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User Guide

Guide to the use of this instrument as a variometer and as a flight computer

THGF Variometer/flight computer Manual

# Table of Contents

---

## General

If you do not see a variometer screen on your aircraft:

### What is a Variometer?

What are the Buttons?

What are the Pages?

## Variometer Page

Basic Screen Layout

The Analog Compass/Wind/Vertical Speed area

Analog Compass

Analog Variometer

Vertical speed type

Vertical Speed (raw data)

Variometer (as defined by MSFS 2020)

NETTO (as defined by MSFS 2020)

Total Energy (as defined by MSFS 2020)

Wind direction indicator.

Waypoint direction indicator (\*optional).

The vertical bar that indicates speed and critical speed data.

Data fields

Changing data fields within page group

Switching data groups

WHERE YOUR CUSTOM DATA TYPE CONFIGURATION IS STORED

The Waypoint left/right indicator.

## Moving Map Page

Quick Access to the map

Zooming In/Out on the map

Orientation

When to use the moving map

Cylinder Types

Line Types

Changing Map Types

Changing Color Types

Changing altitude lines

Toggle Lines

Task / Course display

Toggle Data overlay

Wind direction and speed

## **Last Flight data page**

## **Variometer Settings Page**

## **Task Page**

What is a task file?

Clearing the last task

Choosing a task

Paging thru the task list

Task file directory

## **Waypoint Page**

Choosing a waypoint

Skipping a waypoint

Marking a waypoint as complete

Marking a waypoint incomplete

## **Tone Settings Page**

## **Speed Settings Page**

MacCready Settings

Vario Type

## **THGF Variometer About Page**

Aircraft Type

Aircraft Model

Variometer Version

Launch Location

Weather Information

**Index**

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## General

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This document is a guide to using the THGF variometer/flight computer.

This is the only flight instrument to be used on hang gliders of any kind built by The Hang Gliding Files. Every aircraft we build will share this common code and feature set. In this way, we reduce the all the code to one common element. This makes it easier for us to upgrade and fix the code because it is not duplicated across many aircraft.

The variometer is installed as part of the WIDGET. If you do not have the WIDGET installed, you do not have access to a working variometer.

All gliders marked as STAND ALONE do not have access to the variometer as they are not dependent on the WIDGET being installed and can operate (*fly anyway*) without the widget being present.

## If you do not see a variometer screen on your aircraft:

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This error condition is created when:

1. You are flying a STAND ALONE version of a glider. Standalone gliders cannot have a vario. That is why they are standalone!
2. You have not installed the WIDGET in the community folder. All gliders share 1 common variometer and that code is shared from the widget.
3. You have an invalid version of one of our Glider Models.

## What is a Variometer?

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A variometer is simply an instrument for providing soaring information to a pilot. It is not like most aircraft instruments you find in simulator aircraft such as a compass, airspeed, or attitude controls. This instrument attempts to present all

possible information using a single screen on a single instrument. This necessitates that the flight information is presented in a form different than most instruments.

It is also an instrument that provides flight information using sound. This is the most important information that the variometer can provide: Lift and Sink information. The instrument will provide different sounding tones for lift and sink and in varying levels of volume based on the strength of the lift or sink. This allows the soaring pilot the ability to remain focused to the outside world while still being able to get the most important information without having to look at the instrument.

## What are the Buttons?



**There are 12 buttons on the face of the variometer.**

We will discuss what these buttons do in each of the following page sections.

Just know that not all buttons do something on every page and that some buttons do different things on different pages. For this reason, you need to understand what you should expect from them on each page to use the vario effectively inside MSFS 2020 while soaring.

Buttons can be activated using your mouse while flying inside the MSFS 2020 simulator.

## What are the Pages?

The variometer has just 1 LCD screen to display information on and that is too small to show all possible information you may be looking for.

To get the most out of our 1 page of information display, we need to organize the information into logical pages or general categories of information.



The easiest way to change pages is to use **the F1 button**. This button is always active so you can use it on any page. This button will move from page to page. Simply keep pressing until you get to the page you want.

### Pages:

- Variometer Page
- Moving Map Page
- Flight Data Page
- Settings Page
- Available Tasks Page
- Waypoints Page

- Tone Settings Page
- MacCready Speed Settings Page.
- About Page

We will instruct you on how to use each of these pages on your variometer/flight computer.

