Manual

version 1.3, 3.April 2017

Table of Contents

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Document history

Version	Date	Description	Author
1.0	2017-03-23	Initial manual	Claus Tønnesen
1.1	2017-03-31	Radio setup added, general description and Jeti walk through	Claus Tønnesen
1.2	2017-04-02	Vario recommendation **no TEK tube**, a few images added, Jeti tutorial enhanced.	Claus Tønnesen
1.3	2017-04-03	Setup for Jeti by switch, slider or flight mode	Claus Tønnesen

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FLYMATE Competition GPS introduction

Chocofly is proud to introduce the FLYMATE Competition GPS system for GPS Triangle racing.

After an extended period of development, testing, refining, more testing and then even more testing the FLYMATE Competition GPS system is now made public available.

Design goals of the FLYMATE Competition GPS system
- Fast update rate of glider position, height and speed in the SkyNavigator app (Android only)
- Rock steady telemetry link from glider to ground station
- Rock steady Bluetooth or USB link from ground station to tablet/phone used for running SkyNavigator
- Barometric pressure sensor with optional TEK/Static input for Vario tone output
- Works with all brands of RC-Equipment
- Connection of two devices running SkyNavigator, one for pilot, one for helper

To achieve this, a state of the art GPS receiver is used. It is optimized for aircraft use, with full GPS signal tracking also when performing high bank, high G turns during the speed task. Small form factor GPS antenna with reception in all directions combined with a Swiss GPS receiver chipset makes for a fast and stable 3D GPS signal lock.

A build in pressure sensor, responsive to the slightest change in altitude, supplies input to the Vario function in the SkyNavigator Android app in the 2017 version. The pressure sensor provides attachment of TEK tube or static air pressure, depending on the selected TEK compensation in SkyNavigator (physical or calculated).

Telemetry link from glider to ground unit is on the 868MHZ band using frequency hopping spread spectrum technology (FHSS) as known from 2.4GHZ RC-equipment. Ceramic patch antennas are used in the telemetry link to give the best possible range and avoiding the blind spots known from traditional wire or stick antenna. (915MHZ versions for export outside Europe are available on request)

The combination of GPS receiver and optimized telemetry link gives an update rate of 5 times per second.

The glider and ground unit 'know' each other by having a common FLYMATE identification number.
When bought as a set the glider and ground unit comes preconfigured with a unique FLYMATE identification number.
When additional glider units are ordered, they will be preconfigured to match your ground station, or you can use the
FLYMATE Android app for configuring the glider unit to match your ground station.
Configuration from Windows or Apple computer is also possible using the supplied USB cable and a terminal-style application.

FLYMATE Competition GPS works with all brands of RC-Equipment as it has its own Telemetry link, just add power (5-9V)

For optimal use, connect it to a control channel so you can control the SkyNavigator app from your transmitter.
Switch between thermal/glide/entry in the SkyNavigator app, signal START to make ready for entering the course, signal STOP - START if you flew in to high or too fast and want to re-enter to avoid penalty points.

In short, designed by pilots for pilots, intensive field tested and competition proven.

