User Guide

3DIGI

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Safety instructions

Radio-controlled model airplanes and helicopters are not toys! Appropriate knowledge and a safety-conscious behavior are required for the construction and operation.

Rotating parts in model airplanes and helicopters represent a risk of injury. Always keep sufficient distance to these parts.

Make yourself knowledgeable in advance for the operation of the model. Read the User Guide. If certain points are still unclear, get advice from experienced model helicopter colleagues or clubs or on the Internet in forums and on websites.

Check the model before every flight for a perfect technical condition. Do not start if there is only the slightest doubt about that. Repair any defects before the start!

Before lifting off check the current legal regulations. In many countries there is an obligation for a model liability insurance.

Pick a suitable airfield. Keep sufficient safety distance to persons, animals, vehicles and other objects that could be damaged and do not fly over them. You must also consider technical failures or pilot errors for the safety distance.

Operate the 3Digi only within the stated specifications. Protect the 3Digi from dust, dirt and moisture.

Disclaimer

Since the proper observance of the conditions and methods listed in this manual cannot be verified, we cannot assume liability for any damages arising from incorrect use or operation or things hanging together with that.

Technical data

- Size 38mm x 33mm x 20mm
- Weight approximately 16g without cables
- Operating voltage 2.5V – 9V
- RC input ports for various composite signals or Spektrum Satellites
- RC outputs ports 4x swash, tail and throttle
- Input port for RPM sensor
- Port for Micro USB cable
- Universal port for example Bluetooth Modules or GPS receiver
- Micro SD Card slot

- Software for easy setting of parameters under Microsoft Windows (7; 8; 8.1, 10)
- Firmware updateable
- Monitoring of external power supply
- EventLog
- Governor
- AutoLevel function
- GPS Logger if external GPS Module is connected
- Vibration analysis
- Permanent recording of flight, vibration and GPS data on SD card
- Recorded data can be downloaded and analyzed from SD card after flight

Connections

The 3Digi has various ports and jacks where the sensors, receiver, servos, etc. can be connected. These are explained in more detail below.

Micro USB
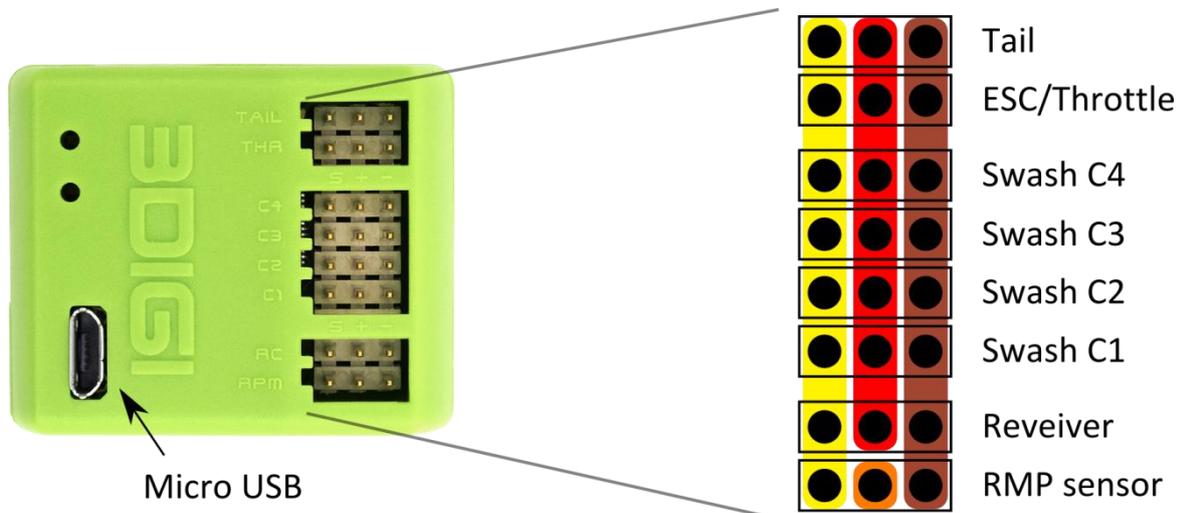
On the right side of the picture above, the inputs and outputs, that are located on the upper side of the 3DigiR, are shown schematically.

Servos, sensors and receivers have always to be connected, that the black / brown wire of the servo cable points to the right or to the outside of the 3Digi. The white / orange wire must be left or on the inside.

The brown colored pins on the right side are connected internally to form the common ground / GND / minus pole connection.

The red-colored pins in the middle are also connected internally and distribute the positive pole of the external power supply to the individual servos.

The yellow colored pins on the left side are the individual signal inputs and outputs.

The single orange colored pin is for the power supply of an active RPM sensor. This connector provides a 3.3V voltage.

> **Hint:**
> At the RPM sensor input an external voltage must not be connected under any circumstances, as this could result in damage to the 3Digi

Tail: Connection for the tail servo. If a special tail servo is used, which has a shortened neutral pulse (e.g. Futaba BLS251, MKS DS760 etc.), the appropriate settings should be made first with the 3Digi setting program before connecting the servo. Otherwise, the servo can run into its end points and get damaged!

ESC/Throttle: Connection for the ESC or throttle servo.

Swash C1 – C4: Here the individual swashplate servos are connected. The exact order and positions of the servos in the helicopter depend on the swashplate mixer selected in the setup software and can be viewed there.

Receiver: Connection for a receiver with composite signal. Most popular protocols, such as PPM, SRXL V1 / 2 (Multiplex, Jeti UDI), SUMD, SBUS, etc. are supported.

RPM sensor: An external speed sensor can be connected here. The signal level should not exceed 3.3V. An active sensor can be powered through the middle pin with a voltage of 3.3V. When connecting a RPM output, as it is available at some ESC, mostly only the ground / GND and the signal line have to be connected.

Micro USB: This port enables connecting the 3Digi with a PC or laptop. The 3Digi is thereby supplied with operating voltage, so that the setting of parameters can be carried out even without connected receiver power supply.

On the side of the 3Digi there are ports for one or two Spektrum satellite receiver. The device connected to the left socket is bound as the master during binding. If an optional satellite is connected to the right socket, this is bound as a slave.

On the back is the slot for the SD card. This should be inserted into the slot with the contacts on the card facing upwards. Then push it in until it stops. The card snaps in then. The card is removed by again pressing it in and will then get unlocked. The card can then be removed by simply pulling it out.

The SD card should only be inserted or removed when the 3Digi is disconnected from power!

On the remaining side from 3Digi is the special port. This is very flexible usable. You could connect e.g. an external Bluetooth or a GPS module here. More information about the assignment of the socket and voltage levels can be found in the chapter **Connections**.

The 3Digi HC variant (HC = high current) has 2 additional cable for direct connection of the external power. These cables have a sufficiently large cross section so that there is almost no loss of voltage between BEC and 3Digi even with power-hungry servos. The cables can be fitted out with various plugs or sockets. We recommend, for example, 2mm or 3,5mm gold contact plugs.

The red cable has to be connected to the positive terminal of the power supply, the black cable to the minus pole. On the underside of 3Digi you can find symbols that indicate the polarity of the cable.

First start-up

This chapter deals with the first start-up and adjusting the 3Digi. You should proceed with great care. An incorrect setting, for example the sensor sense, may make the Heli unflyable.

From time to time new firmware versions are posted on the website www.3Digi.de in the download area. The version number of the current version can be seen after connecting the 3Digi with the setting program in the **Area Information**.Area Information

Connection		
State:	Connected	Start
Communication port:	USB	Setup Assistant

Device info		
Serial number:	05D8FF39.33394746.43118040	
Version hardware:	3.1	
Version firmware:	1.0.6	Update available: V1.0.7
Version Terminal:	1.1.0.0	
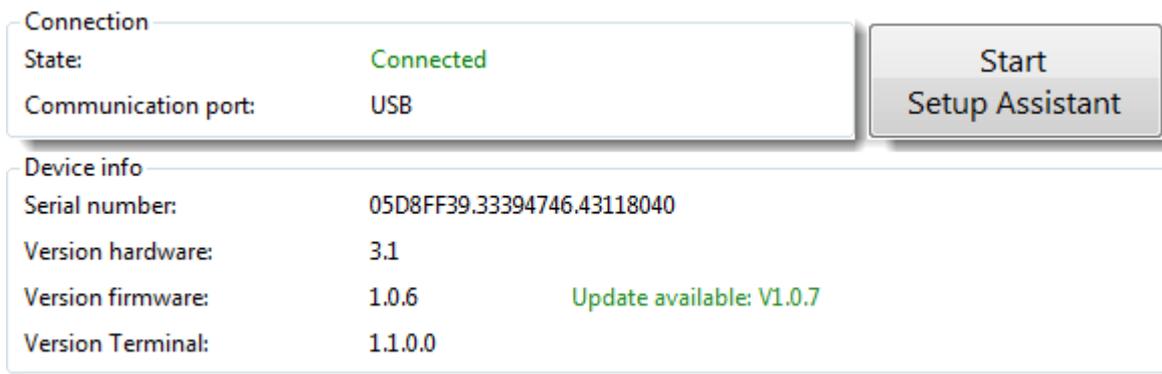
If a new higher version has been released, it should be updated first. Information to perform the firmware update can be found in the chapter **Firmware update**.

The button on the top right edge starts the Setup Assistant. This leads step by step through the base installation of the 3Digi.

Installation

The sensor should be mounted on the dedicated gyro platform or a similar suitable low-vibration place. For mounting a rather harder foam tape should be used. The type of the optimally tape may differ from heli to heli. If the sensor should not work well, you could try to experiment with different materials and damping.

The 3Digi can be installed in any position as long as the axes are parallel to three axes of the helicopter. For this the unit orientation is adjustable in the settings.

The exact terminals for the individual servos can be seen in the chapter **Connections**. The cables of servos should be guided loosely from the 3Digi and after a few centimeters be supported on the chassis. So no vibrations are transmitted through the cable and the cable cannot start to vibrate.

> **Hint:**
> In the 3Digi basic configuration the tail servo is configured as a normal digital servo. If you use a special tail servo with special neutral point, for example Futaba BLS 251 or similar, you should connect this only after its configuration in the settings. Otherwise, the servo could run to its end points and get damaged.
> Moreover the servo arms should not be mounted or the pushrods should be unhooked until the servo settings are made.
> To prevent accidental starting of the rotor, it is advisable to separate the motor cable or disconnect the motor pinion from the main gear until the completion of the initial settings.

Preparation of the transmitter

To prepare the transmitter for use with the 3Digi, it is best to use a new model memory or set an existing first one back to the factory defaults.