## Variometer Page



The variometer page is the main page that you will be using when flying! It contains a great deal of information and can be complex to understand how to use it correctly. We will explain all the active parts of this page so that you can use them to not only help you stay up and soar, but also to navigate to a goal if that is something you are trying to do.

### Basic Screen Layout

The screen is basically 4 parts:

- The Analog Compass/Wind/Vertical Speed area.
- The vertical bar that indicates speed and critical speed data.
- The Data fields.
- The Waypoint left/right indicator.

Find and identify these areas so that you can easily interpret the information found in each area immediately.

### The Analog Compass/Wind/Vertical Speed area



This is one of the most important information displays on the vario!

It has a lot of information that is packed into a very small space.

In the center of this area, you will see the outline of an aircraft. This aircraft represents you and is always pointing up. All the other information displayed will be displayed as information relative to your forward-facing position.



The color of this aircraft conveys some information about the state of your flight!

- **Dark green** = on the ground and not flying
- **White** = your flight has started, and instrument will start the logbook record.

## Analog Compass

The analog compass will show what direction you are flying, and, in the example, we are flying in an SOUTH WEST direction.

## Analog Variometer

The analog variometer (amount of lift or sink speed) is displayed as a moving ARC that surrounds the analog compass. The units of measure and/or scale of this ARC change with the values you have defined on the settings page.

**The ARC visually shows you:**

- **GREEN** = LIFT
- **RED** = SINK

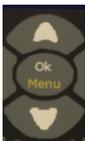
**The Sound/Tone you hear from the variometer is an audio version of the information you see in this arc.**

## Vertical speed type

The speed information used to calculate the ARC is based on basic vertical speed information supplied by the simulator. However, there are several modes that modify this information, and you can use them as you wish.



The active vertical speed calculation type is shown just under the aircraft icon.



You can change the calculation type by using the **UP and DOWN** arrows on this page.

## Vertical Speed (raw data)

## Variometer (as defined by MSFS 2020)

## NETTO (as defined by MSFS 2020)

## Total Energy (as defined by MSFS 2020)

The units of measure and scale of the vertical speed does not change with the type. The type only changes what information data is to be displayed.

### Wind direction indicator.



The wind direction indicator is the red arrow.

Wind direction is always shown as a relative position to your current glider position. It is always pointed at the glider.

### Waypoint direction indicator (\*optional).



The waypoint direction indicator is the green arrow.

The waypoint direction indicator points the direction you should go to get to the current waypoint in the task you are flying. This indicator is not active if you are not flying a task on this flight.

Tasks will be further explained by this document in more detail on the **Task Page** and **Waypoint Page** sections.

## The vertical bar that indicates speed and critical speed data.



Airspeed bar graph information

All airspeed data are displayed in the units of measurement defined in the Settings Page.

The digital airspeed is shown at the top of the page.

The analog airspeed is shown in bar graph form on the right-hand side of the page.

**\*\*Critical Airspeed Values\*\*** Every aircraft has specific airspeed parameters that pilots should be aware of. These are marked on the vario the color-coded arrows found beside the bar graph. These definitions for these values are different for every aircraft and the variometer will adjust automatically to each glider it is being used in.

- **YELLOW** = stall speed
- **WHITE** = best glide or L/D speed

- **RED** = never exceed speed

## Data fields

This is the most complicated area of the variometer screen, and it is all the data fields you see displayed.

There are **6 groups of data fields**. Each group can show **7 data fields at one time**.

### Changing data fields within page group

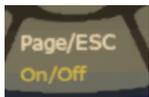
Each group position can be configured to display any data field, in any order. This makes these data fields groups completely user defined. How you set up your groups will be consistent and saved between flights and even different gliders.

There are **53 different data types you can select from**. See data type index at the end of this document to see all the possible types.

You can cycle through a data type by simply **CLICKING THE MOUSE** on the data area. Doing that will cycle that data area to the next type. Repeat until you have the right data type in the right area for you.

### Switching data groups

You can easily switch between groups of data with the mouse.



The easiest way to toggle data groups is to use **the Page/ESC key**.