FLYMATE Competition GPS, a ChocoFly premium product

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FLYMATE normal use

1. Turn on your transmitter
2. Turn on your model
3. Turn on tablet/phone and FLYMATE ground unit
4. GO FLY :-)

FLYMATE getting started

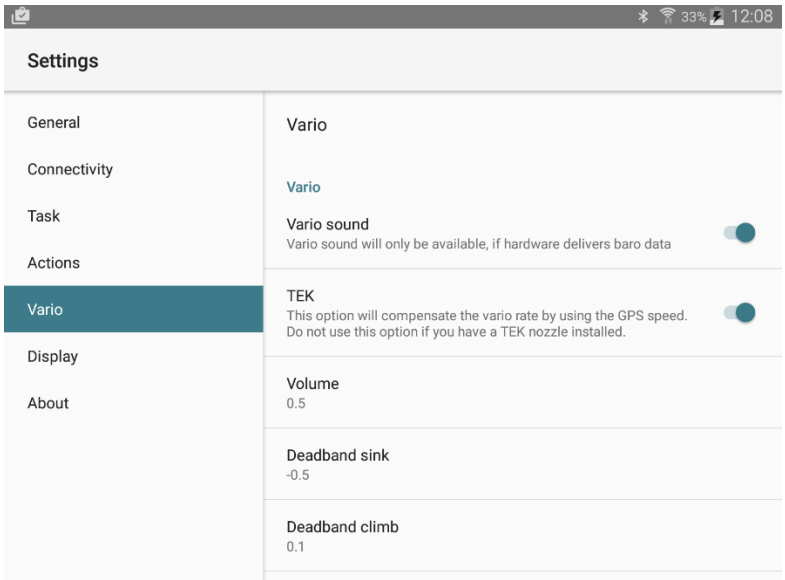
Install the Glider unit

Mount the Glider unit, make sure the GPS antenna (1*1cm) on points up and has a free view of the sky from under the canopy or through Glass/Aramid fibre, mounting under Carbon fibre is a no go.
~~If you have a TEK nozzle installed, attach it to the GPS/Vario unit.~~
Place the 868MHz antenna flat in the bottom of the glider, again NO carbon fibre below the antenna, a piece of Velcro is fine for fixing it.
Plug the GPS/Vario unit in to a free channel of the receiver for power supply (5-9V) and control signal.

SkyNavigator set up

Update SkyNavigator to latest version, current version at time of writing is 1.1.05(build 2650), if you get a higher version, fine.
Start SkyNavigator, go to settings select connectivity and enable USB.

Also under Settings, select Vario and enable Vario. ~~Don't activate TEK if you have connected a TEK nozzle, it should be enabled when you don't have a TEK nozzle installed.~~
For best vario sound in SkyNavigator 1.1.05, DO NOT attach TEK nozzle and enable the TEK option in SkyNavigator.
Exit and start SkyNavigator again.



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Connect to the Ground Unit

Connection to the Ground unit can be direct via USB cable or wireless via Bluetooth connection.

For direct USB connection use the supplied USB OTG (On The Go) cable, the RED connector goes to the tablet, the black connector to the FLYMATE Ground unit. Notice the orientation of the USB connector, if it doesn't fit, please try turning it around before using a hammer to force it in. (Hammer method already tested, no good ;-)
Turn the Ground unit on by pressing the On/Off switch on the side of the box in.
A dialogue box pops up, select "allow" to give SkyNavigator access to the USB connection.

Make sure to be out in the free when you test, GPS reception indoors is limited, and the GPS configuration is focused on precision, not getting an approximate position in indoor conditions.

For Bluetooth connection, you need to power the FLYMATE from a powerbank via a normal USB Micro-B charging cable. (watch out for 'thick' USB connectors…)
On the tablet go to settings, Bluetooth and pair with the FLYMATE, password is 1234.
Next configure SkyNavigator to use the FLYMATE, done under settings, connectivity, Bluetooth.
Then initiate Bluetooth connection from SkyNavigator.

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FLYMATE Ground unit

Connect to tablet/phone via USB cable

An USB On-The-Go cable (OTG) is supplied for direct connection between FLYMATE and the tablet/phone used for the SkyNavigator app.

The red connector goes to the tablet/phone, it has the OTG coding telling the tablet to deliver power on the USB cable, black connector goes to the FLYMATE.

<picture of USB cable connected to FLYMATE and Tablet>

Press the On/Off switch on FLYMATE to turn it on, green/blue indicators should come on immediately.
In SkyNavigator enable USB and close the app. On next start of SkyNavigator it should say "USB connected)

<screenshot of SkyNavigator setting>
<screenshot of USB connected>

Not all tablets and phones support USB OTG connection :-(

Unfortunately not all tablets and phones support USB On-The-Go (OTG) connections. It is a basic functionality in Android, but not all companies have implemented it in the hardware.
Use this app to test whether your device is OTG capable <link to USB test app>
See list of tested tablets and phones <appendix>

Connect to tablet/phone via Bluetooth

Power the FLYMATE from an USB Powerbank/Charger via a standard "USB-A Male / Micro-B male" cable, usually supplied with the tablet/phone.
If buying an extra cable please note the thickness of the MicroB connector, some are rather thick and needs to be trimmed down to fit in the FLYMATE cutout.
TBD ## recommend cable to buy (from Lindy)
<picture of FLYMATE connected to powerbank>
<picture of good USB MicroB connector compared to thick connector>

Press the On/Off switch on FLYMATE to turn it on, green/blue indicators should come on immediately.

Setup the Bluetooth connection from your device, look for FLYMATE_2017xx bluetooth device and connect, PIN = 1234.