As the type of memory model select the helicopter configuration and swashplate mixer H1 (mechanical mixing). So the control commands for aileron, elevator and collective are transmitted in separate channels to the 3Digi.

By selecting a new model memory it should also be ensured that all trims of the control channels are set to 0.

Expo can be enabled on the control functions of the transmitter according to personal habits.

The gas curves should be programed as usual.

After installing the 3Digi in the helicopter, a range test should always be carried out before the first start!

Installation of the software

The installer for the 3Digi settings software, the so called **Terminal**, is available for download on the website www.3Digi.de in the download area.

After downloading the current installer and storing it on the local hard disk, it can be run by double clicking on the file. The installer starts and the following window appears.
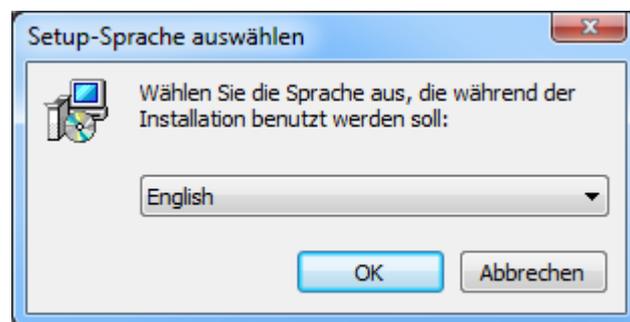
Here you can select the preferred language for the installation process, and then click **OK**. The program then leads through the other dialogues in which the components to install and the destination folder can be selected.

After the installation you will find an icon in the start menu or on the desktop. This icon starts the Terminal.

Overview Terminal

Here is a brief overview of the most important functions for the initial adjustment in the setting program.

Before the 3Digi can be adjusted, the connection with him has to be established. For this purpose connect the 3Digi via USB cable to the PC, wait until the 3Digi has initialized, and then click **Connect**. The program then loads the current settings from 3Digi and after that these can then be adjusted.


Values changed in the setting program are initially stored only temporarily on the 3Digi. If you would now disconnect the power source, the new values would be lost and the old would be active again at the next start. The values are saved permanently if you click the **Save** button in the toolbar.

The settings of the configuration are initially blocked for changes for security reasons. An accidental clicking while fine-tuning or looking at the parameters could for example, change the sensor effective direction and have fatal consequences. In the toolbar is a button with a lock icon. Clicking on it enables the configuration settings.

Making basic settings

For making the first basic settings the 3Digi must first be connected to the setting program. For this connect the 3Digi to the computer via USB cable and wait until the 3Digi has initialized. Then in the setting software click **Connect**.
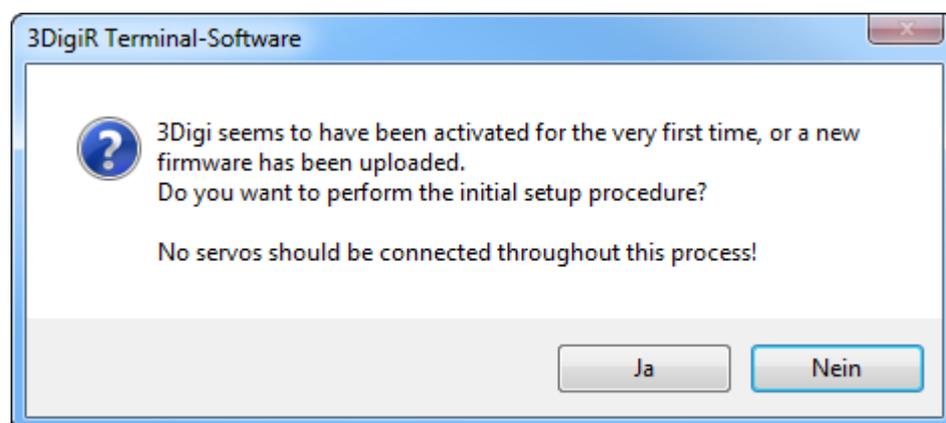
If the 3Digi is taken in operation for the first time and connected to the setup software, the above message may appear, which should be confirmed with **Yes**.

A first-initialization and reset of the parameters to the default values is then performed.

Upon successful completion, a message will appear and then the Setup Assistant will be started. This will lead step by step through the initial installation of the 3Digi.

If there is a prepared setup file available for the used type of helicopter (may be downloaded from the internet), you can load this using the menu **File|Load setup from file**. Possibly only a few parameters have to be adjusted then, such as trims and sensor effective directions. Some of the initial-setup steps may then be skipped. However every loaded value should always be checked again critically!

Operation

The following sections contain information that are important for the operation of 3Digi.

Switch-on procedure

When the 3Digi has been connected to the power supply, the sensors are checked first and the zero point determined. During this period the helicopter should stand absolutely still and should not be moved. In addition, the neutral positions of the transmitter sticks are read. So the sticks should remain in neutral positions and collective stick on full negative.

The completion of this process is indicated by a two-time rotational movement of the swashplate. From this point the servo and ESC outputs are active.

> **Hint:**
> If the rotary motion is not carried out, a problem has occurred during initialization and it must not be flown in any case! The servos remain powerless in this case, and the ESC output is not active.

Switch-on procedure trim flight

It is a requirement for a trim flight, that the auto trim has been activated in at least one of the parameter sets.

When connecting the 3Digi with the power, the collective pitch stick has to be in the central position (0 degrees, this corresponds to a live data value for collective pitch of -30 to 30), the other sticks in neutral position. A successful activation of the trim flight is signaled with a short break between the two rotations of the swash plate.

> **Hint:**
> In this process it must be ensured that the motor of the helicopter does not accidentally start when the collective stick is in the central position! You can prevent this by appropriate adjustments in the transmitter (throttle curve) or by operating the autorotation switch.

Pre-flight control and start

Before every flight, the helicopter should be initially tested for external mechanical damage.

Then first switch on the transmitter and then the 3Digi. The 3Digi initializes and then checks the sensors as well as the RC input. If everything has been initialized properly, he acknowledges this with 2 rotations of the swashplate.

Now you should make a short check of the function of the swashplate servos, for example by moving the collective stick, and the tail servo.

Then make sure that the swashplate is horizontal and the tail blades in their neutral position. The swashplate should neutralize itself automatically, depending on the setting.

Now you can start the engine and then lift off when there is enough rotational speed. While the helicopter is still on the ground, you should not give any control commands!

State LEDs

The 3Digi shows different states by different blinking patterns of the red and green LED.

● means LED on

○ means LED off

More ● or ○ in succession mean, that the LED is a correspondingly longer time on or off.

LED green	LED red	State
●●○○●●○○●●	○○○○○○○○	Initialization, slow green blinking; sensors are checked and zero point determined
●○●○●○●○●○	○○○○○○○○○○	Initialization, fast green blinking; sensors OK, device waiting for RC signal
●●●●●●●●●●	○○○○○○○○○○	Initialization OK; normal operation
●●●●●●●●●●	○○○○○○○○●	Normal operation, Watchdog-Reset occurred in operation
●●●●●●●●●●	○○○○○○●○●	Normal operation, BrownOut-Reset occurred in operation; bad power supply
○○○○○○○○○●	●●●●●●●●●●	Firmware update was made. Connect the 3Digi with the setting program to finish the procedure and/or make changes to the settings.
○○○○○○○●○●	●●●●●●●●●●	Error, no valid RC signal
○○○○○●●○●○●	●●●●●●●●●●	Error, wrong parameter in memory or wrong software version; Reset the setup with the setting program!
○○○●○●○●○●	●●●●●●●●●●	Error, sensor not OK; 3Digi moved while initialization or sensor defective
○●○●○●○●○●	●●●●●●●●●●	Error, extended sensor check failed; acceleration sensor jammed by vibrations, AutoLevel function not possible
●○●●●●●●●●	○○○○○○○○○○	Waiting for GPS fix
●○●○●●●●●●	○○○○○○○○○○	GPS fix received

SD card

For the recording of the various log data, the 3Digi requires a micro SD card. Cards in size 2GB up to 4GB are sufficient. The card should be formatted with FAT32 file system.

The log files are stored on the SD card into numbered subdirectories. 100 flights will be saved per subdirectory. The directory "00000000" includes, for example, the files of flights from 1 to 99, the directory "00000001", the flights 100 to 199, etc.

Already a card with only 2GB is enough for a large amount of flight records. But you should always make sure, that the card is not too full and therefore then no more data can be saved.

The setting program

By using the 3Digi Terminal, the control parameters can be adapted to the used helicopter and the desired flight characteristics can be adjusted. Setups and parameters can be saved in files and the recorded flight data can be analyzed. In addition, an update of the firmware is possible.

File types

In the setting program different types of files are used to store the settings and log files. These can be distinguished based on the file extension.

„4ds" files

These files contain the complete configuration (swashplate mixing, sensor effective directions, etc.) and parameter sets (gains, agility, etc.).

If you download and use preconfigured setup files from the internet, you should check all the settings and parameter critically after loading it. Sensor installation, directions of rotation of servos, etc. might be different from the own configuration.

„4dp" files

As a second type, there is the 3Digi parameter set files with the file extension "4dp". These contain only the parameter sets and no configuration data. They are for example useful to try a new parameter setting, without overwriting the configuration.

„4df" files

These files are stored during operation in subdirectories on the SD card. They contain the recorded flight data (sensor data, control commands, etc.). As the file name, the current flight number is used.

„4dv files

These files contain the recorded vibration data and are also stored on the SD card.

„4dh" files

These files contain data for a firmware update of 3Digi.

Window partitioning

The program window is divided into 3 parts. In the upper part there are menus and toolbar. In the left part the individual areas can be selected. In the middle there are the actual information and input fields. In the right part the individual help texts can be seen.

Menus

File menu
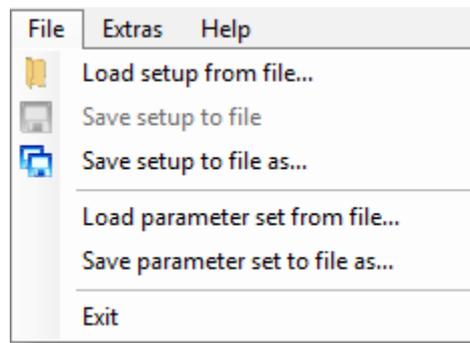
With the top three menu items, the entire setup of 3Digi, which means basic settings such as servo travel, sensor effective directions, etc., are stored or loaded in files.

