VARIO SD

User manual

Document version:2.0

Contents

1 Getting Started

Fully charge battery before using your Flymaster for the first time.

Figure 1.1: right view

The battery may be charged by either connecting the VARIO SD USB connector to the wall socket charger, or to a powered USB port using the USB cable. USB connector can be found on the right side of the VARIO SD (see figure 1.1).

1.1 Charging the Battery

Flymaster VARIO SD has an advanced battery power management system, which gives the pilot accurate information about the battery state, as well as the charging time and battery remaining time.
To charge the Flymaster VARIO SD battery you may use the wall charger, the USB cable, or the car charger. Original Flymaster accessories are recommended in order to avoid damage to the power management system.
The Flymaster VARIO SD has 2 charging modes, namely, *Quick Charge* and *Slow charge*. The charging mode choice is automatic and based on the power source. *Quick charge* mode is activated when charging with the wall charger or the car charger, while Slow Charge mode is activated when a USB cable connected to a PC or MAC is used.
Charging, and battery status information is shown on both the power up screen and the *Shutdown* menu. When the Flymaster VARIO SD is connected to a power supply (wall charger or via USB cable), even with the unit off, the instrument will show if it is being *Slow* or *Fast* charged. The time remaining to full charge is also shown. This may not appear immediately when a power source is connected, since the instrument requires some time to calculate the remaining charge time. A *Slow* charge is ok for topping up the battery but not for fully charging. Use the wall or car charger to fully charge the instrument.

> Note: The instrument will not charge when it is turned on and connected to a PC. The instrument must be turned off in order to charge the battery using the PC USB port . This behavior is deliberate to prevent overwhelming competition organizer's download hubs.
>
> Note: Charging the instrument with high ambient temperatures should be avoided. Such action can cause the battery to overheat and affect battery health.

1.2 VARIO SD Keys

Four keys are used to interact with VARIO SD (see Figure 1.2). In this manual we will call MENU key - S1, ENTER key - S2, UP key - S3, and DOWN - S4. Each key has 2 functions depending whether the device is in flight mode or in menu mode. Additionally the MENU key is used to *power-up* the VARIO SD when it is switched off.

Figure 1.2: VARIO SD keypad

> Note: If the active page includes a Map (Task Map, or Airspaces Map) FS Keys definition will be ignored. In this case S3, and S4, will zoom in and out of the map whilst the S2 will switch page.

In menu mode all keys have fixed functions shown by symbols on the keys namely S3=Move Up S4=Move Down, S2=Enter and S1=Back(Exit).

1.3 Using keys Inside Menu

Changing parameters on the VARIO SD can be performed through the menu. Changing a parameter involves accessing the menu, selecting an option, and then changing a specific field value. Accessing the main menu can be done by pressing the MENU key in flight mode. Once in the menu, UP(S3), and DOWN(S4) keys can be used to scroll up and down through the menu options list. During the scrolling process the selected option is highlighted. The ENTER(S2) key should be used to access the option. Depending on the menu option, a new menu options list, or a data fields list appears. In any time pressing the MENU(S1) key takes you back. When accessing data fields the associated menu option becomes *grayed* and the respective field data item is highlighted. Using the UP and DOWN keys changes the value on each field. Pushing the ENTER key moves to the next field, or in same cases to the next character/digit. Conversely, pushing MENU key moves to the previous field, or to the previews character/digit. If the ENTER key is pushed on the last field all the data in the selection section is stored and control returns to the configuration menu. Inversely, if the MENU key is pushed on the first data field the changed settings are ignored and control is returned to the configuration menu.

> Tip: When setting a data field that involves setting several characters, e.g. when defining a waypoint name, after defining the desired characters, pushing the ENTER key continually for more than 2 seconds will make the cursor jump to the next data field, or return to the configuration menu if no more data field needs to be set.

1.4 Switching VARIO SD On and Off

To switch on the VARIO SD , briefly push the S1 key (Menu Key). This will display the start up screen with a 10 second countdown . Pushing the S2 (Enter key) before the 10 seconds have elapsed will power up the VARIO SD . The VARIO SD initiates in flight mode. If the S2 key is not pushed within 10 seconds the VARIO SD returns to sleep. To switch off the VARIO SD , push the S1(menu key) to activate menu mode, then use the S3 or S4 to select the *Shutdown* item, and finally push the S2 Key.

1.5 Resetting the VARIO SD

The reset procedure allows the pilot to restart the VARIO SD in the unlikely event that it freezes, or stops responding (if this ever occur please report it to our support email). To reset the VARIO SD push S1 (Menu) key and the S4 (Down arrow) key, simultaneously, for at least two seconds. The display will go blank and after will return in Flight mode.

1.6 Setting the Volume

The VARIO SD sound volume can be adjust using one FS Key, or trough the *Vario Accoustics* option of the *Settings* Menu (see Section 4.4). The VARIO SD has six different sound levels, plus *no sound*. The current volume level can be seen using the sound element (see Section 3.1.2 for more details).
Pressing the defined FS Key will scroll up the sound level until the maximum value. Pressing more will mute the sound before start scrolling again starting from the minimum value.

> Note: Changing the volume using an FS key is only valid for the current flight, and will not override the volume level setting. Every time the instrument is turned on, if the sound is muted, an alarm is generated in order to notify the pilot.

1.7 Flight Start and Recording

Most of the VARIO SD features are only available after the *Flight Start*. This procedure is taken in order to avoid wrong calculations due to missing data. Flight starts when average vario is greater than +-0.15m/s

2 Flight Mode

The Flymaster VARIO SD has two main working modes, namely Flight mode, and Menu mode. Flight mode is used during flight, and this allows the user to see information such as Altitude, Speed, or Vario. The VARIO SD can have up to 16 different pages (see Figure 2.1) in memory. Each page corresponds to a different screen, which can be completely configured by the user. A set of 16 pages is called a Layout.