Or you can go directly to a specific group of data using specific buttons (*only on this page*).



- Free Flight



- Start Gate



- Waypoint

- Goal



- Thermal

- AAT

## WHERE YOUR CUSTOM DATA TYPE CONFIGURATION IS STORED

Your personal data configuration is saved in the PACKAGES folder for the widget in the community folder.

C:\Users\**<YOUR NAME HERE>**\AppData\Roaming\Microsoft Flight Simulator\Packages\thgf-widget\work

The name of the file is:

**data\_config.JSON**

## The Waypoint left/right indicator.

This control is used to show you if the current waypoint is off to your left or right by some amount.



This control appears on all pages so that no matter what data you are looking at, you can always visually know the general direction you should be flying when flying a task. If you are NOT flying a task this control will show NO WAYPOINT.



You can use the **Left/Right buttons** on this page to move forward or backwards the current active in the waypoint list in the current task.

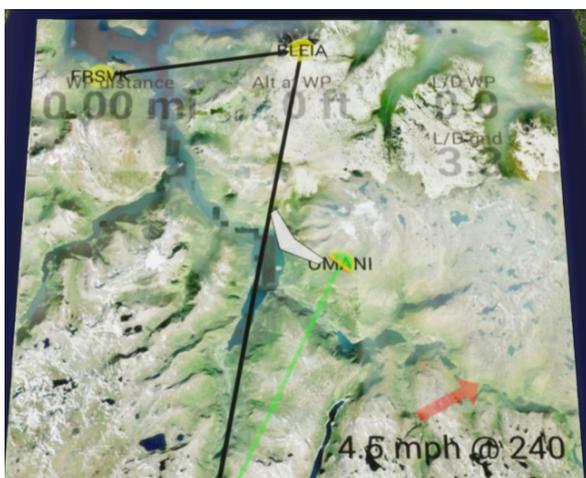
The color of the task name indicates the status of the currently selected waypoint:

- **WHITE** – indicates the last uncompleted waypoint.
- **YELLOW** – indicates an uncompleted waypoint, but it is not the last uncompleted waypoint.
- **RED** - indicates a completed waypoint.

When the bar background turns GREEN, the entire task is completed.

## Moving Map Page

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The moving map page will show your current position on a map. This map will move to keep the glider icon in the center of the map.

## Quick Access to the map



You can quickly switch between the Variometer page and the Moving Map page by using **the OK button**.

## Zooming In/Out on the map



You can ZOOM in or out using the **Left/Right buttons**.

## Orientation

The map always has NORTH at the top. This is not configurable.

The glider icon will rotate and show the glider position relative to NORTH.

## When to use the moving map

The purpose of using this page is to make it easier to find and correctly score or make a waypoint. Because they are visually drawn on the map, you can more easily position and fly your glider relative to these unseen structures. This can be very handy.

When you are close to a turnpoint, this would be a good time to switch to the moving map **(use the MENU button to quickly switch to this page)**.

You can then visually see the relationship between your glider's position and the scoring position and area of the turnpoint.

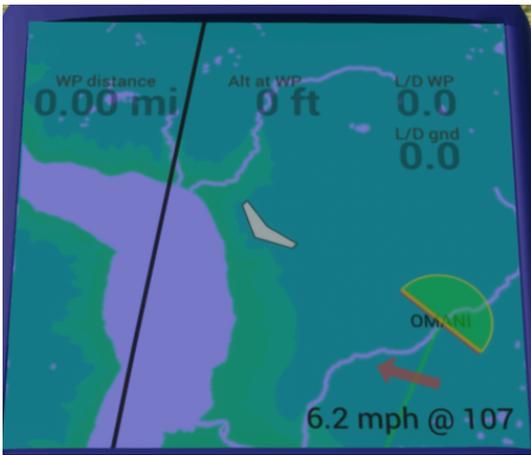
## Cylinder Types

Fly your glider anywhere into the cylinder to score the waypoint. Some cylinder types can be setup as SCORE ON EXIT types. If this is the case, you will get credit for the turnpoint when you exit the cylinder.

## Line Types

To score a line type turnpoint you must fly over the line and in the correct direction. Direction is indicated by the task line(s) between turnpoints.

