via the port of the **GPS module**.

Important notice:

- During the **update** the LinkVario must **only be supplied with electricity** – the data line (orange) must remain open.
- The LinkVario is not to be connected to the receiver.
- It would be ideal to use the receiver battery with a switch as electrical power supply in order to be able to stick to the required timely course of action.
- System requirements: Windows XP, Vista, Win7.

Firmware

The two firmware files are to be found in the LV_Jeti_EX_xxx.zip. They first must be unpacked and saved on the computer.

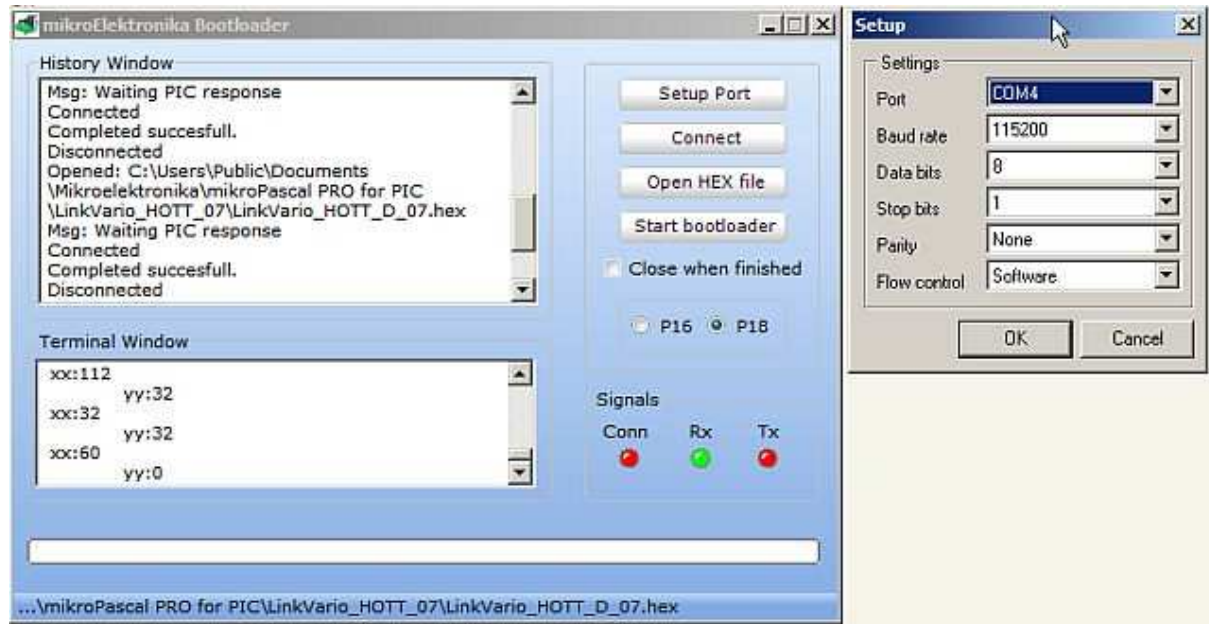
Important: The LinkVario has an own firmware: LV_Jeti_EX_Nxxx.HEX

The LinkVario **Duo** has an own firmware: LV_Jeti_EX_Dxxx.HEX.

Bootloader program

The **microBootloader** program for the computer can be downloaded from the homepage www.wstech.de > **User Info LinkVario**. Save it to an appropriate folder on your computer.

The **Bootloader program** can be run without previous installation



Update

1. Double-click on "**bootloader.exe**" to start the **microBootloader** on the computer.
2. Click on "**Setup Port**" and select the COM port with the SM USB interface.
3. Make sure the BAUD-Rate is set to 115200 bps.
4. For the selection of P16 or **P18**, the **P18** button must be clicked.
5. Click on "**Open HEX file**" and select the appropriate HEX file you want to install on the LinkVario.
Important: The LinkVario **Duo** has an own firmware: LV_Jeti_EX_Dxxx.HEX and for the standard LinkVario it is LV_Jeti_EX_Nxxx.HEX.
6. The **bootloader** in the LinkVario is only available in the first 5 seconds after switching on the device. After that the operating program will be launched.
7. To obtain a connection you must click the "**Connect**" key in the bootloader **within the first 5 seconds** after powering on the LinkVario. As the timely course from switching the unit on and connecting with the bootloader is slightly critical the process may have to be repeated a few times until the program states "connected".
8. In the last line of the history window you will read „connected“ if the connection has been successful.
9. To start the upload, simply click on the "**Start bootloader**" button.
10. The upload normally takes about 1.5 minutes.
11. Once the upload has successfully ended, unplug the USB interface cable from the unit and connect the latter again as usual.