With the middle two menu items individual parameter sets can be stored or loaded in files.
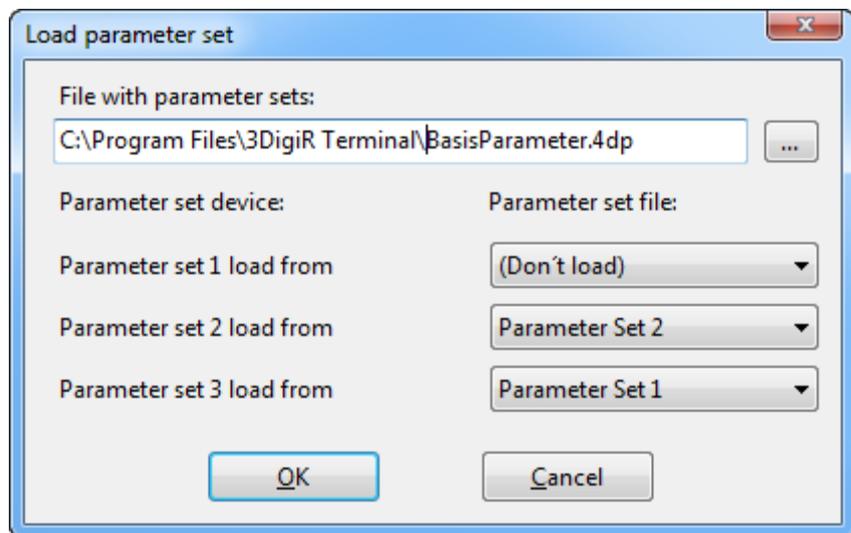
In the window that appears, a file name can be selected and where the individual parameter sets should be loaded or saved.

You have the option to load only individual parameter sets and assign them freely. In the above example, the parameter set 1 of the 3Digi is not overwritten. Into the parameter set 2 of the 3Digi parameter set 2 from the file is loaded, into parameter set 3 from the 3Digi parameter set 1 from the file is loaded.

The *Exit* menu item closes the program.

Extras menu
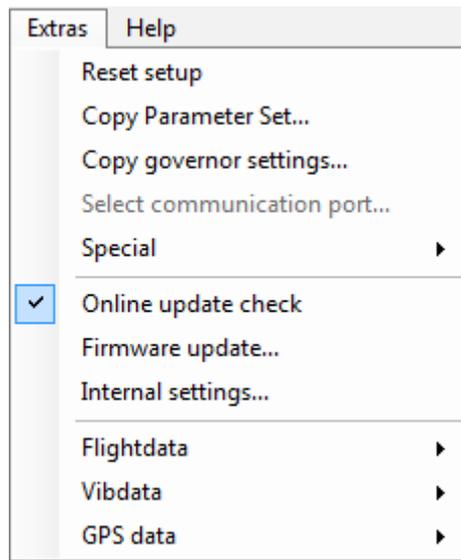
The topmost menu item resets all settings to their factory defaults. It is recommended, that the servos are disconnected from the 3Digi during this process, since servo and swashplate settings will be lost and servos could run into their end points.

With the help of the second menu item from the top, you can copy a parameter set into another. It opens a window, where the source and target parameter set can be specified.

If you only want to copy the parameters of the governor from one parameter set to another, the **Copy governor settings** menu is useful. Here, too, a window opens for selecting the parameter sets.

With the menu item **Select communication port** the interface, which the program uses to connect with the 3Digi, can be selected. Normally "USB direct" is selected in the appearing dialog. Alternatively, a connection via an emulated COM port can be used. This is needed for example when connecting via a Bluetooth module. The corresponding COM port can be identified in the device manager of the operating system or in the Bluetooth settings.
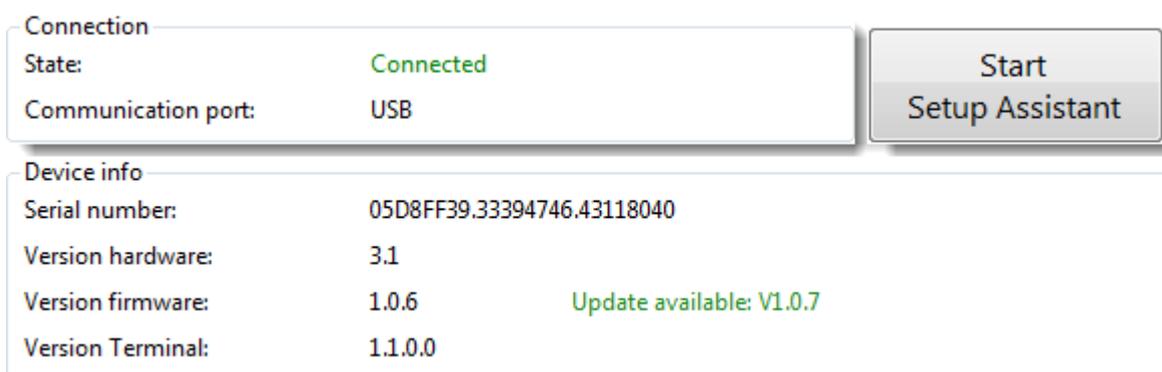
If the option **Online update check** is selected, at the start of the program it will be checked if there are newer versions of the firmware and the setting program available. This is displayed in the **Area Information** then. In addition, the update of firmware 3Digi can then be carried out directly with the online version, without having to download the firmware file first.

Firmware update opens a dialog which helps to update the firmware of the 3Digi. In this dialog, a file with the new firmware has to be selected and then the update procedure can be started. See also section **Firmware update**.
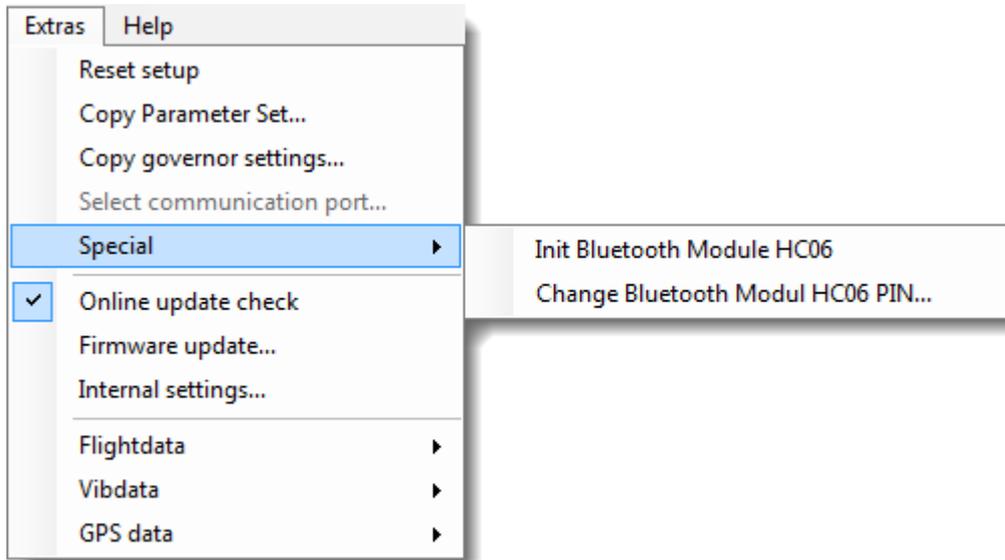
The submenu *Special* contains items, which are of interest associated with the special port. See also section **Bluetooth module** and **GPS module**.
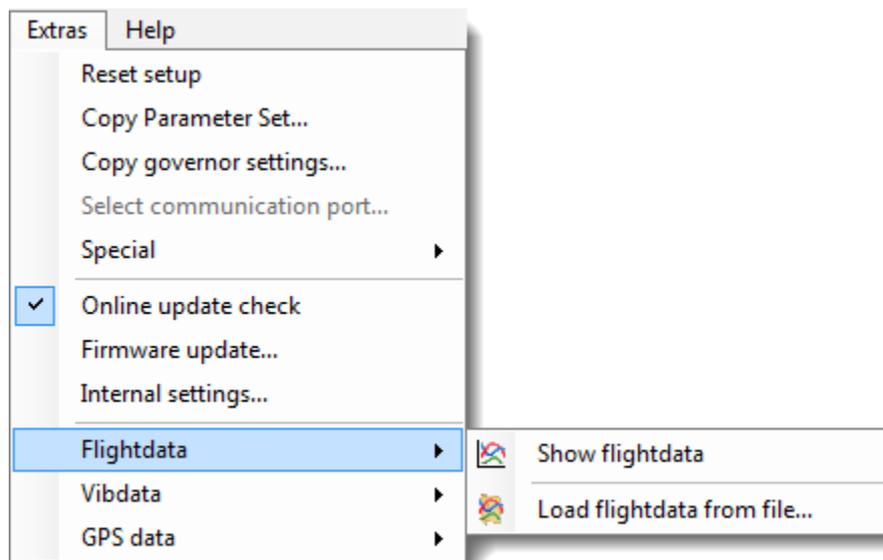
With the submenu *Flightdata* flightdata records recorded by the 3Digi can be analyzed and managed.

The top menu opens the window for the actual display of flightdata (see chapter **Window Flightdata** analysis).

The bottom menu opens a dialog, which helps to load the flightdata from a file. These files with the file extension "4df" are stored by 3Digi during flight in subdirectories on the SD card.
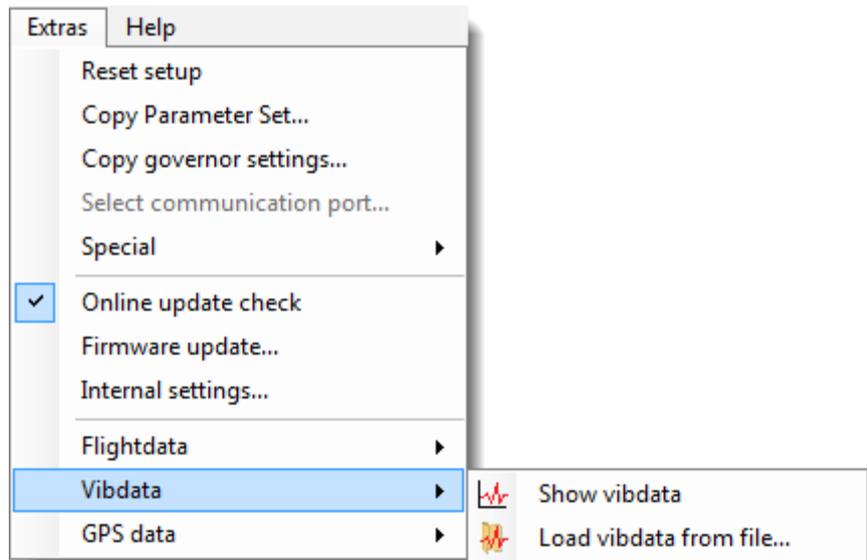
With the submenu *Vibdata* the records made by 3Digi can be analyzed and managed.