## Changing Map Types

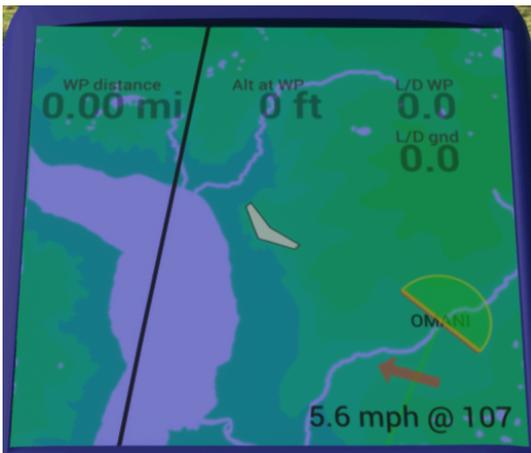


The moving map can display as either a satellite view map or as an isographic map showing lines of altitude.

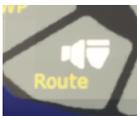


The **WP button** will toggle between map types

## Changing Color Types

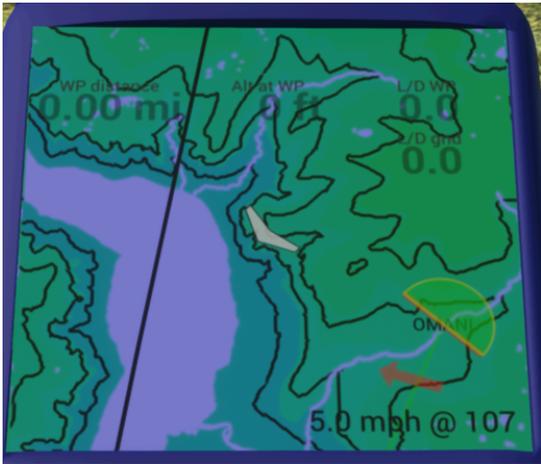


The color scheme showing isographic altitudes can be switched between 2 modes.



The **Route Button** will toggle between altitude color schemes

## Changing altitude lines



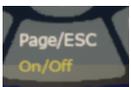
You can choose to have these lines drawn or not. They give a greater clarity to terrain changes but at times might clutter the view.

## Toggle Lines



The **H/Twnd** button will toggle lines on and off

## Task / Course display



The **Page/ESC** key will turn the task display ON/OFF on this page.

## Toggle Data overlay

The page can show 4 simple data fields that overlay the map:

**This includes:**

- **Waypoint Distance.** Useful in gauging zoom.
- **Alt at WP.** Calculate the estimated height you will arrive at the waypoint based on LD.
- **L/D Waypoint.** This is the LD value you need to achieve to reach the waypoint.
- **L/D Ground.** This is the actual LD value you are getting over the ground.



The **GOTO** button will turn these data field overlays ON/OFF

## Wind direction and speed

The wind direction (relative to NORTH) by the red arrow. It will also show the wind direction in degrees and wind speed using the current units of measurement defined in the Settings Page.

## Last Flight data page

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This page shows the summary of information about your last completed flight. It is persistent from flight to flight and represents the data saved into the logbook when you land.

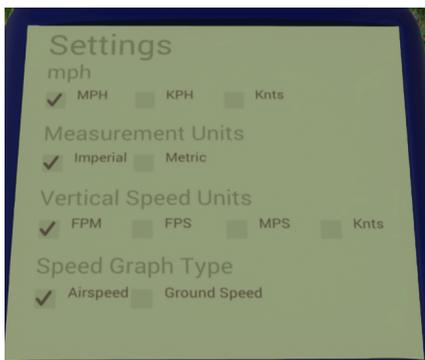
**This page does not show any current information while a flight is active.**

Upon landing, this information will be available as it represents the data being written in the logbook for this flight.

This page will retain this information until a new flight (a launch) has been done and then the flight data is re-initialized.

## Variometer Settings Page

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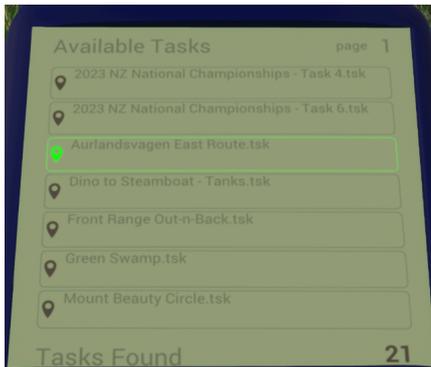


The settings page allows you to set the units of measure that you want the vario to use and display in all data fields or controls.

