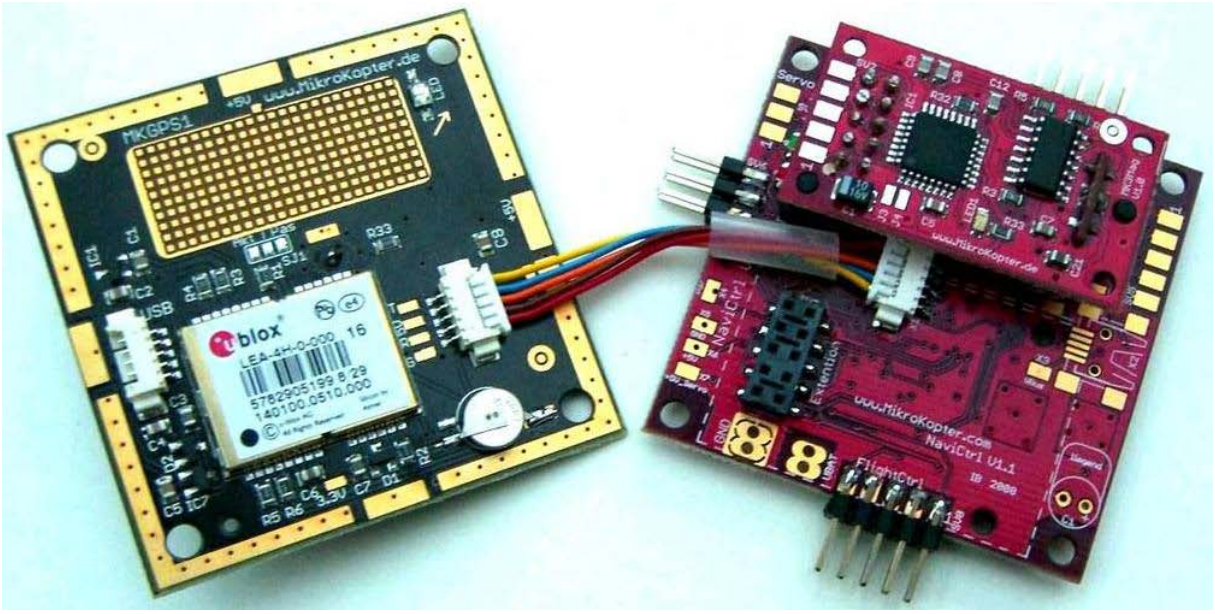
Navigation Control



NaviCtrl, MK3Mag and MKGPS cards

Introduction

The NaviCtrl together with the MK-GPS and MK3Mag extend the abilities of the Mikrokopter. Functions such as Position-Hold or Coming-Home are therefore now possible.

Besides an ARM9-Mikrocontroller and Mikro-SD-Card-Socket, the NaviCtrl-Board is also equipped with expansion sockets for future developments.

GPS modes

GPS_MODE_FREE

GPS is not used.

GPS_MODE_AID

Every manual intervention disables temporarily the GPS function. The GPS operates supportively and tries to stabilize the current position. After a manual control intervention, it slows down. After the "Position hold login time" the desired position is set. It beeps when the new position is logged in.

GPS_MODE_HOME

20 target points describing the HD-K path to the destination can be stored. The different points are located each in an area, defined by a circle and a radius. When a point is reached, The HDK stays

there for the predefined amount of time before continuing flying to the next point. When the last point is reached, it flies back to the start location. The sequence of path's points is reset every time a change to the GPS_MODE_HOME is done. The HDK flies to the start position when the sequence of path points is empty. The start position is the position where the engines start.

Note: When the HDK flies back by GPS_MODE_HOME mode, it has to be kept high thanks to height sensors. Otherwise it sinks and accelerates possibly always further.

Generally, GPS only works really well when the height controller is on. Otherwise the movement caused by the control vertical accelerations confuses the ACC -sensors too much. Since Flight-Ctrl V0.71C and NaviCtrl V0.12 it is possible to control the height sensor and GPS through a switch.