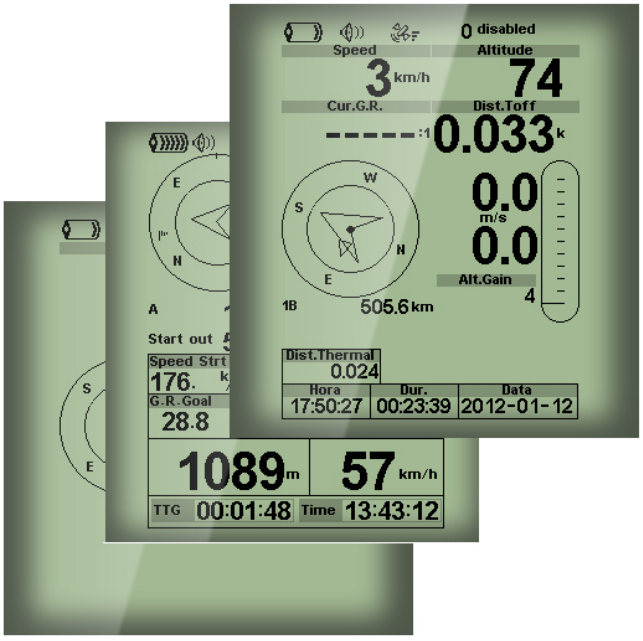

Figure 2.1: Page examples (Some elements on the picture could not be available on your model)

Screen layout can be configured by the user using a free application, called *Flymaster Designer* which can be downloaded from the Flymaster website (www.flymaster.net). This intuitive tool allows the user to create an unlimited number of layouts, which can be saved to the computer, uploaded to the instrument, and even shared with other Flymaster users. See the Designer user manual, available on the website for more information about the Designer tool.
Designing a Layout consists of inserting a set of objects, called *Elements*, in the desired position, and with the desired dimensions, in each of the available 16 pages. The Designer works by *what you see is what you get*. This means that when you insert a element in a page, and after uploading the layout to the instrument, you will see exactly the same thing on the VARIO SD screen.

> Note: If a Layout is uploaded to the VARIO SD the previews layout is deleted (all pages are deleted).

There are several elements available for the VARIO SD which are presented in the following section.

3 VARIO SD Elements

The main objective of an element is to provide information to the user. Elements can be Graphical, or Data Field type. Each element has its own properties which can be changed in order to alter the element behaviour, and/or shape.

3.1 Graphical Elements

Graphical elements are characterized by providing information in a graphical way. Most of the graphical elements have fixed dimensions, although their position can be altered.
As the VARIO SD firmware evolves the list of Graphical Elements will likely grow. The current list includes the following graphical elements.

3.1.1 Battery

The Battery Element provides a graphical indication of the current battery level. In Table 3.1 it is possible to see the relationship between what is shown and the actual battery level in percentage. This element has fixed dimensions.

Table 3.1: Battery Element description

Symbol	Description
	Battery level above 90%
	Battery level between 70% and 89%
	Battery level between 50% and 69%
	Battery level between 30% and 49%
	Battery level between 15% and 29%
	Less than 15% battery remaining

3.1.2 Sound

The Sound Element provides graphical representation on the current volume level. Table 3.2 Shows the relationship between what is shown and the sound level. This element has fixed dimensions.

Table 3.2: Sound Element description

Symbol	Description
	Sound Level 6 (maximum sound level)
	Sound Level 5
	Sound Level 4
	Sound Level 3
	Sound Level 2
	Sound Level 1
	Sound is muted (No sound)

3.1.3 Vario

The Analog Vario Elements shows information regarding the analogue instantaneous vertical speed. There are four different Elements that can be used to display the vario. All of these element can be resized and re-positioned.

Analog Vario

This Element which can be resized and repositioned, graphically represents the rate of climb, scaled from 0 m/s to +/-10 m/s depending if you are climbing or sinking Figure 3.1.

Figure 3.1: Analog Vario

When the VARIO SD detects that the pilot is climbing, a black bar starts to grow on the left, from the bottom of the scale to the top ,with 0.1 m/s increments. The same bar grows on the right, from the top of the scale to the bottom, if sinking is detected.

Big Analog Vario

The *Big Analog Vario* element shows the instantaneous vertical speed (Figure 3.2). This element can be resized and re-positioned.

Figure 3.2: Big Analog Vario

This Element graphically represents the rate of climb, scaled from 0 m/s to +/-10 m/s depending if you are climbing or sinking. In this Element a black bar starts from the middle of the scale and grows at 0.1 m/s increments, up to 5 m/s at the top of the scale. When 5 m/s value is reached the black bar starts to disappear from 0 m/s (middle of the scale) until the top of the scale. When the bar completely disappears the climbing rate is equal, or above 10 m/s. The same process occurs when descending, but from the middle of the scale to the bottom.

Double Bar Analog Vario and McCready Indicator

The Double Bar Analog Vario element shows not only the instantaneous vertical speed, but also the *Average Thermal* and *Next Expected Thermal* (McCready Indicator) (see Figure 3.3). This element can be resized and re-positioned. The element consists of 4 columns. In the left most column a black bar is

shown which indicates the average thermal climb rate. This value is always positive. In the next column a double arrow is shown which indicates the next expected thermal climb rate. Finally, the last columns show 2 bars indicating the climb rate and the sink rate. See more about the McCready indicator in Chapter 5.

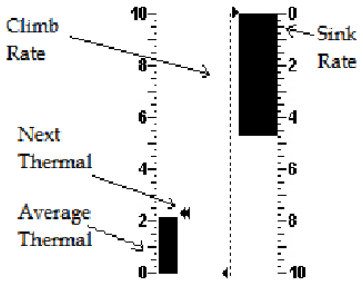

Figure 3.3: Double Bar Vario and McCready Indicator

Dial Analog Vario

The Dial Analogue Vario element shows the instantaneous vertical speed (Figure 3.4). This element can be resized and re-positioned. Climb or sink rates are shown by the position of the needle on the analogue dial. The maximum and minimum climb rates can be set using the DESIGNER software.

Figure 3.4: Dial Vario

3.1.4 Altitude graph

The Altitude graph element (Figure 3.5) corresponds to a graph of barometric altitude versus time. Altitude is shown in the vertical axis graduated in meters with time shown on the horizontal axis graduated in seconds.

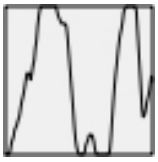

Figure 3.5: Altitude Graph Element

The range of the horizontal axis is fixed and corresponds to 240 seconds (4 minutes), while the range of the vertical axis is automatically adjusted in order to accommodate the gained height. In reality the altitude graph element is a plot of the absolute barometric altitude over the last 4 minutes of flight (Figure 3.6).