In SkyNavigator select the FLYMATE_2017xx device and "initiate bluetooth connection"

FLYMATE placement = horizontal

Optimal placement of FLYMATE is horizontal when mounted stationary on a tripod, or angled towards the model if placed on the transmitter.

The supplied 3M Dual-Lock can be used for mounting FLYMATE either on the edge or on the buttom. (Dual Lock is dependable and can withstand the forces much better than Velcro - this is why a piece of Dual Lock is supplied).

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FLYMATE Glider unit

FLYMATE Glider unit consists of 3 parts, the combined GPS and Vario sensor, the main Unit and a Patch antenna for the 868 MHz radio link to the Ground unit.

<picture of Glider unit>

The parts are connected by a 4 wire cable and a coax cable, they can be disconnected, but please take care when doing so, the small connectors takes considerable force to open/connect.

The Glider unit is connected to the receiver via a standard patch cable, feel free to replace with other length if required.

Operating voltage is from 5 to 9 volts.

Mounting in glider

GPS-Vario unit mounting

Mount with GPS (1*1cm square) pointing UP, and with a clear view of the sky through the clear canopy.
<picture of GPS mounted in plane>
Remember carbon fiber (CFK) blocks signal reception, glass fiber (GFK) / aramid (kevlar) doesn't. If model have a carbon fiber canopy, find a placement of the GPS-Vario unit under a glass fiber part of the fuselage.
GPS-Vario can work in other positions as well, optimum is point up.

GPS-Vario TEK attachment

A TEK tube can be attached to the GPS-Vario via the black pressure sensor nozzle.
It is **not** required for Vario operation as SkyNavigator has the option to do the TEK (Total Energy Compensation) calculation and thereby eliminating the need of a TEK tube to do the mechanical compensation.
For best vario sound in SkyNavigator 1.1.05, DO NOT attach TEK nozzle and enable the TEK option in SkyNavigator.

Lots of fancy words, point is to eliminate a false climbing tone when up-elevator is applied converting speed to height, and only get a nice beep-beep-beep when you are actually in lift :-)

<picture TEK tube connection>
<picture SkyNavigator TEK Tube or Calculated setting>

Patch antenna mounting

Patch antenna to be mounted in bottom of glider.
Again make sure it is not over a Carbon filled part of the fuselage.
Mounting with Velcro/Dual Lock approved and recommended.

<picture Antenna mounting in bottom of fuselage>
<picture beware of Carbon inlays in fuselage>

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Glider unit mounting

Make sure to be able to see the Status LED at the end of the unit (next to the antenna connector).

<picture Status Led>

<picture complete setup in glider fuselage>

Power on

Turn on receiver, and watch status led turn on.

Status codes

RED, initializing Vario sensor, visible for 0.5 second
FAULT = RED light for 5 seconds or stays RED forever.

YELLOW, initializing GPS, visible for 0.5 second

GREEN, good to go, awaiting GPS lock

BLUE blinking, GPS lock and transmitting 5 times a second.

Back to GREEN, GPS lock temporarily lost.
GREEN constant, programming mode.

<pictures of status codes>

Wait for GPS lock

Initial GPS lock can take a while depending on reception quality.
Make sure to be outside with a clear view of the sky. While GPS lock can be maintained under severe reception conditions (inside, under roof, many reflections), initial lock will take 'forever' under these conditions.
GPS is of course battery backed up, but without the help of up to date Almanac data from the Internet as the GPS in your smartphone is helped by, first start will take 30-60 seconds.
Also consider it is set up to only report when stable 3D lock is in place, a 'rough' 2D position is quickly established, but not what we want to use for GPS-Triangle racing.
In short, have patience during the first start of the day.

When stable 3D GPS lock is established a blue LED flashes 5 times a second.

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Pairing FLYMATE Ground and Glider units

FLYMATE units are paired by a ID number.

Initial delivery is a paired set containing a FLYMATE Ground unit and one or several Glider units, all with the same ID.

When ordering additional FLYMATE Glider units, please state desired ID, then it will be delivered preconfigured with that ID.

Setting ID by FLYMATE settings App (in development)

Download FLYMATE settings App from Google Play Store <##TBD## Link to FLYMATE APP>
Connect via USB OTG cable, and start App.
FLYMATE ID, bluetooth name and PIN code can now be configured.
##TBD##

Setting ID from Windows PC

Fully functioning, awaiting description.