The top menu opens the window for the actual display of vibdata (see chapter **Window Vib-Data analysis**).

The bottom menu opens a dialog which helps to load the vibdata from a file. These files with the file extension "4dv" are stored by 3Digi during flight in subdirectories on the SD card.
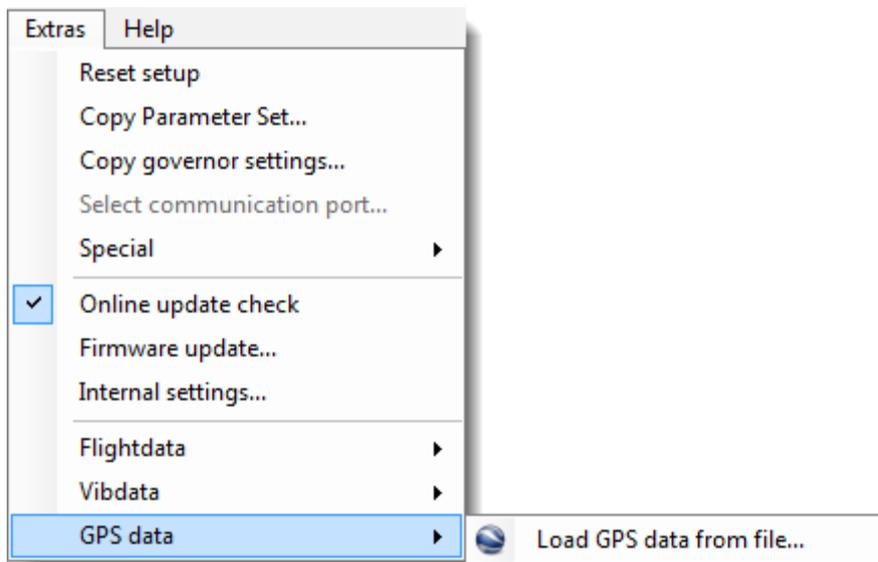
With the *GPS data* menu recorded GPS data can be converted and displayed in Google Earth (if installed).

The menu opens a dialog which helps to load the GPS data from a file. These files with the file extension "4dg" are stored by 3Digi during flight in subdirectories on the SD card.

Help menu
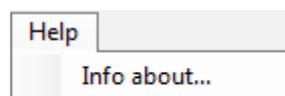
The **Info about** menu opens a window, where you can see the version number of the program.

Toolbar
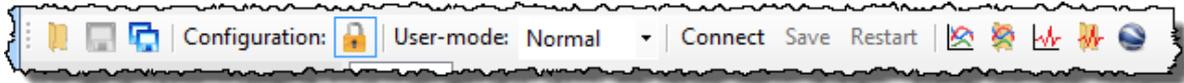
The toolbar is located below the menu bar and provides quick access to frequently used functions. When the mouse hovers over a button, after a moment a tooltip window opens with a brief explanation of the function of the button.

 These three icons call the functions for opening, saving and storing of setups under a specific name.

 The settings of the configuration are initially blocked for changes for security reasons. An accidental clicking while fine-tuning or looking at the parameters could for example change the sensor effective direction and have fatal consequences. In the toolbar is a button with a lock icon. Clicking on it enables or disables the configuration settings.
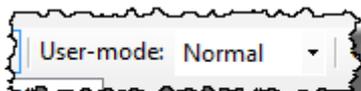
 The application supports various input modes to accommodate different applications and knowledge of users. Depending on the settings in this combo box ("Simple", "Normal", "Expert") more or less fields for the parameters are displayed.

 Use this button to establish the connection to the 3Digi. For this the 3Digi has to be connected to the PC via USB cable. With this button, the connection can also get disconnected later.
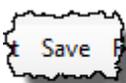
 If the 3Digi is connected and parameter changes were made, they are initially stored only temporarily on the 3Digi. If this would be disconnected from its power supply, the new settings would be lost and the next time the old ones active again. With this button the changes are stored permanently on the 3Digi, so they are available even after switching off and on.
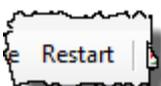
 With this button the 3Digi restarts. This can be helpful for certain settings, that require a reboot to get enabled.
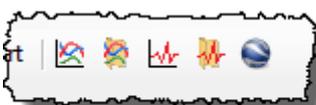
 These icons flightdata, vibdata and GPS data can be loaded from file and displayed in the appropriate application windows.

Selection of areas
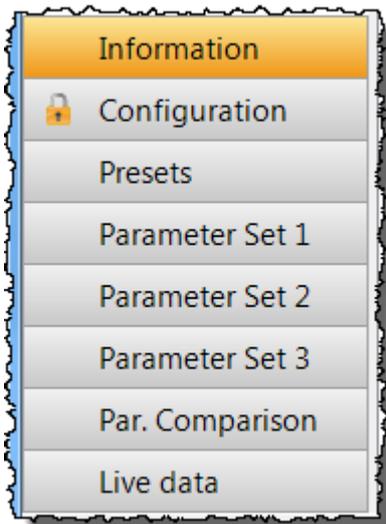
At the left bottom of the application there are buttons that allow the selection of the different areas.

In these areas, certain information is displayed or settings can be made.

Inside the Configuration button on the left, you can see a symbol of a lock. If this is visible there, this area is currently locked for changes and must be unlocked first with the corresponding icon on the toolbar.

Area Information

In this group different information about state of connection, port and serial and version numbers of the used software and hardware is shown.

When the program starts, it will check online if there are updates for the Terminal or the firmware of the 3Digi available. The version number of the updated versions will then be shown.

The button on the top left starts the **Setup Assistant**. This will lead you step by step through the initial installation of the 3Digi. Furthermore already existing settings can also be adjusted here.

The 3Digi logs the count of carried out flights and shows the number in the frame as **Current flight number**.

This flight number is also used as file name for the log files, which are saved on the SD card. The files will be saved in different numbered sub folders. Inside one folder a maximum of 100 flights will be saved. If this number is reached a new folder will be created and the following files will be added there.

The 3Digi has an event log, where critical errors will be recorded. In the flight data files on the SD card, all occurred errors will be saved. The last occurred error will also be recorded within the internal storage of the 3Digi and be shown inside the *Flight info* frame. The error message, the number of the flight, where the error occurred, and the point in time in seconds after the power up of the 3Digi are shown.

Area Configuration

This area is used to make the basic adjustments of the 3Digi, like RC input channels, swash configuration, sensor orientation and so on, and to adapt the settings to your helicopter. Because of this, this area is especial important for the first setup.

The settings are grouped by themes and shown in different tabs. For a first setup you should go through all the tabs from left to right and adjust the settings there. Or just use the *Setup Assistant*.

The user-mode, which you can find in the toolbar, should be set to *Normal*. In this mode only the settings, that are important for this purpose, will be shown.
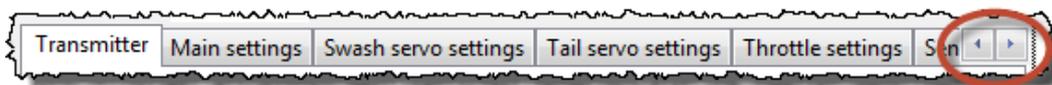
If the programs window is decreased in width, it may be possible, that not all tab titles can be shown simultaneously. In this case two buttons with arrows will be shown right of the tab titles. With these buttons you can scroll within the tabs.

> **Hint:**
> Many settings within this area are important for the fundamental functioning of the 3Digi and should not be adjusted within flight!

Transmitter

Here the type of the connected receiver respectively the communication protocol can be chosen.

The following protocols are supported:

- CPPM / combined PPM
- SRXL V1/2 (Multiplex SRXL, Jeti UDI)
- SRXL V3 (Beast)
- SRXL V8 (Graupner SUMD)
- SBUS
- Spektrum 1 Sat
- Spektrum 2 Sats
- Jeti EX

The receiver has to be connected to the 3Digi receiver input (see chapter **Connections**) by using a normal servo plug. Exceptions are the Spektrum sats, which have their own special ports at the side of the 3Digi.

If Spektrum sats are chosen, you can activate a binding procedure if you check the ***Bind at next init*** check box. The procedure will take place at the next time you connect the 3Digi to its external power. You can choose a special ***Bind mode*** before this. Consult your Spektrum transmitter or receiver manual for questions about the right bind mode.

> **Hint:**
> If Spektrum sats are connected for the first time to the 3Digi or master and slave sat ports are interchanged, you should perform a new binding procedure again in any case!

After the receiver has been chosen, the 3Digi input functions have to be mapped to the appropriate RC channels.

For this purpose a RC channel can be selected for every input function (aileron, elevator, collective pitch etc.). Additionally the channel can be inverted, that means the control direction can be flipped.

The combo box **Presets** allows to choose between different channel mappings for certain transmitter brands. By clicking on **Set** the selected mapping will then be activated. You have to check the rightness of this mapping after that in any case!

The exact directions of control inputs are important for the 3Digi, because several control functions and optimizations are based on these. You can check the directions in the middle of the frame below **Assigned functions monitor**. Here you can find a display for every input function, which shows the RC input and its direction as a small moving line. If the direction is wrong, you can correct this by inverting the function using the **Invert** checkbox.

Directions of control:
- **Collective pitch**, Line to top →Helicopter up/positive collective pitch
- **Tail**, Line to left →Rotation to left/counterclockwise
- **Elevator**, Line to top → Nose down
- **Aileron**, Line to left → Aileron left
- **Throttle**, Line to top → Full throttle

On the right side of the channel display the current number values of the input channels are shown. These values should be between 80 and 100 at maximum throw at the transmitter. If this is not the case, the travel values of the according channels should be adjusted in the transmitter settings (ATV, servo travel).

These maximum values influence the agility respectively rotation rates of the helicopter. Higher values result in more agility, lower values in less.

At the bottom edge of the channel mappings you can find a display of all input channels. These can help to assign transmitter sticks and other switches to their according channels.