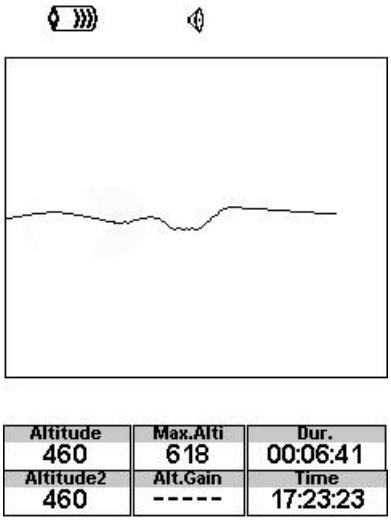

Figure 3.6: Altitude Plot

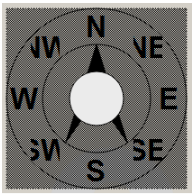

Figure 3.7: Compass Element

3.1.5 Compass

The Compass element (Figure 3.7) show all the data provided by the VARIO SD built in magnetic compass. This element can be resized and moved around the screen. The compass includes an arrow which is always alined with the VARIO SD . If the VARIO SD is turned the cardinal points will also turn in order the arrow tip points the right cardinal point.

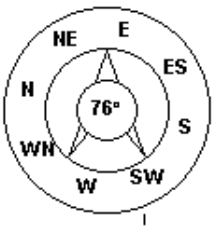

Figure 3.8: Compass example

In the example of Figure 3.8 the VARIO SD is pointing almost to East. The direction is represented by the arrow, and also indicated numerical (76˚degrees).

3.2 Data field Elements

Data field elements can be used to shown numerical information like altitude, vertical speedand many others.
These elements have configurable size, and position, although the text within has only 3 possible sizes. The folowing table explains the available data fields. As the VARIO SD firmware evolves this list will likely grow.

Table 3.3: Data fields Description

Field ID	Description
Date	Current date. This value is automatic set when the device gets a valid GPS Signal
Altitude	Current altitude. This altitude is calculated based on the barometric pressure and depends on the QNH value.
Time	Current local Time. This value is automatic revised when the device gets a valid Gps Signal. (see Note 2)
Dur.	Flight Duration. Duration of the current flight.
Battery	Shows battery strength as a percentage of complete charge
Alt.Gain	Altitude Gain. Altitude gained in current thermal.
Max.Alti	Maximum altitude reached during current flight. This is based on barometric altitude.
Vario	Instant vario value.
Ave.Vario	Average Vario calculated using an integration time constant in order to indicate smoother climbing rates.
Max.Climb	Once a flight has started, it shows the maximum rate of climb encountered during the flight. This value uses the integrated vario not the instantaneous rate of climb. This provides good indication of the quality of the day's thermals. This value is reset when the instrument is switched off.
Max.Sink	Once a flight has started shows the maximum sink encountered during the flight. Note that these values are using the integrated vario. When the instrument is switched off this value is reset back to zero.
Altitude2	Second Altimeter which can be set independently to the main altimeter.
Altitude3	Third Altimeter which can be set independently to the main altimeter. Altimeter3 can be quickly reset to 0 using a short cut key which can be user configured.
Abs.Pressure	Absolute atmospheric pressure value in Pascals.
Flight Level	Current altitude in hundreds of feet, based on a fixed QNH of 1013.25hPa.
Above Toff	Altitude above takeoff is the altitude over the flight starting point.
MotorTemp	Motor Temperature (available when connected with Flymaster M1).
RPM	Motor revolutions per minute (available when connected with Flymaster M1).
Fuel	Fuel level in liters (available when connected with Flymaster M1).
Page Num.	Current layout active page number.
Voltage	Current battery level in Volts.
Int.Temperature	Temperature inside the instrument.
Pulse	Current heartbeat in beats per minute, when using the Flymaster Heart-G sensor.
Steps/Min	Cadence showing number of steps per minute.
Steps	Number of steps taken since counting initiated.

Continued on next page

Table 3.3– continued from previous page

Field ID	Description
G-Force	Current G-Force being experienced by the pilot when using the Heart-G sensor.
TAS	True Air Speed. This information is available when the instrument is used in conjunction with the Flymaster TAS pitot probe.
TTG	The TTG field is dynamic and will vary according to the current flight status and type of task defined. It will show TTG (time to go) before start gate opening, and will then change to *SS* (Speed Section time) which is the time elapsed after the opening of the start. If no start gates are defined in the task, or no task is defined, then this field will show *Dur*, which in this case is the time elapsed since takeoff. The takeoff event is triggered when ground speed exceeds 5km/h and a 3D fix is available.
Alt.Gain/Loss	Altitude Gain/Loss. When at the top of the thermal displays the altitude gained from the base of the thermal, else displays the altitude lost since reaching the top of thermal.

Note- The Altitude *field indicates the absolute height in meters or feet depending on the setting. This altitude corresponds to the barometric altitude and thus depends totally on the QNH (absolute pressure at a given moment and location in regards to the correspondent pressure at MSL). The altimeter cannot be reset, but can be set using the corresponding menu option (see Section 4.2).*

4 Menu mode

When in flight mode, pushing the menu (S1) button accesses the menu mode. When in menu mode pushing the menu(S1) button will go back to flight mode.

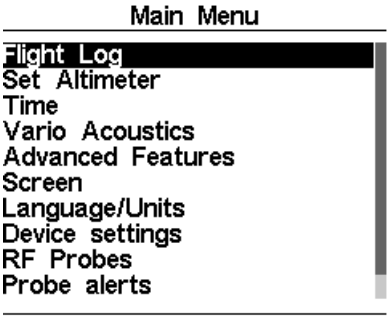

Figure 4.1: Main Menu

To access the different items on the menu you can use the UP(S3) and DOWN(S4) keys. Once a menu item is selected pushing the ENTER (S2) executes the selected function. A short description of each option can be seen in Table 4.1.