FLYMATE Technical specifications

Dimensions

Weight

Glider unit 54 gram (GPS/Vario, Processor, Antenna)

Power

Ground unit, 5V (USB), 120-100mA
Glider unit 5-9V, 130-70mA

Radio link

FLYMATE uses 866-870MHz, FHSS on 30 channels, LBT and AFA, 25 mW as per ETSI EN 300 220-1 V2.4.1

List of tested USB direct connect Tablets and Phones

Tablets

Samsung Galaxy Tab S
Samsung Galaxy Tab S2
Xiaomi Mi Pad 2

Phones

Xiaomi MI5 (requires USB-C OTG adapter)

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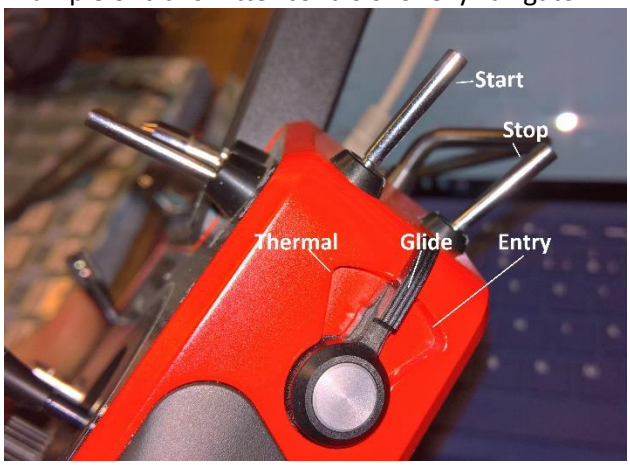
Radio set up for SkyNavigator

Take control of SkyNavigator

The SkyNavigator application can be controlled from your transmitter by setting up a control channel. This is highly recommended as it allows the pilot to have full control without having to take hands of transmitter or eyes of the glider.

Switching SkyNavigator between Thermal, Glide and Entry by a dedicated switch or linked to a flight mode simplifies the operation, and the possibility to control Start/Stop from the transmitter makes for simple restart of the task if first entry was too high or too fast.

Example of transmitter controls for SkyNavigator



The technical part, getting the control value

The control impulse in SkyNavigator must be between 0 and 99%.

The width of the servo pulse from receiver to FLYMATE must be between 1.000ms and 1.990ms, and is translated to the SkyNavigator value by deducting 1.000 and multiplying by 100, e.g. a pulsewidth of **1.400ms** = (1.400-1.000) * 100 = **40**

For a **Jeti** system this means the control channel vary between -100% and +99%.

The actual value sent to SkyNavigator can be seen on the last tab “Other”/”Rest” as the Impuls value.

Set up of radio in general

Goal is to have a control signal that switches between 1.400ms, 1.500ms and 1.600ms for controlling Thermal/Glide/Entry, and 1.050ms and 1.950ms for start and stop.
This translates to the control values of 40, 50, 60, 5, 95 which is entered in SkyNavigator under actions

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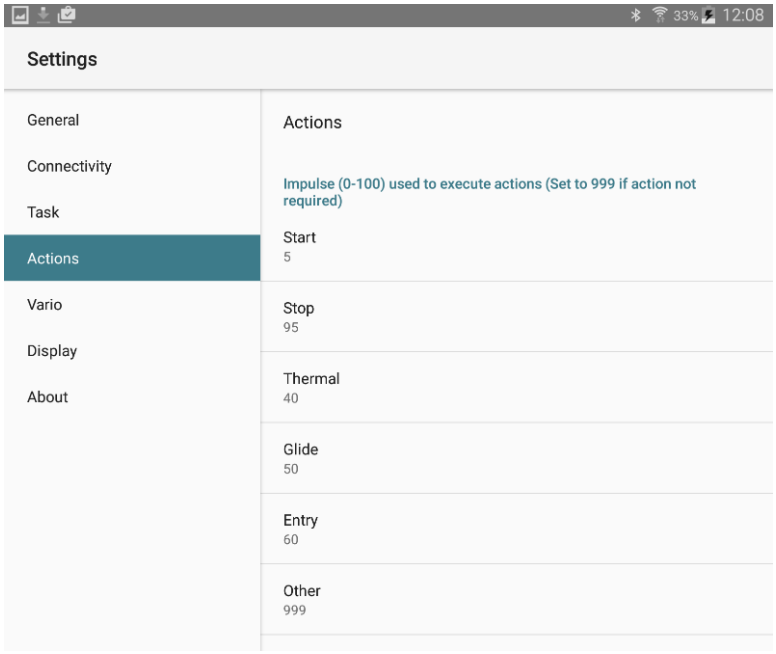

The values can vary depending on how you set up your transmitter, the above numbers are based on the Jeti programming example below.