Main settings
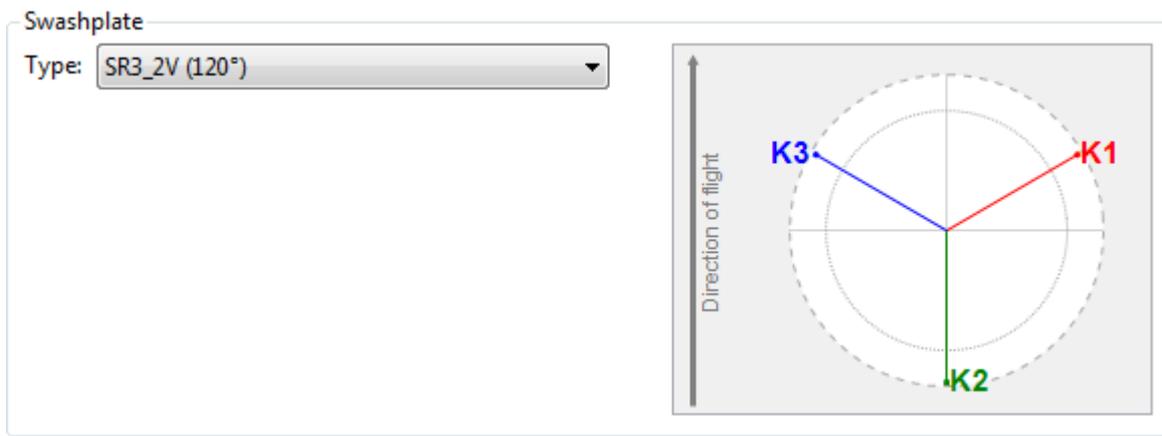
With the input fields in the frame **Swashplate** you can define the arrangement of the servos for the control of the swashplate.

The combo box **Type** offers several predefines swashplate arrangements. Normally most of the common arrangements should be available here.

On the right side you can see a graphical representation of the selected arrangement. With the help of this you can assign the single servos (C1 to C4) to their outputs at the 3Digi.

If none of the predefined arrangements applies, you can set one individually after selecting the type "Special". Some input fields will get visible after selecting that.

With these input fields you can individually for every servo (C1 to C4) set an **Angle**, the **Gap** between the pivot point and the rotor shaft and the collective **Pitch factor**, which the servo channel should put out.

By using these inputs you can realize for example a so called virtual rotation of the swashplate. You can often find these rotations on rotor heads with more than 2 blades. You can realize this rotation by simply changing the angle of the servos by a certain amount of degrees.

> **TIP:**
> You can identify the exact amount of degrees, if you place one rotor blade exactly over the tail boom. If you have set the correct rotation, this blade should not move if you make an elevator command on your transmitter.

The buttons marked with arrows help you setting the swash rotation. They rotate the complete servo arrangement by 1 or 10 degrees per click clockwise or counterclockwise.

Here you can set the **Rotational direction** or the main rotor (seen from top). With the help of this setting the 3Digi can find out the correct direction for the tail torque compensation for example.

Swash servo settings

3Digi

User Guide

With the combo box **Servo frequency** you can set the control frequency of the used swash servos.

As a little help you can display a list of commonly used servo types in the combo box **Pick servo** and choose one of them. The value for servo frequency will then be set automatically. You should compare this value with the specs made by the servo manufacturer in any case!

With the check boxes at the bottom left edge you can invert the servo output.

On the right side a graphic set of the current swashplate assembly is displayed. The buttons located there trim the swashplate on aileron, elevator and collective pitch. The trims are automatically transferred to the neutral position of the servos in the inputbox **Neutral**.

If the user mode "Expert" is chosen in the toolbar, several other input fields will be visible.

With these fields you can change the servo travel and the directions of the swash servos (C1 to C4). At an initial setup the cyclic throws for aileron and elevator should be set first using the **Swashplate travel**, before changing the parameters here.

The input field **Neutral** sets the neutral point of the servo. The values will be in internal resolution. Values between 0 and about 200 can be seen as normal. If you would need higher values, you should consider fixing this mechanically be adjusting the servo arm. If you change the neutral value, the end points of the servo will move too. So the neutral point should be adjusted before the end points.

Limit L and **Limit R** will change the end points of the servo travel. The values should be in the range of 90 to 125. By using different values for **Limit L** and **Limit R** you can compensate geometric asymmetries of the rotor head (for example different positive and negative collective pitch).

> **Hint:**
> The 3Digi allows quite large electronic throws. Some servos do not support this and might get powerless for large throws at the end points. As a warning for too large values the background of the input values will be colored yellow and red. Yellow values should be avoided already. If you have red colored values you should in any case check, that the servo works properly at its end points!

The checkbox **Activate angle correction** activates a so called servo linearization. This compensates differences in throw caused by the circular motion of the servo arm. If the correction is activated or deactivated, the collective and cyclic throws can change und should be checked because of this.

With the settings in **Swashplate travel** the cyclic throws for aileron, elevator and collective pitch can be adjusted.

You should set a cyclic throw of about 10°!

The set values should range from 40 to 60. Large deviations from the normal range are signaled by coloring the background. Red values should be avoided. For the deviation the value of a single parameter counts, but also the relationship between collective pitch and aileron/elevator values. You should try to keep the values in the neutral-colored region.

If both aileron/elevator and collective pitch values are too high, the servo travel for the swash servos should be increased or the rods on the servo arm should be mounted further out. If the values are too low, do it the other way round.

If mechanical mixing H1 is set, the input fields are deactivated. In this case there is no electronic swash mixing.

You have to set the directions with **Invert** so, that if you make an elevator command to front (nose down) on your transmitter, the blades pointing 90° to flight direction (blades point to the left and right) tilt to the front. If you make an aileron command to the left, the blades facing in flight direction (back blade over tail boom) tilt to the left.

In most cases the movement of the swashplate corresponds to that of the blades, that means the swash tilts in direction of the control input. An exception would be, if you have set a virtual rotation of the swashplate for multi blade rotor heads.

If you set positive collective on your transmitter, the blades should get a positive angle of attack (leading edge of rotor blade goes up).

The 4th channel of the swash can also be used for special functions. The channel will then not be controlled by the swash mixer, but instead by any channel of the transmitter.

The check box Activate activates the stated functionality. Using Input channel you can set the channel of the transmitter, which will be routed through to the 3Digi C4 output.

> **Hint:**
> The settings for channel 4 of the swashplate mixer (**Invert**, **Neutral**, **Limit L**, **Limit R**) are still valid. Thus, the same servo frequency is used for the channel as for the other swash servos!

The button **Manual servo control** shows a dialog, which helps mounting the servo arms and making the servo settings.
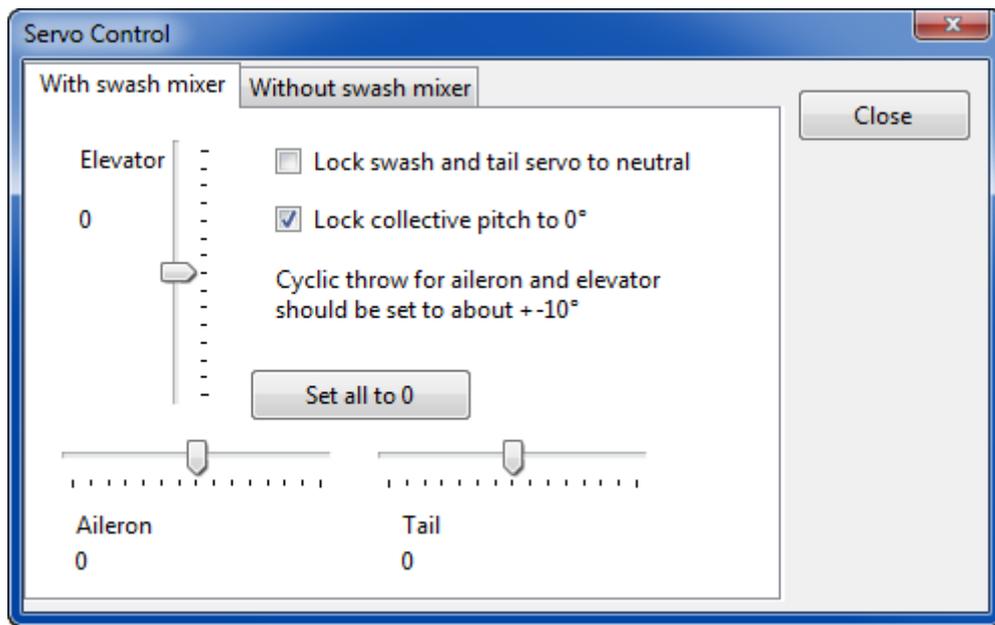
If the checkbox **Lock swash and tail servo to neutral** is set, the swashplate and tail servos are placed in their neutral positions. The servo arms can then be mounted so that they are perpendicular to the servo housing or to the push rods.

With the available sliders you can comfortably set the control inputs for aileron, elevator and so on from the dialog and measure the angles of the blades. **Parallel to this** you can change settings in the main window, for example servo travel, and measure the effect immediately on the blades. The control loop is deactivated, so that no disturbing outputs can influence the measurement. All the throws you can set here with the sliders should work without binding of the rotor head or tail linkage.

Because the servos are controlled by the Terminal program and not by the transmitter, they might run a little bit "choppy".

When setting the cyclic throws, you normally set a cyclic pitch of 0° as a base for the following measurements first. You can do this by using the collective stick on your transmitter or by activating the **Lock collective pitch to 0°** checkbox. The angle activated by the control box depends on the settings of the collective pitch trim in the tab **Swash servo settings** and the 0° position set in the tab **Diverse**. You should measure this 0° angle first before you continue.

After that set the aileron slider to full throw and measure the angle of attack of the blades for aileron with a pitch gauge. If the measured value is not within the wanted range, you can readjust it in the settings for servo travel, swashplate travel and so on.

For the measurement of the elevator use the same procedure.

While you are making an aileron measurement, the main blades should be aligned in flight direction of the helicopter, which means parallel to the tail boom. During an elevator measurement the blades should point exactly 90° to the flight direction.

The collective pitch function will be directly controlled by the transmitter. So the maximum collective throw has to be measured by this way. The collective pitch function can also be

fixed at the 0° position using the checkbox. This is a little help to measure the cyclic throws for aileron and elevator.

The maximum cyclic throw of aileron and elevator should be set to about +-10°.

The button **Set all to 0** sets all sliders to their neutral positions.

Tail servo settings

With the input fields in the **Tail** frame the tail servo can be configured.

In the combo box **Pick servo** you can choose between different predefined servo types. The values for servo frequency and neutral point, which are changed automatically by picking a servo from the list, have to be seen as a recommendation only and in case of doubt have to be compared with the servo specs made by the manufacturer!

If the current servo should not be in the list, **Servo frequency** and **Neutral point** can be manually set. Wrong values can lead to a blocking of the servo at the end points and destroy the servo! Consider the servo documentation here in case of doubt!

The input field **Neutral** sets the neutral point of the servo. The values will be in internal resolution. Values between 0 and about 200 can be seen as normal. If you would need higher values, you should consider fixing this mechanically be adjusting the servo arm. If you change the neutral value, the end points of the servo will move too. So the neutral point should be adjusted before the end points.

LimitL and **LimitR** will change the end points of the servo travel.

> **Hint:**
> On some servos the limit values should not be set too high. If the values are too high, the servo could get powerless at its end points or the movement is limited. Please check this at your helicopter!

