

## Description of the serial data stream coming out of the Borgelt B50/B800 variometer

The serial data stream out of the Borgelt variometer consists of 3 NMEA sentences sent every second (frequency: 1 Hz)

\$GPGGA	Standard NMEA GGA message
\$GPRMC	Standard NMEA RMC message
\$PBB50	Proprietary Borgelt NMEA message

The messages are sent with a comma (,) as separator and numbers have a dot (.) as a decimal separator.

### Field description of the \$PBB50 message

Borgelt uses knots for all velocities and feet for all heights.

The \$PBB50 message consists of 10 (ten) fields and a standard checksum

<b>Field</b>	<b>Description</b>	<b>Format</b>
Field 1	NMEA Header	\$PBB50
Field 2	TAS (Knots)	###.#
Field 3	Vario (Knots)	###.#
Field 4	MC (Knots)	##
Field 5	IAS squared (Knots <sup>2</sup> )	#####.#
Field 6	Bugs	##
Field 7	Ballast ratio	###
Field 8	Cruise/Climb Mode	#
Field 9	OAT (Celsius)	###.#
Field 10	Static (Pressure) height	###*HH (*HH = checksum)

### Comments about field 5: IAS squared

The indicated airspeed is passed as a squared number for legacy reasons. Simply take the square root to get the correct number (IAS).

### Comments about field 6: Bugs

To get the efficiency number used in LK8000 simply calculate (100 – bugs) and convert to percentage if necessary.

## Comments about field 7: Ballast ratio

In LK8000 we define ballast as a percentage of the max water ballast the plane can load. Internally the Borgelt variors handles ballast in exactly the same way, but for legacy reasons, Borgelt passes the number as a ratio. I managed to get hold of the actual code, and dug out the exact calculations.

In our (LK8000) polar files we have as field 1 the gross weight of the glider,  $w_{gross}$ , and as field 2 the max water ballast the glider can load,  $w_{max\ ballast}$

If we call the current percentage of water loaded to the plane  $\alpha$ , the Borgelt ballast ratio is calculated as:

$$Ballast_{Ratio} = 1 + \alpha \frac{w_{max\ ballast}}{w_{gross} + w_{max\ ballast}}$$

This is indeed a bit unusual, but never the less how it is calculated and passed for legacy reasons.

If we want to isolate  $\alpha$  (the ballast number used in LK8000), we can rearrange the equation:

$$\alpha = (Ballast_{ratio} - 1) * \frac{w_{gross} + w_{max\ ballast}}{w_{max\ ballast}}$$

In LK8000 we can specify the water ballast in increments (steps) of 5%. In the Borgelt variors, the water ballast is specified in increments (steps) of 10%.

Due to possible smaller differences in gross weight of the glider and max water ballast between the polar in LK8000 and in the Borgelt vario, I suggest a rounding routine to the nearest 10% applied after the above calculation of  $\alpha$ . (Bear in mind, that Borgelt uses 10% increments).

In the attached log file of the serial output from the Borgelt vario the following values were registered (used) in the Borgelt vario:

Gross weight of the glider ( $w_{gross}$ ):	350
Max water ballast ( $w_{max\ ballast}$ ):	175

## Comments about field 10: Static (Pressure) height

The height is passed rounded to the nearest 100 feet and concatenated with a "\*" together with 2 hexadecimal characters as checksum.

/Soren Braes, 12-08-2021