The described setup uses a three-position switch, slider or flight modes to switch between Thermal/Glide/Entry, and two momentary switches to activate Start or Stop regardless of which general mode is currently selected.

This is achieved by using center values for Thermal/Glide/Entry, and pulling it low or high by mixing in the signal from the Start and Stop switches. To match the exact number every time, the Start/Stop value is restricted by the minimum and maximum for the channel.

This below examples are done using a Jeti transmitter, but the general principle of setting up the radio is the same regardless of brand.

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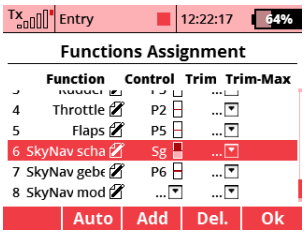
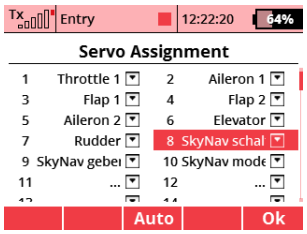
Jeti setup with 3 position switch + start and stop

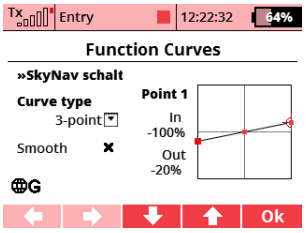
1. **Create a new function “SkyNavi”**

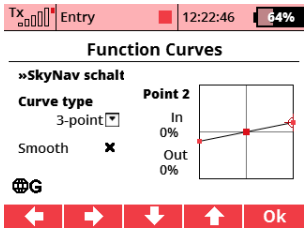


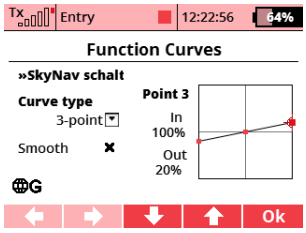


Assign it to the 3-position switch you want to use, in this example switch **Sg** and then assign it to a servo channel, in this example 8.

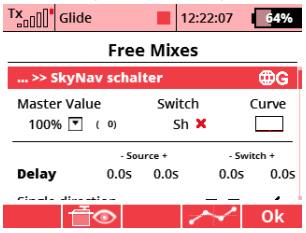
2. **Create a 3-point function curve to give -20%, 0%, +20%**

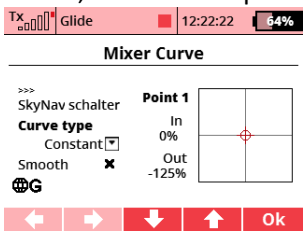




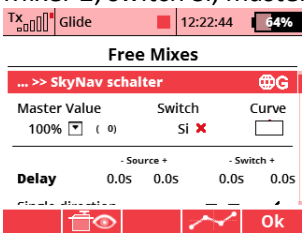


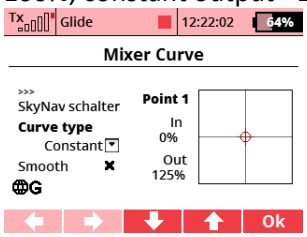
3. **Create 2 free mixers from ‘nothing’ to SkyNavi activated by start/stop switches**
Mixer 1, switch Sh, master value 100%, constant output -125%



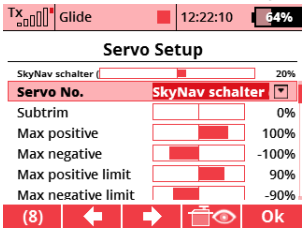


Mixer 2, switch Si, master value 100%, constant output +125%





4. **Limit servo travel to +/-90% on SkyNavi ‘servo’**



Step 3 and 4 to ensure you can always select start/stop, if you have -20% and add 125% you get 105% or if you have +20% and add 125% you get +145%, in both cases it ends up as +90% as the maximum servo travel controls this.