The check box **Invert** will invert the rotational direction of the servo. You have to adjust this so, that the helicopter would rotate according to the direction of the stick input.

> **TIP:**
> If you make a tail command on your transmitter to the left, the **trailing edge** of your tail blades should also move to the left side.

The button **Manual servo control shows** a dialog, that simplifies the adjustments of the servo settings. See chapter **Swash servo settings**.

Throttle settings

Throttle input channel

Failsafe   Position

☐ Activate   -100 ⇅   [Use Current]

The 3Digi has the option to activate a failsafe function for the throttle output. This comes into effect, when for example the connection between 3Digi and receiver is interrupted and puts out a predefined servo position then. This position should be "Engine off" in most cases.

The check box **Activate** activates the failsafe function in the 3Digi, with **Position** the failsafe output can be manually defined

Alternatively you can set the engine off position on your transmitter and then click on the button **Use current**. The throttle position will then be read out and automatically transferred to the input field.

> **Hint:**
> Some receivers stop sending signals to the 3Digi in case of a failsafe. In this case a failsafe position that is only defined in the transmitter is not sufficient.
> Because of this the failsafe function in the 3Digi should always be set and activated!

Throttle output channel

Invert   Limit L   Limit R

☐   100 ⇅   100 ⇅

In the frame **Throttle output channel** the settings for the output of the throttle servo respectively ESC will be made.

Limit L and **Limit R** set the limits for the output channel. The check box **Invert** inverts the direction of the output.

> **TIP:**
> If the 3Digi is used as a governor for a nitro, the servo travel of the throttle servo should be set with the **Limit L** and **Limit R** fields and not with the servo travel settings of the transmitter!
> Before that, you should use the servo travel settings of the transmitter and set the gas input so, that the maximum throw in the **Channel mappings** is between -100 and 100.

The 3Digi has a port to connect a RPM sensor to measure the main rotor rpm and save that data into the flight log. To be able to calculate the correct number of rotations, some information to the gear ratio have to be entered first.

The field **Prescaler** sets how many pulses per revolution of the engine the rpm sensor puts out. For electrical engines this is mainly the count of the poles **pairs**. So with a 10 pole engine you would have to enter "5" here.

When using a nitro engine this value corresponds to the number of magnets, which are detected at each revolution.

In **Gear ratio** you have to enter the ratio between engine and main rotor. You can calculate this out of the count of teeth of the main pinions of the main rotor and the engines pinion. You could also check your helicopter manual for this.

In **Tail gear ratio** you have to enter the ratio between main rotor and tail rotor.

The sensor input of the 3Digi can be adapted to different sensor types. The field **Sensor port configuration** switches between 2 different internal wirings. If a sensor does not work with the 3Digi, you can switch here and try the other variant.

Phase sensors for electric drives mostly work with activated **PullDown** setting, magnet sensors for nitros mostly with **PullUp**.

> **Hint:**
> For safety reasons the main and tail rotor blades should always be removed, when changing the settings of the governor.

In the frame **Governor base settings**, the main settings for the governor can be made.

With the radio buttons next to **Mode** you can switch between **Electro** and **Nitro** mode.

The field **Throttle output low position** indicates the minimum gas value that the governor can output during operation. This is also the throttle position at which the governor soft start begins, when starting from standstill.

If you are using an electro heli, the position should be slightly below the position where the motor starts. When using a nitro it should be stable or slightly increased idle position.

If you click on **Use current**, you can read out the current input throttle position and put it into the field.

The governor is activated, when it is turned on in the active ParSet and the throttle input channel has a certain minimum position. This minimum position can be defined in the field **Governor activation position**.

You can also click on **Use current** here to read out the current input throttle position and put it into the field.

In electric helicopters the activation position should be set just below the output low position. This helps to have a good and smooth spool up.

If you use a nitro heli, the activation position should be located just above the output low position.

> **Hint:**
> After adjusting the activation position, you should always carry out a test with disassembled main and tail rotor blades and check, whether the governor really deactivates as planned (for example when operating the throttle hold switch).

The input field **Spoolup time** sets the time the helicopter takes to accelerate from standstill up to the specified RPM. The higher the value, the more slow and smooth the rotational speed is raised.

Spoolup time bailout sets the time the heli takes to spool up during a bailout phase.

The bailout phase is a short period of time after the deactivation of the governor. If the governor is reactivated during this period, the control spools the RPM faster back up. This can be practical e.g. when canceling an autorotation.

The field **Bailout phase duration** sets the length in seconds of the bailout period.

The period should be chosen so, that the bailout is still active even at the end of a longer autorotation.

If after the landing of the helicopter the governor is reactivated still within the bailout phase, it accelerates the RPM quite strong depending on the settings. You should pay attention on this and maybe wait a short period until the bailout phase has ended reliably.

> **Hint:**
> If there is a problem in governing mode (e.g. no more signals from the RPM sensor or measured RPM below minimum number of revolutions 500rpm), the governor deactivates itself and the throttle input signal is directly routed to the throttle output. Because of this, you should always have a throttle curve as a backup in your transmitter, so that you can continue flying safely.

Sensors

The inputs fields in this frame help to define the installation position of the 3Digi and the effective directions of the sensors.

Coming from the normal position (3Digi upright, servo connectors to the front of the helicopter in flight direction) you can define how the 3Digi is positioned within the model using *Unit orientation*.

On the right side near *Live gyro data* you can find 3 fields, which show the activity of the aileron, elevator and tail sensors by colored bars.

If the unit orientation is set properly, mainly the elevator bar should move on a movement of the helicopter in elevator direction, on an aileron movement mainly the aileron bar should move and on a rotation around the yaw axis mainly the tail bar.

If this is not the case, the setting in *Unit orientation* has to be corrected.

With the 3 checkboxes on the lower left side, the effective directions of the sensors can be inverted and adapted to the installation position.

To check the effective direction the sensor live data is helpful again. While you tilt the helicopter over its elevator axis to the front (nose down), the colored elevator bar has to move to the top. If the direction is not okay, click the *Invert elevator* checkbox. Then check direction again.

At next the aileron and tail directions have to be checked. While you tilt the helicopter to the left side, the aileron bar has to move to the left. While you rotate the helicopter to the left (counterclockwise), the tail bar has to move to the left side too.

> **TIP:**
> The effective directions can also be checked directly at the helicopter. At a movement around the aileron or elevator axis, the swash should move into the opposite direction and should keep its position against the horizon. If you rotate the helicopter to the **left** (counterclockwise) the **trailing edge** of the tail blades should move to the **right**.

Some of the following parameters are only visible in user mode "Expert". They are not required for the initial setup.

During a flight the 3Digi permanently performs a vibration analysis and stores this data on the SD card for a later examination.

As source for the vibration data one of the gyro or acceleration sensors can be chosen. Depending on the source different results for the analysis can appear.

Alternatively "All sensors alternating" can be selected. Here all sensors will be used in turn and you will get a widespread result, but with lower resolution.

AutoLevel

The AutoLevel function makes it possible to bring back the heli into the horizontal position in unclear situations.

If AutoLevel is active the 3Digi takes control over the swash functions. If the heli is completely in inverted position, at first a short negative pitch impulse will be given to gain some height. Then it will be rotated to normal position and stay there, as long AutoLevel is activated, using the set hovering collective pitch.

The tail is always controllable by the pilot. This can be used for example to readjust the heli after he has taken hovering position. After that you can deactivate the AutoLevel function and will get back full control. During the turning process no tail input should be set.

> **Hint:**
> Very important for a proper function are correctly configured input directions in the **Transmitter** tab.
> The collective pitch function can be checked if the AutoLevel function is activated on the ground. The swashplate must then be moved in such a way that positive collective pitch is set on the rotor blades.

The orientation of the helicopter (artificial horizon) is permanently calculated for the AutoLevel function. For that the built-in rotation and acceleration sensors have to work as precise as possible. However, the sensors may be disturbed by vibrations and the calculated horizon may deviate from the ideal position. Therefore a good mechanical build of the heli and lowest possible vibrations during flight is very important.

Partially, disturbing vibrations can be determined by the vibration analysis of the 3Digi. However, some vibrations are so high frequent that they are not indicated by the vibration analysis. Possible reasons for this may be e.g. bearing failures.

How strong vibrations interfere often depends on their frequency. So a slight increase or decrease of the main rotor RPM may improve the situation.

> **Hint:**
> It cannot always be guaranteed that the AutoLevel function places the heli exactly in a horizontal position. Therefore, you should always be prepared to possible deviations and ensure sufficient safety clearance and height.

Deviations of the horizon can be corrected by the system in smooth hovering phases.

> **Hint:**
> AutoLevel must not be activated during takeoff or land!

The AutoLevel functionality can be activated in several ways. The combo box **Activation mode** shows these ways.

> **Deactivated**: The AutoLevel functionality is deactivated. When the 3Digi is started, there is no extended check of the sensors.

> **Channel switch**: AutoLevel is activated by a channel of the transmitter. This is the recommended method. The channel should be actuated by a pushbutton and not by a switch. It is then possible to stop the AutoLevel function at any time by simply releasing the button.

> **Parameter set**: The AutoLevel function is activated depending on the parameter set. In which parameter set AutoLevel is permanently active, is set in the parameter set settings. One single channel can then be used for switching between 2 parameter sets as well as for activating the AutoLevel function.

Activation channel sets the channel for the activation of the AutoLevel. **Invert channel** reverses the channel.

The information field **Activation state** shows, if the AutoLevel function is currently active. The box will be displayed in green color then. You can also check the AutoLevel activation state in the **Live data** display.

In the frame **Output control** you can set, how the AutoLevel function will control the rotation back to level position.

The **AutoLevel controls collective pitch** checkbox sets whether the collective pitch is controlled by the AutoLevel function. When the box is clicked (this is the recommended default), the correct collective pitch position will be automatically set for optimal results during rotation. If the box is not clicked, the pilot must control collective pitch manually.

Hovering collective pitch determines the collective pitch position used during the horizontal AutoLevel hover. This should be adjusted in such a way that the helicopter maintains its height or gains height slightly in all the rotor head speeds used.

Negative collective pitch sets the collective pitch position, which is used when the AutoLevel function is activated in inverted position of the heli. Here you should set so much negative

pitch, so that the heli climbs slightly and gains enough height for the following rotation to the normal position.

The value **Negative collective duration (ms)** defines the duration of the negative pitch pulse in inverted position in milliseconds. Within this period, the heli is not yet rotated in the normal position, but first tries to gain some altitude with the negative collective determined in the previous value.