Any changes made to these settings are seen immediately and are saved and used as your personal default in all gliders.

## Task Page

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The task page will show you a list of all .TSK files that exist in the work directory of the widget. These files can be copied here by hand or can be placed there automatically by using the THGF app.

**The current task** is the task that is highlighted in **GREEN**.

## What is a task file?

Our flight computer can use any XCSOar type task file. These must have the extension of .TSK.

**We do not use the native MSFS 2020 Flight Plan (.PLN) files.** These are not meant for glide computers and are structurally inadequate for this purpose. They also must be loaded prior to starting a flight and XCSOar file(s) can be loaded while in flight! XCSOar tools are also very common and are used in almost all real-life competitions. This allows you easy access to a huge existing library of real life tasks and repositories.

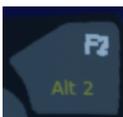
This task file format is very common and easy to produce, find and/or share with other pilots. These task files can be used if they are put into the variometer work directory (*see below*).

You can also create your own task files using the THGF desktop app and that will automatically put your task file into the proper places to be used by the variometer/flight computer. Doing this through the desktop app will also create a site scenery package that will include all turnpoints as points of interest. That makes it visually easy to navigate the course using just VFR.

## Clearing the last task

The last task selected always remains selected. Even if you leave the flight or even re-boot the simulator. This is because things happen from time to time, and this is 1 less thing to worry about as you prepare a flight. You can for example, pre-load the task as your selected task long before you fly a task, and it will be ready to use automatically.

The opposite is also true. Sometimes you want to fly without a task and having a previous task selected just gets in the way as the flight computer will not know any better. In this case, you need to clear the last task.



The **F2** key will clear the currently selected task.



You will not see any task file selected in the list when there is no active task.

## Choosing a task

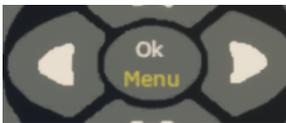
You can select any task to use by just clicking on it with the mouse!

You can also scroll thru the list.



You can use the **Up/Down buttons** to move the current task marker up or down the available list.

## Paging thru the task list



You can use **the Left/Right arrow buttons** to move the page of tasks forward or backwards. There can be only 7 pages of possible tasks. If there are more than 49 task files in the work directory, only the first 49 files will be shown.

## Task file directory

The path to where to put TSK files in the PACKAGES folder for the widget in the community folder.

**C:\Users\<<YOUR NAME HERE>\AppData\Roaming\Microsoft Flight Simulator\Packages\thgf-widget\work**

## Waypoint Page

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The waypoint page will show you all the waypoints of the current task and the status of those waypoints.

**The current waypoint** is the waypoint that is highlighted in **GREEN** and that has **WHITE icon**.

A valid task will contain at least 2 waypoints. There must be 1 start waypoint and 1 finish waypoint to have a valid task. Invalid tasks can still be flown but cannot be scored. An invalid task will have its name in **YELLOW**.

Distances are calculated to the outside edges of cylinders, not to the center point.

**Each waypoint will show:**

- STATUS
  - **WHITE** = current task
  - **BLACK** = incomplete
  - **GREEN CHECK MARK** = completed
    - **Time to compete**
    - **Average speed on that leg**
- NAME
- TYPE
  - START
  - TURN
  - FINISH
- OBSERVATION TYPE
  - LINE
  - CYLINDER
  - RADIUS (km/ft)
  - ALTITUDE (ground)
- DISTANCE (to point – radius)

## Choosing a waypoint

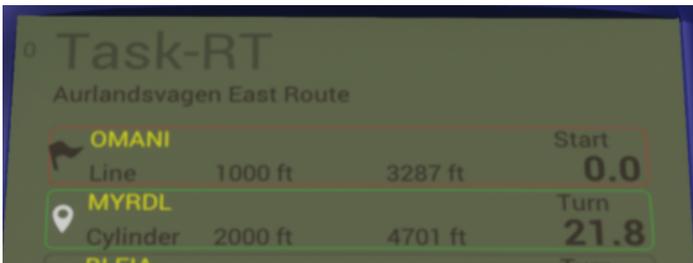


You can use the **Up/Down buttons** to move the current waypoint to any waypoint in the list.