Settings

GPS gain

This gives how strong is the effect of GPS. If it is high, the position swings strongly. The value should be determined experimentally by assigning this setting to a Potentiometer.

Stick threshold

It allows to set, for the active GPS mode (i.e. GPS_MODE_AID or GPS_MODE_HOME), the threshold manual control, through Nick- and Roll stick.

Useful: If the value is set to 0, manual instructions, which interrupt GPS control, are not recognized anymore. Thereby, the HDK will not log using GPS_MODE_AID mode, but only by switching the Mode-Switch.
After flying to the desired position and switching to GPS_MODE_AID, playing with the sticks has no more effect and the HDK will still continue to return to its set position. Especially in windy conditions, this can be used to prevent that the HDK starts to drift.

Min Sat

This sets the minimum number of satellites, which are required by the GPS receiver in order to activate GPS functions. For a 3D control, at least 4 satellites are needed to calculate the HDK position. A reliable position value is given starting from a number of satellites.
The GPS signal power of the different satellites can be viewed when clicking on MKGPS in HDK tool. This should not be done during flight, as the data stream for the GPS display in MK-tool will be forwarded directly from Navigation Control card to the MK-tool, which makes GPS features on the flight control run out of energy.

Parameter GPS-P

It indicates the influence of the GPS-distance on the controller. Higher value means greater tilting during drift from a position).

Parameter GPS-I

It eliminates the permanent positional drift during wind. Higher Value means greater tilting during prolonged positional drift.

Parameter GPS-D

It indicates the influence of the GPS-Speed on the Controller (Higher Value = Slower movement)

Parameter GPS ACC

It indicates the support of positioning with the acceleration sensors. If the MK is pushed away it will react faster. Using a Poti, we can slowly and gradually work towards higher values.

GPS Wind Correction

A deviation from actual direction to the desired destination location can be caused by wind. A correction angle tries to minimize the deviation. This parameter controls the degree of influence of this compensation. This function is turned off when the value is equal to 0.

Speed Compensation

This is the D-component during a break-phase in GPS_MODE_AID mode after manual control. The higher the value, the harder the HDK brakes after a manual control before it sticks to the desired position.

GPS Max Radius

This value defines a circular area around the start position. The target positions are set only within this region. If a position is outside this area, the target point will be set on the edge the closest to intended position. The maximum radius is 250m.

Note:

- Position Hold (PH) works also, with the latest firmware, for a position outside the maximum radius.
- This value can also be set to a potentiometer and thus changed dynamically during the flight. If turned to 0, every goal is the starting position.

GPS Angle Limit

This parameter delimits the maximum influence of the GPS. A value of 100 equals about 20 degrees of inclination in an axis. With a too small value it could happen that the HDK will not be strong enough against winds and drifts away. A too large value might end in a too high speed.

Position Hold Login Time

This is the delay in seconds between the end of manual control (nick/roll back in neutral) and the sticking to the desired position in GPS_MODE_AID.

Signal tones

When properly connected, the NaviCtrl -FlightCtrl beeps often. The tones communicate the following:

- In GPS_MODE_AID or GPS_MODE_HOME modes, it beeps 1 time per second, as long as the minimum number of satellites has not been found (see parameter "Min Sun"). It turns off if a SATFIX exists but a sufficient number of satellites is not yet found.
- 1 beep (Piiiep) - Log new target coordinates
- 1 beep (Piiiep) - when changing the GPS mode
- 1 beep (Piiiiiiep) - It beeps longer when the engines start. Thereby setting the starting position is confirmed.

LED-Display

On the NaviCtrl there are 2 LEDs, 1 red and 1 green. The red LED indicates an error state. For the resolution of the current error the NaviCtrl has to be connected to the HDK tool. The green LED indicates the currently active communication with MK3Mag.

MicroSD card

The NaviCtrl logs the flight route in KML format on FAT16 formatted MicroSD-cards up to 2GB in size. A recognized and initialized SD-card can be seen in the NaviCtrl initialization messages.