Table 4.1: Main Menu Options

Menu item	Description
Flight log	Accesses the stored flights list. (see Section 4.1)
Set Altimeter	Allows setting the altimeter related parameters. (see Section 4.2)
Time	Allows setting time and date. (see Section 4.3)
Vario Acoustics	Allows setting the sound and vario thresholds. (see Section 4.4)
Advanced Features	Allows to set more of the VARIO SD acoustics. (see Section 4.5)
Screen	Allows setting the Screen contrast.
Language/Units	Allows setting the interface language and units. (see Section 4.7)
Device Settings	Allows reset all parameters to the default factory values. (see Section 4.8)
RF Probes	Allows pair up any of the Flymaster wireless devices. (see Section 4.9)
Probe Alerts	Allows setting alerts related with the wireless devices. (see Section 4.10)
Calibration	Allows to calibrate the accelerometer and magnetometer. (see Section 4.11)
Shutdown	Switches off the VARIO SD , and displays detailed battery status.

All the menu options are explained on the folowing sections.

4.1 Flight Log

The Flight Log option allows the user to access information about previous saved flights (Figure 4.2). The top half of the screen lists flights stored in memory. Each flight is identified by the take off date, time and flight duration.

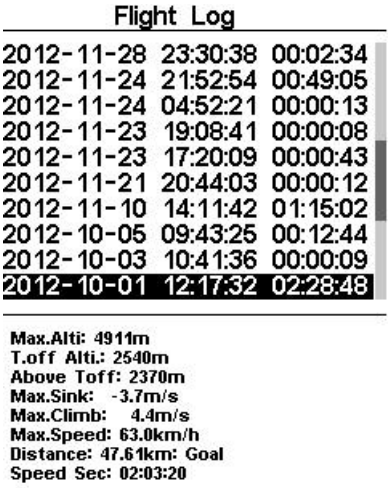

Figure 4.2: Flight log

Flights can be selected using UP and DOWN keys. For the selected flight additional information is displayed on the bottom half of the screen:

- Max. Altitude - Maximum altitude during flight (ASL).
- T.off Alti. - Take off altitude.
- Above Toff- Altitude above take off
- Max. Sink - Maximum sinking rate during flight
- Max Climb - Maximum climbing rate during flight
- Distance - Distance flown

Pushing the ENTER key will display the Flight Log Action List, with options:

- Delete flight
- Delete all flights

Each of the options is explained in the following sections.

> Also if you use a flight data download application and request the flight list while the Flight Log Action is active only selected flight will be reported to the downloader application.

Delete Flight

Selecting the *Delete Flight* option will delete the selected flight from memory. Before deleting the flight, a message is displayed asking the user to confirm the action (Figure 4.3).

Figure 4.3: Delete Flight

Delete All Flights

All of the flights in the VARIO SD can be deleted by selecting the *Delete all flights* option. A message is displayed asking the user to confirm the action of deleting all flights (Figure 4.4).

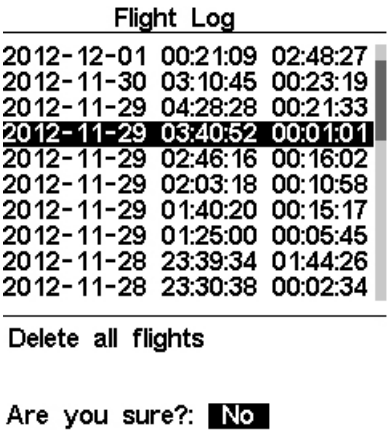

Figure 4.4: Delete all flights

WARNING: Deleting all flights will completely erase the flight log memory, all track logs will permanently erased.

4.2 Set Altimeter

The *Set Altimeter* page (Figure 4.5) allows the user to adjusts the barometric altimeter. A barometric altimeter calculates altitude based on atmospheric pressure . Since atmospheric pressure can vary substantially with meteorological conditions, and so with time, the barometric altitude also varies according. In order to have the correct altitude for a certain place the altimeter should be calibrated.
Calibrating the altimeter can be achieved by entering the know altitude of the location. Entering an altitude automatically calculates the QNH, which is the local barometric pressure adjusted to sea level. Alternatively, the altimeter can be calibrated by adjusting the QNH for the local, and time. Changing the QNH will adjust the barometric altitude.

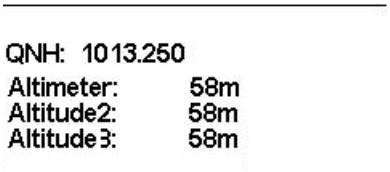

Figure 4.5: Set Altimeter

4.3 Time

The *Time* page allows the user to set the time, and date. (Figure 4.6) Time and date values are important because they are used to classify data in the Flight Log.

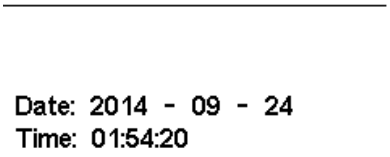

Figure 4.6: Timing Parameters

4.4 Vario Acoustics

The *Vario Acoustics* settings menu option allows the user to change vario sound related parameters. The user can change the climbing, and sinking rate sound through the respective threshold values. These thresholds correspond to the climbing and sinking rates at which the sound activates. The user can also define in the Acoustic Thresholds option the sink alarm and the sound volume of is the VARIO SD (Figure 4.7).

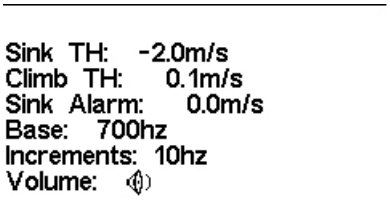

Figure 4.7: Vario Acoustics

4.4.1 Climb Threshold

The *Climb Threshold* defines the rate of climb at which the vario will start beeping. The frequency of the first beep is defined trough the Base Frequency parameter,and steadily increases according the Increments parameter value.
The default value for *Climb Threshold* is 0.1m/s. This means that beeping starts once the instantaneous vario value goes above 0.1m/s.

4.4.2 Sink Threshold

The *Sink Threshold* is the rate of descent at which the vario will emit a low frequency sound. Contrary to the climb sound the sink sound is continuous. The deeper the sink rate the lower the sound frequency. Default value for this parameter is -2 m/s, we suggest setting a value lower than the natural sink rate of the glider when flying with speed bar in still air.