Notice:

- If required new firmware will be sent by mail upon request.

16 Disclaimer / Compensation

The adherence neither to instructions for installation and use nor the conditions and methods of installation, operation, use and maintenance can be supervised by wsTech.

Therefore wsTech will not assume any liability for losses, damages or costs associated or resulting from faulty or inappropriate operation and use.

To the extent permitted by law, any obligation irrespective of their legal grounds, for wsTech to pay compensation, is limited to the invoice value of the items from wsTech directly involved in the damage causing incident.

The device is only to be operated for the use described in this instruction manual.

17 Warranty

The warranty is 2 years from the day of delivery and is applicable to the functions of the device described in the manual. The warranty refers to occurring defects caused by manufacturing or material defects. All further claims in particular for personal injuries and material damages and their consequences are excluded. Damages resulting from inappropriate handling are not covered by our warranty. The item for which a warranty claim is made must be sent to wsTech with a copy of the invoice and with sufficient postage.

18 Disposal note



Waste equipment marked with the above symbol is not to be disposed of with domestic waste. Send your old device back to the manufacturer to enable an environmentally friendly disposal.

19 Safety information

The device must only be used for the purpose described in the instruction manual. Please also follow the safety information and instructions for the use of accessory equipment connected to the device. The manufacturer does not assume liability neither for damages caused while using the device nor for third party claims.

20 Trademark

JETI DUPLEX EX is a trademark of the company **Jeti www.jeti-model.cz**
The items mentioned which are from SM-Modellbau are trademarks of the company **SM-Modellbau www.SM-Modellbau.de**

21 Technical data

Variometer resolution:	typ. 1 cm/s
Variometer stability:	typ. +/- 3 cm/s peak-peak
Variometer data rate:	typ. 8 Hz with GPS 7 Hz (only valid for use without expander!)
Variometer measure range:	max. +10/-5 m/s
Variometer time constant:	typ. 0.5 s
Altitude measurements:	up to typ. 3200 m referenced to sea level
Altitude resolution:	0.1m internal, Telemetry value 1m
Dimensions:	60 L x 24.5 W x 14.5 H mm without TEC port
Weight:	typ. 13 g
Power supply:	4 to 10 V via connection from the receiver
Current consumption:	typ. 15 mA; with GPS typ. 80 mA
Sensor-ID	42020xxxxx

Optional sensors in the LinkVario

Depending on the power system current sensor:	Current measurements up to 400 A
Voltage measurements:	up to 60 V
Temperature measurements with ext. sensor:	-40...125 °C
Pitot speed measurement with dynamic pressure tube:	up to 350 km/h in the measurement range of 250km/h; up to 600km/h in the 450km/h measurement range of the sensor.

Manufacturer data is valid and applicable - please read under www.SM-Modellbau.de

Speed measurement selectable with GPS II module and/or pitot speed sensor.
With GPS II module GPS display of location, course, GPS altitude, distance and direction to the model.

Remark: The use of the LinkVario for the JETI DUPLEX EX system is only possible in combination with this system – it does not work with 2G4 systems of other manufacturers.

22 Declaration of conformity



Variometer

Hardware and software development

EG – conformity declaration



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

I declare that the product

Model aircraft variometer
LinkVario

referred to in this declaration complies with the following directives and standards.
R&TTE Directives 99/5/EG Norm: EN 300 220 - 1

This declaration is made by Wolfgang Schreiner wsTech.
Oberteuringen 1.2.2012

A handwritten signature in black ink, appearing to read 'W. Schreiner'.

wsTech Wolfgang Schreiner