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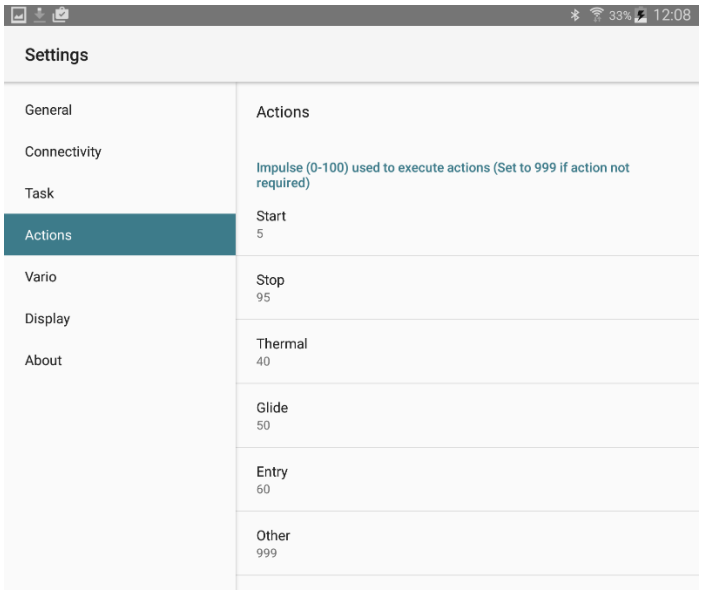
If you check the servo output, it should now switch -20%,0%,+20% and -90% or +90% when you pull start or stop.

This should give the values 40,50,60 and 5 or 95 in SkyNavigator app, you can check the value on the 4th tab “Other”/”Rest”

If the value isn’t stable (e.g. flickering between 40/41), try changing the subtrim of the channel by a few %

Now setup Actions in SkyNavigator and verify the controls.



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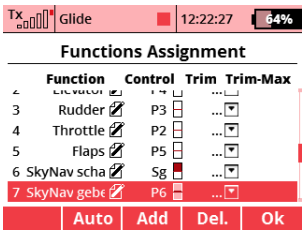
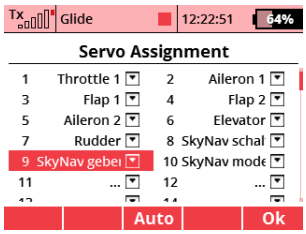
Jeti setup with proportional slider/knob + start and stop

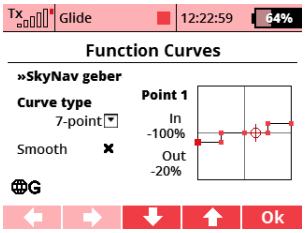
1. **Create a new function “SkyNavi”**

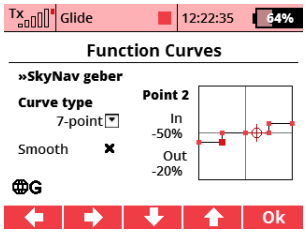


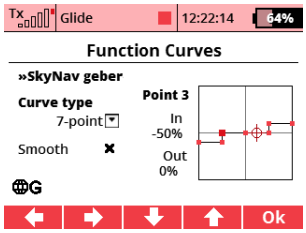


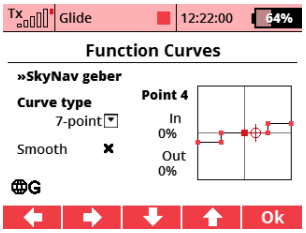
Assign it to the slider or knob you want to use, in this example switch **P6** and then assign it to a servo channel, in this example 9.

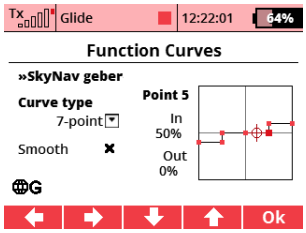
2. **Create a 7-point function curve to give -20%, 0%, +20%**

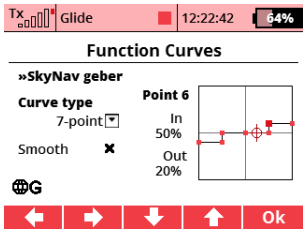


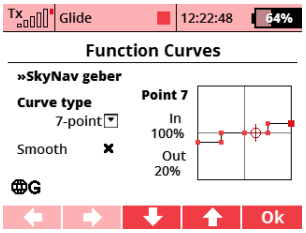












Point	In	Out
1	-100%	-20%
2	-50%	-20%
3	-50%	0%
4	0%	0%
5	50%	0%
6	50%	20%
7	100%	20%