4.4.3 Sink Alarm

The *Sink Alarm* defines a vertical speed value at which a sound (alarm siren) starts to be produced. For example, if the *Sink Alarm* is set to -10m/s, then if the instantaneous vario goes below -10m/s, and alarm will be fired. This alarm can be used to identify high vertical speeds, as for example, in a spiral dive. The Sink Alarm parameter can vary from 0 to -25m/s. Set the Sink Alarm to *Off* to disable the alarm.

4.4.4 Base Frequency

The audio frequencies can be adjusted to match the user's preference, by setting the *Base Frq* and *Increments*.
The *Base Frq* is the first frequency used to produce the initial sound which corresponds to the climb threshold (by default 0.1 m/s). Later, as the climb rate increases, a bip, bip sound is produced for which the cadence, and frequency, also increase. The *Base Frq* can be set from 500 to 1500 Hz. The higher is the frequency value, the higher pitched the sound is.
In order to change the base frequency value press the ENTER key after the *Audio Frequencies* menu option is highlighted. This action will highlight the *Base Frq* value so it can be increased using the UP key, or decreased using the DOWN key. The ENTER key should then be pressed, thus confirming the *Base Frq* setting. The preset value for *Base Frq* is 700 Hz.

4.4.5 Increments

The *Increments* parameter sets the frequency increment for each 0.1 m/s climb rate increase. The *increments* can be set from 1 to 99 Hz. The preset value for *Increments* is 10 Hz.
Considering an *Increments* value of 10, and *Base Frq* of 700 Hz, the vario frequency at 1 m/s is 800 Hz.

4.4.6 Volume

The final option allows the user to adjust the sound volume. The VARIO SD has six different sound levels, plus *no sound*. Pressing UP, or DOWN, keys will respective increase, or decrease the sound level. After setting the sound value , to confirm and return to the Settings menu press the ENTER key. The new sound level is saved in memory and is used when the VARIO SD is turned on. Sound volume can also be adjusted using one FS key. However, the sound level adjusted using the FS key is not kept in memory, so is only valid until the VARIO SD is turned off.
In *Flight Mode* the current volume level can be seen using the sound element (see Section 3.1.2 for more details).

4.5 Advanced Features

The advanced features settings option can be used to set more of the VARIO SD vario acoustics. (Figure 4.8).

Damper: 6
Cadence: 1
Dynamic freq: On
Buzzer: 3
Auto Silent: On
Start Speed: 1

Figure 4.8: Advanced Features

4.5.1 Damper

The VARIO SD 's vertical speed calculation is based on air pressure variations. It is very seldom to have air pressure absolutely stable. Turbulence caused by air moving near the sensor is sufficient to cause small variations in pressure. For this reason the VARIO SD filters (averages) the pressure data to prevent constantly detecting tiny pressure variations. The value that defines how must the pressure is filtered is the *Damper*. Setting a lower damper value caused the VARIO SD to become more responsive but harsher. Inversely a higher value causes the VARIO SD to be less responsive but smoother. The default value is 6.

4.5.2 Cadence

When a rate of climb is higher than that specified by the Climb threshold the VARIO SD creates a beeping sound. The rate (cadence) of the beeps increases as the climb rate increases. This increase in rate is not linear. The cadence parameter specifies which cadence curve should be used. Current there are 2 possibilities represented in the graph of Figure 4.9.

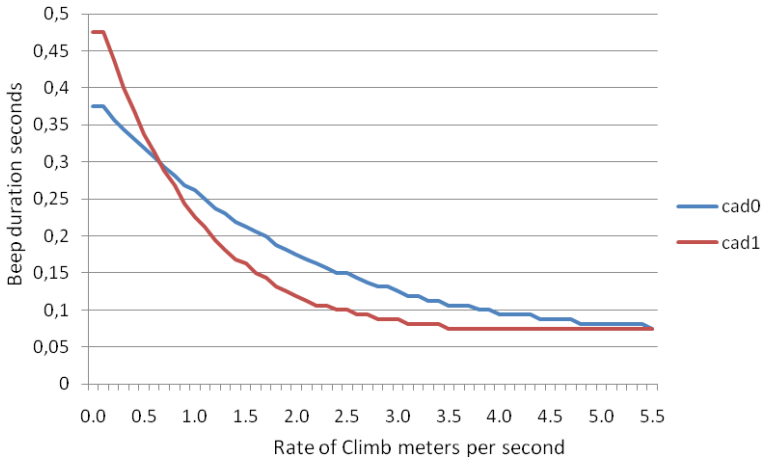

Figure 4.9: Cadence timing

4.5.3 Dynamic Frequency

The VARIO SD beeps at a specified pitch (frequency) when a certain rate of climb is encountered. When dynamic frequency is off, the pitch (frequency) of that beep will remain constant if the rate of climb changes. With dynamic frequency on, the pitch of the beep may vary if the rate of climb varies during the individual beep.

4.5.4 Buzzer

Is so called because of the sound it emits, which resembles a buzzing sound.
The buzzer sound is produced when the rate of climb is close to, but has not yet reached the specified Climb threshold (see 13.3.1). This value is set between 0 and 9 with each unit corresponding to be 0.1 m/s, ie. 3 is 0.3m/s. Subtracting this decimal value from the climb threshold will give us the value at which the

VARIO SD will start buzzing. For example with the VARIO SD default values, Climb threshold=0.1m/s, and Buzzer=3 (0.3m/s) the buzzing with start at -0.2m/s because 0.1 - 0.3= -0.2. In this case at 0.1m/s directly below the Climb threshold the VARIO SD will emit a constant sound varying rapidly in pitch from around 100hz to the set base frequency at which the first beep is emitted. This is the buzzer sound and may resemble a growl noise. Setting the Buzzer value to *Off* will disable the buzzer feature.
Although the Buzzer will sound very annoying on the ground it becomes an amazing companion in flight allowing the pilot to pick-up thermals he would have usually missed.