You can choose any waypoint at any time. There are no restrictions on modifications to the state of waypoints or which waypoint is the active waypoint.

## Skipping a waypoint

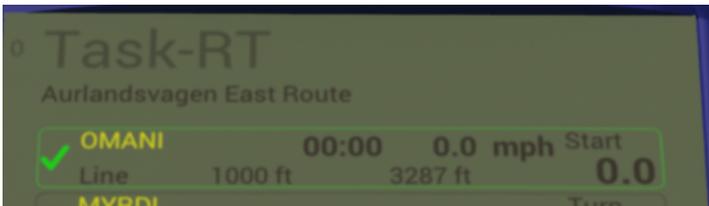
If you select a waypoint that is past the last completed waypoint (skipping a waypoint), the skipped waypoints will appear in **RED**.



## Marking a waypoint as complete

Normally, waypoints are marked as completed automatically as you fly a course. However, if it is necessary, you can manually mark any waypoint as complete while flying.

The **RIGHT button** will mark the current waypoint as completed



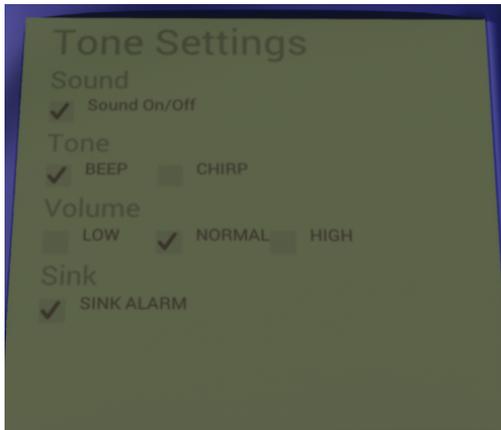
## Marking a waypoint incomplete

The **LEFT button** will mark the current waypoint as incomplete

This will always make the modified waypoint the current waypoint.

## Tone Settings Page

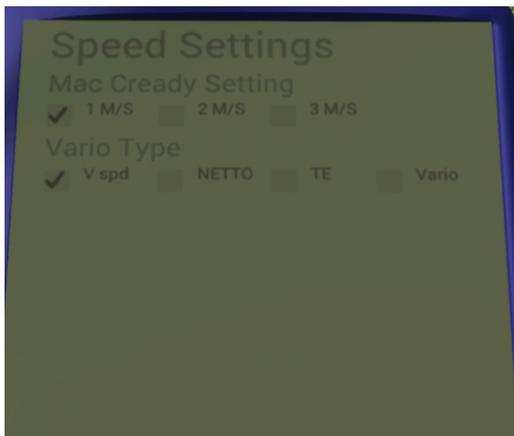
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The tone settings page lets you control some aspects of how the variometer creates audible feedback while flying.

## Speed Settings Page

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The speed settings page controls the use of MacCready related displays and calculations.

### MacCready Settings

This value is used in defining the speed to fly calculations. These value can be changed in flight and are persistent between flights.

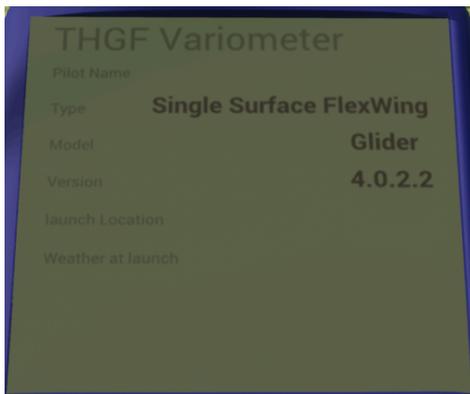
### Vario Type

Variometer type relates to the current type of vertical speed calculation being used by the variometer.

**NOTE:** This value can also be changed directly in the Variometer page (see above).

# THGF Variometer About Page

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The about page displays some basic information about the glider, pilot, version and logbook related information.

## Aircraft Type

This field shows the aircraft type. If this type is not a hang glider type the ground handling features will not be activated.