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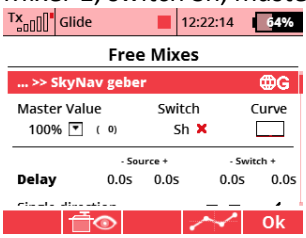
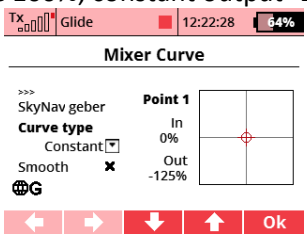
Mixer 1, switch Sh, master value 100%, constant output -125%





Mixer 2, switch Si, master value 100%, constant output +125%

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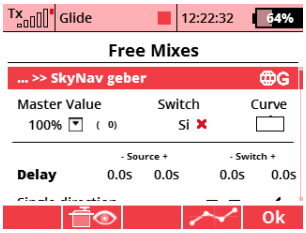
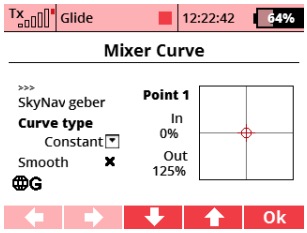
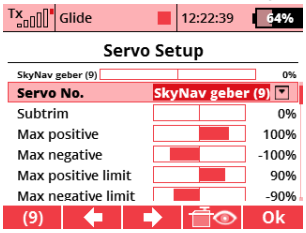




4. **Limit servo travel to +/-90% on SkyNavi 'servo'**



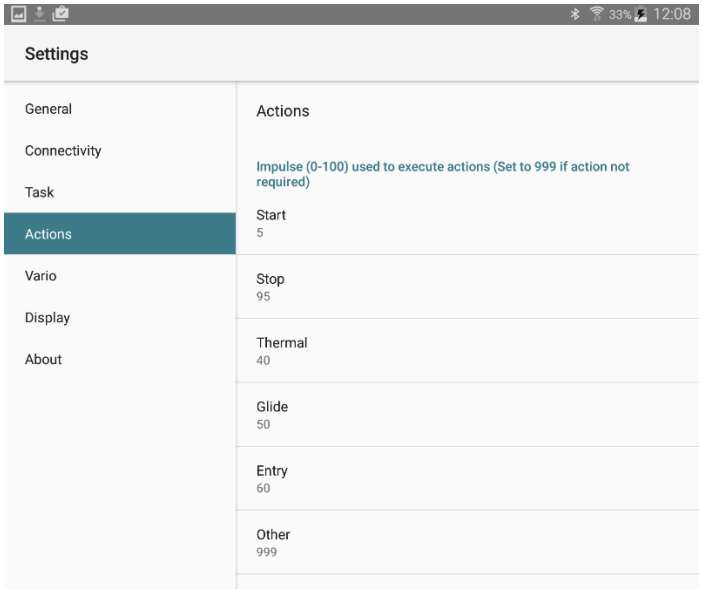
Step 3 and 4 to ensure you can always select start/stop, if you have -20% and add 125% you get 105% or if you have +20% and add 125% you get +145%, in both cases it ends up as +90% as the maximum servo travel controls this.

If you check the servo output, it should now switch -20%,0%,+20% and -90% or +90% when you pull start or stop.

This should give the values 40,50,60 and 5 or 95 in SkyNavigator app, you can check the value on the 4th tab "Other"/"Rest"

If the value isn't stable (e.g. flickering between 40/41), try changing the subtrim of the channel by a few %

Now setup Actions in SkyNavigator and verify the controls.



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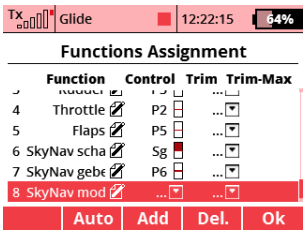
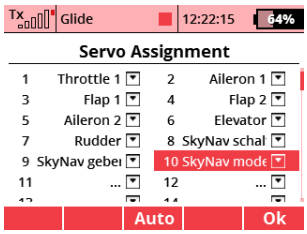
Jeti setup with flight mode control + start and stop