The value **Cyclic response** can be used to determine how strong the cyclic control commands (aileron, elevator) will be for the rotation. Higher values make a faster rotation with less loss of height, but may increase the mechanical stress. Lower values conserve the mechanics, but extend the duration of the rotation to the normal position.
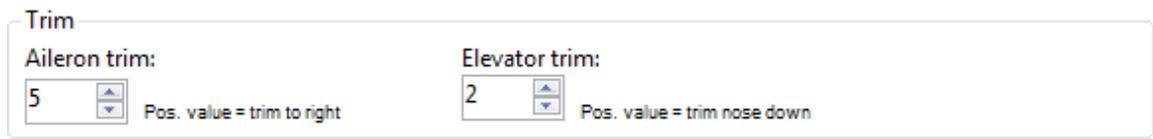
Trim
Aileron trim:
5   Pos. value = trim to right
Elevator trim:
2   Pos. value = trim nose down

The heli can be trimmed using the values in the **Trim** frame. The values set how straight or inclined the heli should hover with activated AutoLevel function.

Aileron trim sets the trim for the aileron function. The heli could for example be adjusted so that it hovers slightly to the side and the lateral thrust of the tail rotor is compensated. Positive values tilt the heli to the right.

The value should be set so that the helicopter hovers around the spot when it is windstill and the AutoLevel function is activated. A recommended starting value for a clockwise turning heli is 5. The heli would then hover tilted about 5° to the right. The optimal value must be found in flight.

Elevator trim defines the tilt for the elevator axis. Positive values trim the heli forward. This can also be used to correct any forward or backward drifting of the helicopter when the AutoLevel function is activated.

TIP:
In the case of unusual or problematic sensor values, the AutoLevel makes entries in the EventLog. The EventLog should therefore be regularly checked for such entries.
A "Sensor limit rotation" entry indicates a too high rotation rate around the roll, pitch or yaw axis, which can lead to a shift of the horizon.
A "Sensor limit acceleration" entry is caused by too high values of the acceleration sensors. Possible reason for this could be too strong vibrations of the helicopter.

Live Tuning

If you are experimenting with different settings it is sometimes troublesome to land for every change and make adjustments with the setting program.

Because of this the 3Digi supports a so called Live Tuning. With this you can assign up to 8 different parameters out of the parameter sets to a channel of your transmitter. So the parameters can be adjusted in flight with this channel.

Normally a slider or rotary knob is used on the transmitter to adjust the channel. Through this channel the base value of the parameter, which has been set in the settings, can be modified or fine-tuned by about +-20 points up or down. The range of adjustment is intentionally kept relatively small in order to obtain not to big changes in the regulatory behavior.

You can set the direction of the parameter change with the checkbox *Invert*.

At the right edge the current resulting active values of the parameters are shown. Here it should be checked if the adaption really has the desired effect.

> **Hint:**
> You should make sure, that by the change of the parameter the gain of a control axis is not unintentionally set to 0! This could deactivate the control for this axis completely!

In the above example, the tail gain is adjusted by the channel 5, the sensitivity of roll and elevator at the same time through the channel 8.

The button *Apply values to PSX* transfers the actual tuning values to the corresponding parameters of the currently active parameter set.

> **Hint:**
> After transferring the tuning values, the tuning controls used on the transmitter should be reset to neutral! Otherwise the change of the corresponding parameters would be doubled!

Diverse

Collective Pitch

Pitch 0° position: [0] [▲▼]   [Use current]

The torque compensation from collective pitch to the tail outputs a little control amount to the tail, which is depending on the collective position. At a collective angle of attack of 0° the amount is minimal and increases linear with the angle of the main blades.

The input field tells the 3Digi, at which collective input the main blades have an angle of attack of 0°. With a common 3D setting in your transmitter with 0° at centered stick, the value here will be mostly 0. If you have a scale setting for example with hovering collective at centered stick, the value will be different.

If you have special settings, you should move your collective stick, so that the angle of attack of the main blades is 0°. Then click the button **Use current**. The value will then be read out automatically from your transmitter and transferred to the input field.

PowerOn init delay

Delay initialization after PowerOn (0 = no delay):   [0] [▲▼]

Some receivers (for example Spektrum) need relatively long time for their initialization and binding procedure and output wrong neutral positions for a short time during initialization on the input channels. The 3Digi would then take over these wrong neutral positions. With init delay you can set an additional time in seconds, which the 3Digi will wait after power on before it continues with its own initialization.

Variable ports

Special port: [Hott Telemetry   ▼]

Master port: [No function   ▼]

Slave port: [No function   ▼]

Hott telemetry sensor ID: [General Air Module   ▼]

The 3Digi has an additional port, with which different special functions can be realized. It is possible for example to connect a Bluetooth Module, the cable for the Jeti integration or a GPS module here. If the Spektrum ports are free, a GPS module may also be connected there. You have to keep in mind, that the Spektrum Slave connector and the normal receiver input of the 3Digi internally share the same port and there can only be something connected to one of the two ports. You can find further information about this in the chapters **Bluetooth module** and **GPS module** in the manual.

If Hott telemetry is activated, the 3Digi identifies itself to the receiver with a specific sensor type. The type can be set with the combo box **Hott telemetry sensor ID**. This can help to prevent collisions with other Hott sensors connected at the same time.

> **TIP:**
> After you have finished with the entire configuration settings, you should not forget to save the changes permanently on the 3Digi by clicking on **Save** in the toolbar!

Area Presets

In this area different presets for Agility and so on can be selected. These presets have an effect on several settings in the parameter sets.

By using the combo box **Agility** a preferred agility respectively rotation rate can be chosen. The check boxes **Parameter Set** control, in which parameter sets the presets will be activated. The button **Set** will activate the selected settings.

The combo box **Size** can be used to select the size of the helicopter. By clicking on **Set** optimized parameters for that model size will be set in the selected parameter sets.

Area Parameter set 1/2/3

Within this area you can find the settings, which can influence the flight characteristics of the helicopter.

Because the 3Digi has 3 different parameter sets, all of them are adjustable here separately. In this way you can find optimal settings for different flight states or rotational speeds.

> **TIP:**
> When using the different parameter sets, you could always leave one parameter set with "save" and proven settings and experiment with one or two of the other sets. In case that one settings doesn´t work, you can always switch back to the proven parameter set.

Aileron/Elevator

The parameters in the tabs aileron and elevator are largely the same and are therefore described together.
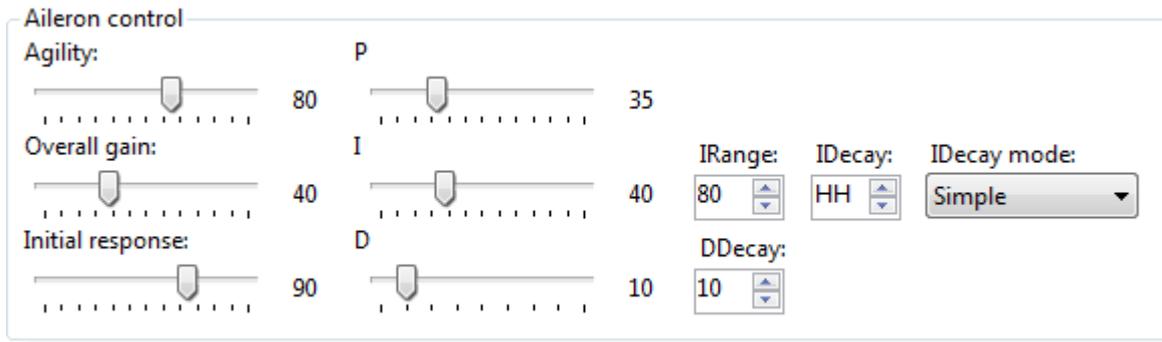
Agility: Specifies how fast the helicopter rotates about the specified axis, i.e. how agile he is. The rotation rate is set by the respective aileron or elevator channel on the transmitter, therefore the maximum value also depends on the servo travel/dual rate set there for the channel.

Overall gain: Specifies how large the total sensitivity (gain) of the control loop is and how strongly this responds to deviations from the controlled rotation rate. Excessively high values may result in a swinging, low values result in a sluggish helicopter which responds poorly to control commands and external disturbances.

After an initial setup of a helicopter these values should be changed and optimized at first.

Initial response: Part of the stick input which is passed directly to the swashplate. Too low initial response may lead to an indirect and delayed reacting helicopter, too high values to turning back at stops.

P: Sets the P-part of the control loop. The P- or proportional part is the control part, which is directly dependent from the control deviation (controlled rate of rotation (nominal) minus real yaw rate (actual)). Too high values lead to rapid vibrations of the helicopter to the longitudinal and transverse axes, too low values in poor snapping behavior. The P-part controls relatively quickly, but cannot completely eliminate a deviation alone.

I: Sets the I-part of the control loop. The I- or integral part adds/integrates the control deviation over time. The I-part is relatively slow in controlling, but in contrast to the P-part can completely eliminate the control deviation. Excessively high values lead to slow oscillations or overshoot in abrupt stops, too low values to a spongy flight behavior or back turning at stops.

IRange: Specifies the maximum available control throw for the I-part. Too low values could for example cause a slow rear up at very fast forward flight since the throw is not sufficient to counteract the rear up tendency.

IDecay: Specifies the return time of the I-part. The higher the value, the longer it takes to neutralize the swash plate/I-part after a control command or a movement. A returning I-part generates a flight feeling which is more like a paddle head. With a setting of 128/HH, the I-part is not running back and the control works in heading hold mode. With a very slowly or not running back I-part, make sure when you start that the swash plate is level! Otherwise, the helicopter might tilt when you take off.

> **TIPP:**
> Especially at helicopters with combustion engine the *IDecay* should better be set a little lower, particularly in the parameter set which is used to take off.

IDecayMode: Specifies the mode for the ***IDecay*** parameters. In "Simple" mode, only the value of IDecay is used. In "Extended" mode, a collective pitch dependent value can be used. Further explanations follow in the next section.

D: Sets the D-part of the control loop. The D- or differential part is dependent on the rate of change of the control commands and can support abrupt changes. The D-part generates a short accelerating control pulse at rapidly changing control input commands. Too high values can cause an overshoot during fast stops or oscillations.

The D-part can help to make abrupt stops of the rotary movement more "crisp" and, especially with elevator to prevent whipping.