## Aircraft Model

If the model is not of type Glider, you will not be able to aerotow.

## Variometer Version

This is the current version number of the variometer code. This is not the same as the version number of the widget or the version number of the glider model.

## Launch Location

This is the latitude and longitude recorded at the time of launching. The variometer does not know what site you are flying from! So for the variometer to communicate to the logbook feature where this flight occurred, it can be determined by the geolocation when the logbook record is processed by the THGF desktop application.

## Weather Information

The weather information will show the temperature, wind direction and speed recorded at takeoff. This provides a minimal amount of flight time weather information.

Actual weather information such as using real-weather or what weather preset was used is not available inside the simulator. This information will be added to your logbook if the THGF desktop app is active before you start your flight.

In addition, the THGF app can add actual glider livery used, Pilots name, and other information to the logbook record. But only if it is running before you start a flight.

# Index

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The following table shows all available data fields that can be used on the variometer data pages.

You can configure them to be on any page in any order. You can use the same data field multiple times if you like.

Each mouse click will cycle that data field through this list and in this order.

Data Type	Title	Is Active
TEMPERATURE	"Temperature"	
GROUND_TRACK	"Ground Track"	
TIME	"Current Time"	
DURATION	"Flight Time"	
WIND_SPEED	"Wind Speed"	
GROUND_SPEED	"Ground Speed"	
MSL_ALT	"MSL Altitude"	
ALT_FT	"Altitude in feet"	
REF_HEIGHT	"Reference Height"	NA
HEIGHT_GAIN	"Total Height Gained"	
GPS_ALT	"GPS Altitude"	
FLIGHT_LEVEL	"Flight Level"	NA
ALTQNH	"Air Pressure (millibars)"	
ALTQNH1	"Air Pressure (Hg)"	
ARRIVAL_H_WP	"Arrival Height at WP"	
ALLOWED_H	"Floor of overhead airspace"	
VARIO	Vario	
ALT_ABOVE_BG	"Altitude above best glide WP"	
ALT_ABOVE_GO	"Altitude above best glide around course"	
CESS	"Vertical distance up to NA CESS"	
TIME_BEFORE_START	"Time before race start"	
TIME_BEFORE_WP	"Time before next WP"	
OPT_START_SPEED	"Ground speed for optimal start"	
WP_DIRECTION	"Direction to destination"	

WP\_DISTANCE "Distance to destination"  
THERMAL\_DISTANCE "Distance to last thermal"  
GOAL\_DISTANCE "Distance to goal"  
RESTRICT\_DIST "Distance to restricted area" NA  
TO\_DISTANCE "Distance to Takeoff"  
CYL\_DISTANCE "Distance to cylinder"  
STCLY\_DISTANCE "Distance to start cylinder"  
OPTCLY\_DISTANCE "Distance to optimized NA cylinder intercept"  
OFF\_TRACK\_DISTANCE "Distance off track of course  
line"  
WIND\_COMPONENT "Wind Component"  
AIR\_SPEED "Air speed"  
WP\_LD\_REQ "L/D required to reach WP"  
ACTUAL\_LD "Actual L/D"  
GROUND\_LD "Ground L/D"  
GOAL\_LD "Goal L/D"  
NAFLARM "FLARM" NA  
AAT\_DURATION "AAT Time"  
AAT\_TIME\_REMAINING "AAT T Remain"  
AAT\_DISTANCE "AAT Dist"  
AAT\_DISTANCE\_GOAL "AAT Goal"  
AAT\_TIME\_TO\_WP "AAT T to WP"  
AAT\_DISTANCE\_IN\_WP "AAT Dist in WP"  
THERMAL\_IN\_THERMA "In Thermal"  
THERMAL\_DIRECTION\_TO "Dir to Thermal"  
THERMAL\_LAST\_AVERAGE "Last Avg"  
THERMAL\_MACCREADY "McCready"  
THERMAL\_SPEED\_TO\_FLY "Speed to Fly"  
THERMAL\_SPEED\_TO\_FLY\_GLIDE "STF L/D"  
THERMAL\_TOTAL\_ENERGY "Total Energy"  
THERMAL\_VARIOMETER\_RATE "Vario"

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