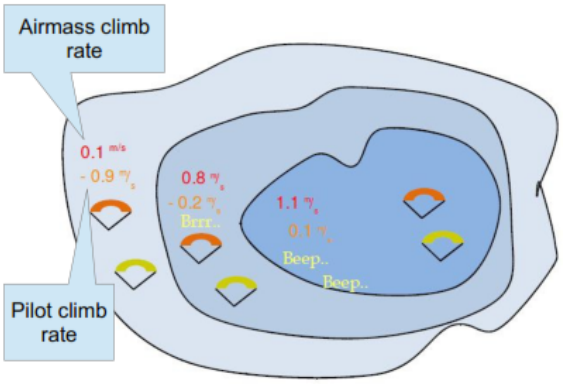

Figure 4.10: Buzzer

A practical example of the advantages of the buzzer feature can be illustrated in Figure 4.10 In this example both pilots are sinking at -1.0 m/s. The orange paraglider has a VARIO SD for which the climbing threshold is set to 0.1 m/s and the Buzzer parameter is set to 3 (0.3 m/s). The green paraglider has a typical vario for which the climbing threshold is set to 0.1 m/s.
As shown in the figure, when both pilots enter the thermal nothing is heard. The air is rising at 0.1 m/s but both pilots are descending at -0.9 m/s. In the second zone of the thermal the air is rising at 0.8 m/s, and so pilots are descending at -0.2 m/s. At this stage the orange pilot starts to hear the Buzzer brrrrr sound of his VARIO SD , which helps him to center the thermal, while the green pilot is still unaware of the thermal. Finally, in the 3 zone, the air is rising at 1.2 m/s, and so both pilots climb at 0.2 m/s. The VARIO SD pilot starts to hear his vario beep... beep... sound, and it is only at this point the green pilot hears the first beep from his instrument.

4.5.5 Auto Silent

Setting *Auto silent* option *ON* will keep the VARIO SD 's buzzer quiet until a *Start Flight* has been detected. (see Section 1.7) This function avoids listening the vario sound while waiting to take off. The audio will then be kept active until the VARIO SD is switched off. The default value for the auto silent parameter is *ON*.

4.5.6 Vario Integrator

The Integrated vario is calculated by integrating the vertical speed during a period of X seconds defined by this value.

4.6 Screen

The screen menu option allows the user to set the Screen contrast
(Figure 4.11).

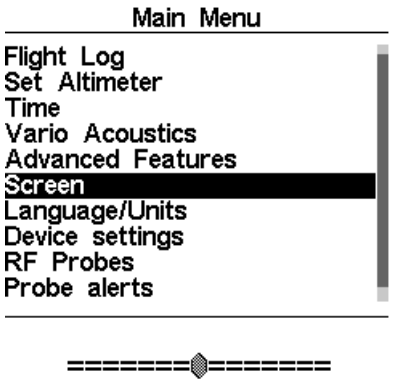

Figure 4.11: Screen Settings

Contrast may be adjusted to the pilot's needs. You can use the UP, and DOWN keys, to move the contrast bar (Figure 4.11). Move the bar to the right to increase the contrast, and to the left to decrease the contrast. When in the desired position push the ENTER key to confirm the value.

WARNING: Beware of adjusting a very low contrast value may cause the display to be totally blank. With a blank screen it is difficult to readjust since nothing is visible.

4.7 Language/Units

The *Language and Units* menu option allows the user to change the VARIO SD interface language and units. A short description off the available options for this menu are shown in Table 4.2.
The UP, and DOWN keys, can be used to change each field option. Pushing the ENTER key confirms the current field value, and highlights the following field. Pushing, the MENU key will undo changes.

Table 4.2: Language/Units Menu Options

Function	Description
Language	Defines the interface language.
Alti. Units	Altitude Units. Altitude can be show in Meters, or Feet.
Roc. Units	Rate of Climb Units. ROC can be show in m/s, or 10 x Feet/ min

4.8 Device Settings

This menu option allows the user to execute some recovery functions. A short description of the available options is shown in Table 4.3.

Table 4.3: Device Settings

Function	Description
Factory Settings	Reset all parameters to the default factory values. This will not change the layout to the factory default layout. Care should be taken because all changes made by the user are lost.
Reset now	Makes a hardware reset to the instrument. The result is the same as the one presented in Section 1.5.

4.9 RF Probes

The *RF Probes* menu option allows the user to pair up any of the Flymaster wireless devices including the M1 and Heart-G to the VARIO SD . Pairing is performed automatically. When ENTER is pressed the VARIO SD will look to see what wireless devices are around and it will shows these on the screen (see Figure 4.12). Devices are identified by their name (e.g. M1, TAS) and serial number. Devices can be selected using the UP, or DOWN keys. For the selected (highlighted) device the pairing state is shown on the bottom of the screen. To pair a device the state should be changed from *No* to *Yes*. Once paired the VARIO SD will always automatically connect with the wireless device. The VARIO SD can be paired with several devices.

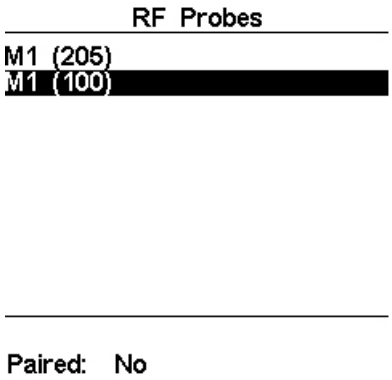

Figure 4.12: RF probes

In the example shown in Figure 4.12, two M1 devices are visible. These are distinguished on the screen by showing their serial number. (The serial number for the device can be found on the back of the wireless device). By selecting one of the M1 devices and selecting ENTER, the option to pair that device becomes available.

4.10 Probe Alerts

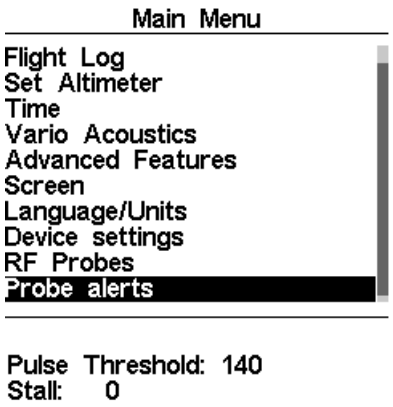

Figure 4.13: Probe Alerts

The VARIO SD allows relating alerts with some probes values (see Figure 4.13). A short description of each alert is sown in Table 4.4.