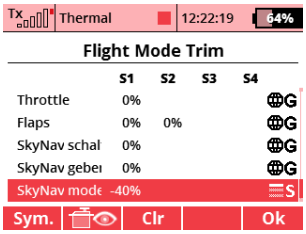
1. **Create a new function “SkyNavi”**

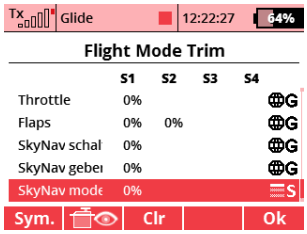


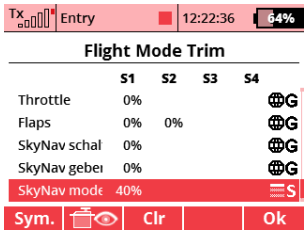


It is **not** assigned to a control. Assign the function to a servo channel, in this example 10.

2. **In flight mode trim, set up trim to give -20%, 0%, +20% servo travel**



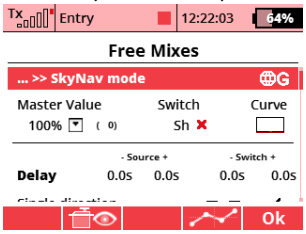


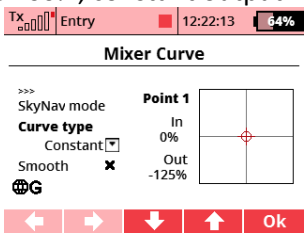


Note the trim is -40%, 0%, 40% for Thermal, Glide, Entry. This ends up as 20% servo travel

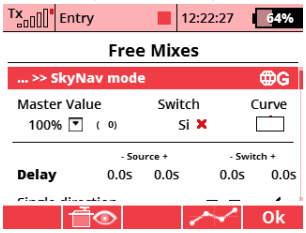
3. **Create 2 free mixers from ‘nothing’ to SkyNavi activated by start/stop switches**

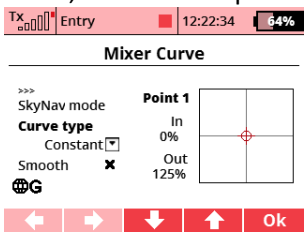
Mixer 1, switch Sh, master value 100%, constant output -125%



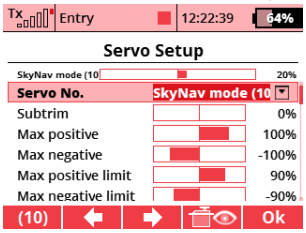


Mixer 2, switch Si, master value 100%, constant output +125%





4. **Limit servo travel to +/-90% on SkyNavi ‘servo’**



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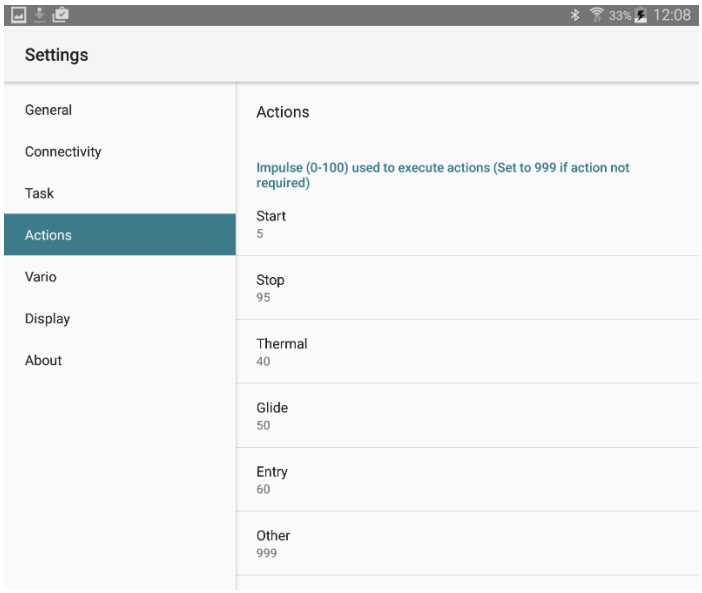
If you check the servo output, it should now switch -20%,0%,+20% and -90% or +90% when you pull start or stop.

This should give the values 40,50,60 and 5 or 95 in SkyNavigator app, you can check the value on the 4th tab “Other”/”Rest”

If the value isn’t stable (e.g. flickering between 40/41), try changing the subtrim of the channel by a few %

Now setup Actions in SkyNavigator and verify the controls.



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