Table 4.4: Probe Alerts

Alert	Description
Pulse Threshold	Pulse Threshold above which the pulse data field will toggle between inverted numerical display and normal numerical display. This allows the user to quickly see that they have a pulse above the desired level..
Stall	IAS speed value starting which a alarm is triggered (TAS Probe needed).

4.11 Calibration

All models of the new Flymaster SD series include a magnetometer and accelerometer sensor. Using these sensors the VARIO SD can provide G-Force and magnetic compass heading. Even though the compass is digital there is a tilt compensation algorithm that ensures accurate compass heading even when the VARIO SD is inclined.
The Calibration menu option allows the user to calibrate the VARIO SD accelerometer and magnetometer sensors. Calibration is particularly important for the magnetometer since without it you will get inaccurate data from the compass. Despite all Flymaster instruments being factory calibrated errors can be introduced due to several external influences, such as the presence of strong magnetic fields or the time. In order to eliminate these errors a proper magnetometer calibration should be made. Calibration parameters are kept when the VARIO SD is turned off, reset or when a firmware update is done. The magnetometer calibration process is described in Section 6.2.

The VARIO SD magnetic compass is very sensible to external magnetic fields. In order to get good readings ensure that there are no interference sources nearby.

The accelerometer calibration is not so critical as the magnetometer. The accelerometer is less sensitive to external factors and the errors are usual negligible for the propose. However, if you notice strange readings (eg. G-Force value different from 1 when the instrument is at rest) a calibration should be made. The accelerometer calibration process is described in Section 6.1.

5 McCready Functions

If the TASProbe is available then the VARIO SD provides some data related with the McCready theory like the Speed to Fly, or McCready setting. The Speed to Fly is the TAS value which maximizes the average Cross Country speed considering a certain average thermal speed. This value is independent of the wind speed, because the fastest average speed achievable through the air corresponds to the fastest achievable average ground speed. To calculate the Speed to Fly the VARIO SD takes in account the polar and the average thermal speed. The value is shown on the *SpeedToFly* data field.

> Note: Traditional the average thermal speed used to calculate the Speed to Fly is manually set by the pilot (McCready Ring). On the VARIO SD this value is calculated by averaging the last thermals climbed.

Conversely, for each TAS (Speed to Fly) value there is a average thermal speed which maximizes the Cross Country speed. This value is also calculated by the VARIO SD and shown on the *McRdyNxtThrm* data field. Additionally, the *McRdyNxtThrm* value can also be visualized on the *Double Bar Analog Vario* (see Section 3.1.3). On the example of the Figure 5.1 Next thermal indicator points to 3.5m/s, while the Average Thermal shows something around 2.1m/s. Ideally, they should point the same value, so the pilot should reduce their speed. Naturally, he could maintain speed if he expects that the next thermal is stronger.

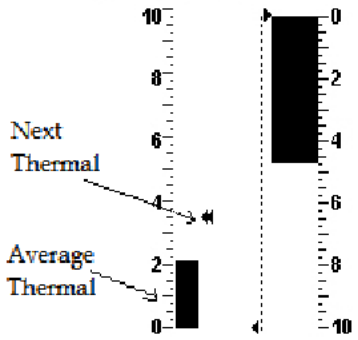

Figure 5.1: McCready Indicator

6 Compass Calibration

6.1 Accelerometer Calibration

Eventhough the VARIO SD Accelerometer is factory calibrated for offset and sensitivity, temperature and aging can cause further changes. These sources of errors may cause the accelerometer to appear to be tilted or rotated relative to the zero reference point. If spurious G-Force readings are noticed, eg. a G-Force value different from 1 when the instrument is at rest, a recalibration should be made. In order to perform an accelerometer recalibration follow the steps described below:

1. Go to Menu->Settings->Calibration and choose the "Calibrate Accelerometer" option (see Figure 6.1);
2. Place the VARIO SD on a flat horizontal surface with the display facing up;
3. Press **ENTER** key **avoiding moving** the VARIO SD ;
4. The message "Calibrating" appears on the display for a while and until the calibration is done;
5. At the end of the calibration process message "Calibration Done" appears.

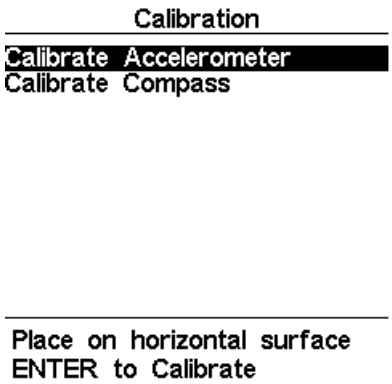

Figure 6.1: Calibrate Accelerometer menu option

6.2 Magnetometer Calibration

Compass heading is calculated using the magnetometer sensor data, and the accelerometer sensor data. In order to get correct values both sensors should be calibrated. The accelerometer is not sensitive to external factors and its errors are usually negligible for this propose. The magnetometer however, is very sensitive to external factors, especially magnetic fields. So, if strange compass heading values are noticed a calibration should be done according the procedure described below. Before describing the procedure lets explain what should be achieved during the calibration process.

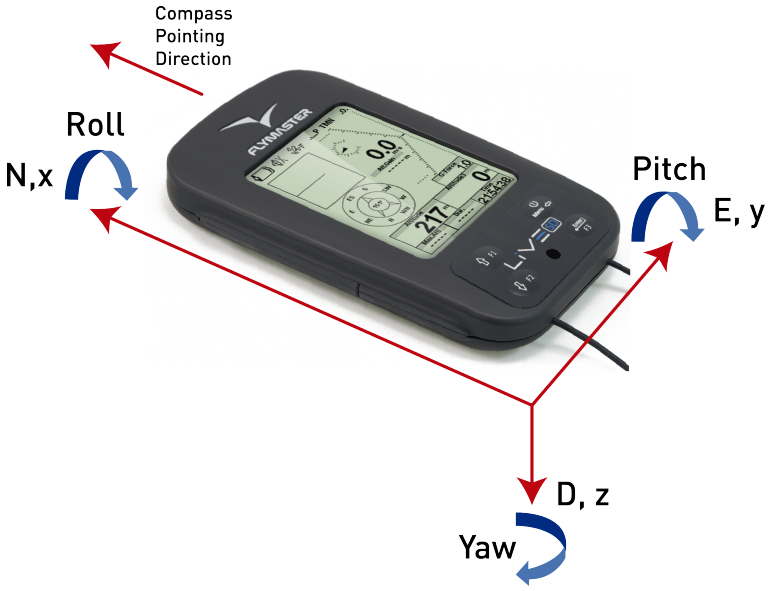

Figure 6.2: Compass Calibration Reference Frame

The magnetometer has 3 axes (Figure 6.2) which are associated with the instrument reference frame. Turning the instrument around each of the 3 axes will change the Yaw, Pitch and Roll angles. In order to make a proper calibration the instrument should be turned/rotated slowly in each of the 3 axis. It is not important to make a complete rotation, or the order in which the turns are made. What is important is that instrument is rotated to vary the Yaw, Pitch and Roll from an angle near -90°to +90°. An indication of the calibration procedure state is given using 4 circles that are shown at the bottom of the calibration page (see Figure 6.3). The top and bottom circles are associated with the Pitch angle, while the left and right circles are associated with the Roll angle. When the calibration is initiated all the circles are empty (no color). If the instrument is rotated so that the pitch angle gets close to -90°then the top circle is filled black. Similarly, if the pitch angle gets close to +90°then the bottom circle is filed black. The same thing happens with the left and right circles when the instrument is rotated for the Roll angle. No indication is given for the Yaw angle. The calibration procedure is automatically terminated when all the circles become black. In the figure Figure 6.3 all the circles are black except the bottom one. The complete calibration procedure can be summarized in the following points:

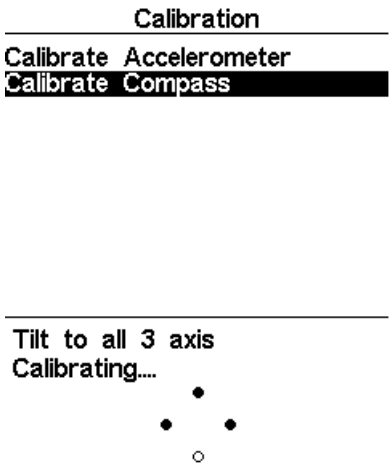

Figure 6.3: Compass Calibration Indication Points

1. Go to Menu->Settings->Calibration and choose the "Calibrate Compass" option (see Figure 6.3);
2. Pick the VARIO SD and turn it around all the 3 axis in order the Yaw, Pitch, and Roll angles go from -90°to +90°. You can accomplish this by performing a movement similar to the one used to

calibrate the iphone;

3. If the movement is correctly made the all the 4 circles will become black and the calibration process automatically stop;
4. The end of the calibration process is indicated by the message "Calibration Done"'

7 Firmware

Flymaster follows a policy of continuous improvement of its products. This means that a new version of firmware can be uploaded from our website periodically. The update process is simple.
Before beginning update procedure make sure you download the next files from the download page of VARIO SD product section:

- Designer software (Windows, windows 7 64bits or MAC OS X)
- The last version of the firmware (xxxFirmware.fmf)

The first step of the updating procedure consists in installing the Designer software. In order to do that you should run the installation file and follow the on-screen instructions. The installation procedure includes the usb drivers, so there is no need to install further software.

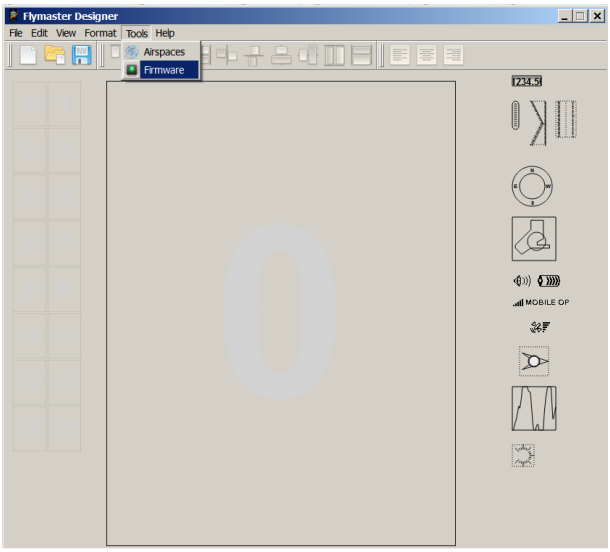

Figure 7.1: Firmware Menu Option

Once the Designer is correctly installed do the following procedure.

1. Open the Designer;
2. Select Tools->Firmware (see Figure 7.1);
3. Use the new box to choose the latest firmware file downloaded from our website;
4. Connect the VARIO SD to the PC using the cable supplied. If it is the first time the VARIO SD is connected to the PC, wait until Windows show the message that new hardware is present and ready to use.
5. Click the *Send to Instrument* button and the update should start automatic. A message appears saying *Programing...*, and a progress bar starts to grow. If after a few seconds nothing happens reset the VARIO SD (see section Section 1.5).
6. When the process is finish the application shows a message saying *complete* (see Figure 7.2). Disconnect the USB cable and the VARIO SD will start to work.

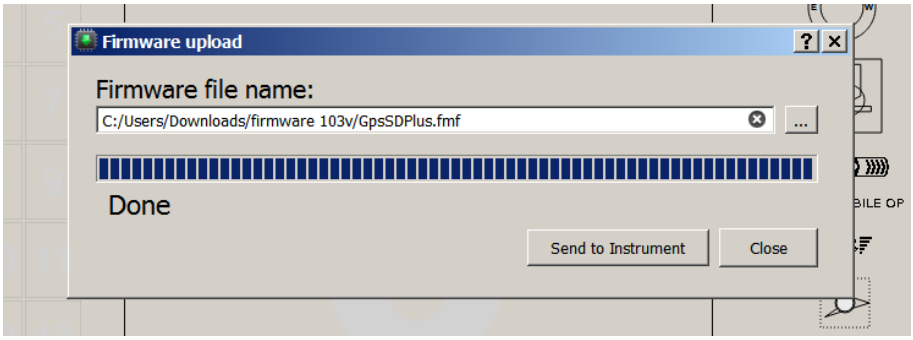

Figure 7.2: Firmware Update Done

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