DDecay: Specifies the length of the D-pulse. The D-part generates short control pulses. This value indicates how long these are. Higher values make the pulses last longer and expire slower.
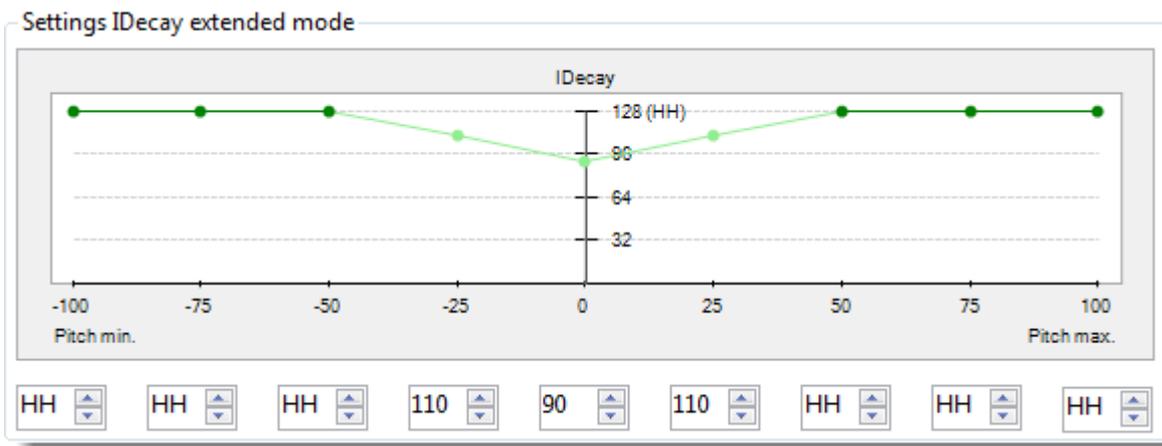
If the value "Extended" is selected in the combo box ***IDecayMode***, the values here will be enabled and you can make changes here.

In the input fields you can set a value for IDecay depending on the collective pitch position. The entry fields on the left correspond to a minimum collective pitch, that on the right side a maximum and that in the middle neutral collective pitch.

In the above example, a value of 128/HH is set for positive and negative collective from about hovering position. At collective pitch around the neutral point a neutralizing swash of approximately 90 is set. This setting would have the advantage that if you go through the neutral collective position during takeoff, the swash would neutralize slowly and that results in a safer takeoff.

In certain flight situations the helicopter might have the tendency to rear up and to take the nose upward undesirably. This behavior occurs especially in high-speed flight.

With the above two values this behavior can be eliminated. The higher the values are, the more is counter steered against the rear up.

The static value improves situations where rear up occurs at a constant pitch, for example, during high-speed flight.

The dynamic value depends on the current value of the integrator and reinforces this, so reacts depending on the flight situation (for example forward, backward flight) differently. Excessively high values can lead to swaying.

With activated rear up compensation the swashplate tilts slightly forward at collective pitch inputs. This behavior, however, is completely normal.

Swash

Here the **Pirouette optimization** function can be activated. This means when the helicopter rotates around the vertical axis the I-part is converted that this still shows in the old direction. So the helicopter will not "wobble" in stationary pirouettes with strong winds.

The Cyclic Ring function limits the servo travel "in the corners" on simultaneous stick input of aileron and elevator and thus prevents a possibly blocking the swash linkage.

The lower the value **Cyclic limit** is, the lower is the servo travel in the corners.

With the settings in **Pitch pump** you can mix an additional short boost to the collective pitch output at fast and strong collective inputs. The response will be harder then and certain figures, such as TicTocs, might become easier. The hovering behavior could get a little worse by this.

The value **Strength** sets the amount of collective boost, **Decay** sets the length of the pulse.

AutoLevel

If the **Activate AutoLevel in this ParSet** checkbox is selected, the AutoLevel function is always activated and is permanently on when the current parameter set is activated. The corresponding **Activation mode** must also have been made in the **AutoLevel** section of the configuration settings.

Tail

Agility: Specifies how fast the helicopter rotates around the vertical axis. The rotation rate is set by the tail channel on the transmitter; therefore the maximum value also depends on the servo travel/dual rate set there for the channel. A maximum regulated rate of rotation of approximately 800°/sec can be achieved!

Overall gain: Specifies how large the total sensitivity (gain) of the control loop is. Excessively high values may result in a swing up in flight or during stops, too low values lead to a slow and spongy tail that reacts poorly to control commands and external disturbances.

After an initial setup of a helicopter these values should be changed and optimized at first.

The overall gain can be additionally adjusted in certain situations based on the values for *Extra gains*.

> *Left*: Value, which will be added to the overall gain in left turns (counterclockwise) of the helicopter.
>
> *Right*: Value, which will be added to the overall gain in right turns (clockwise) of the helicopter.
>
> *Start*: Value, which will be added to the overall gain in accelerations of the rotation of the helicopter.
>
> *Stop*: Value, which will be added to the overall gain in decelerations of the rotation of the helicopter.

P: Sets the P-part of the control loop. The P- or proportional part is the control part, which is directly dependent from the control deviation (controlled rate of rotation (nominal) minus real yaw rate (actual)). Too high values lead to fast oscillations of the tail, too low in poor snapping behavior. The P component controls relatively quickly, but cannot completely eliminate a deviation alone, that means the tail would turn away slowly.

I: Sets the I-part of the control loop. The I- or integral part adds/integrates the control deviation over time. The I-part is relatively slow in controlling, but in contrast to the P-part can completely eliminate the control deviation. Excessively high values lead to slow oscillations or overshoot in abrupt stops, too low values to non-uniform rotation rates at pirouettes or turn back turns at stops.

IRange: Specifies the maximum available control throw for the I-part. A too low value can lead to non-uniform rotation rate in pirouettes at high speed, because the throw is not sufficient to counter steer enough.

IDecay: Specifies the return time of the I-part. The higher the value, the longer it takes to neutralize the I-part after a control command or a movement. With a setting of 128/HH, the I-part is not running back and the control works in heading hold mode. Values less than 128 result in a wind vane effect, which means the tail rotates slowly with the wind or when flying it follows the direction of flight.

D: Sets the D-part of the control loop. The D- or differential part is dependent on the rate of change of the control commands and can support abrupt changes. The D-part generates a short accelerating control pulse at rapidly changing control input commands. Too high values can cause an overshoot during fast stops or oscillations.

The D-part can help to make fast stops more „crisp".

DDecay: Specifies the length of the D-pulse. The D-part generates short control pulses. This value indicates how long these are. Higher values make the pulses last longer and expire slower.

Initial response: Part of the stick input which is passed directly to the tail. In the tail control this value is not as important as in the control of aileron and elevator for example.

Torque compensation
From collective pitch: 50　　From aileron: 0　　From elevator: 0

If the main rotor blades change the angle of attack, for example as a result of collective or cyclic commands, the torque, which has to be compensated by the tail, changes too. This could lead to unwanted swings of the tail.

To counteract this effect, there is a pre-compensation to the tail, which is dependent on the control outputs to the swash. The values here set the strength of this pre-compensation.

A helicopter with clockwise rotating main blades would turn to the left, if the torque of the main blades increases (more collective or cyclic). So the compensation has to output a small right control amount to the tail. On a counterclockwise rotation helicopter it has to go the other way round.

Governor

Activation
☑ Activate governor　　　　Rotor RPM: 1500
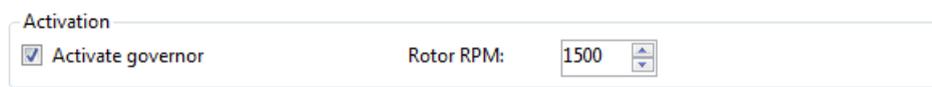
The checkbox *Activate governor* activates the governor in the current parameter set.

When this parameter set is active and the throttle input channel has reached the activation position, the 3Digi starts to control the RPM.

The field *Rotor RPM* specifies the target RPM. You have to make sure, that the entered speed is plausible and also that the speed sensor returns values in the expected range, depending on the gear ratio entered in the configuration settings. To verify the RPM. you

could start the heli with disassembled main and tail rotor blades and check the rotor speed (displayed in the live data).
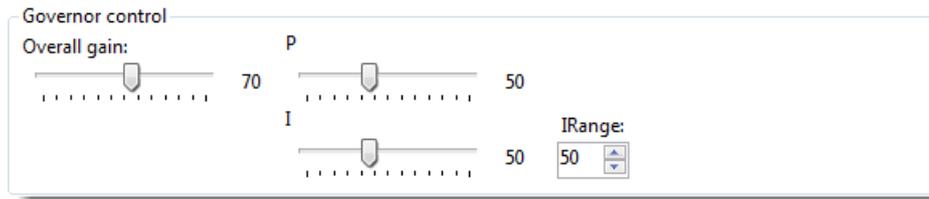
The frame **Governor control** includes the controls for the adjustment of the governor control loop.

Overall gain: Specifies how strong the control loop reacts to deviations from the desired RPM. Higher values produce a faster and stronger reaction, but can lead to swinging of the speed or movements of the tail when throttle changes.

P: Sets the P-part of the control loop. The P- or proportional part is the control part, which is directly dependent from the control deviation (current RPM (nominal) minus real RPM (actual)). The P-part corrects short and fast deviations of the RPM. Too high values can lead to RPM swing.

I: Sets the I-part of the control loop. The I- or integral part adds/integrates the control deviation over time. The I-part is relatively slow in controlling, but in contrast to the P-part can completely eliminate the control deviation. It stabilizes the RPM at longer-term load fluctuations.

IRange: Specifies the maximum available control throw for the I-part. A too low value can lead to longer-term deviations of the RPM.
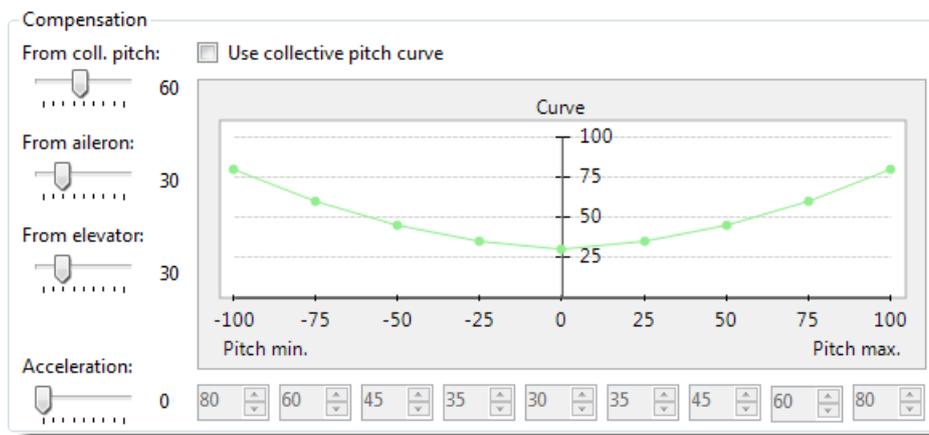
In the **Compensation** frame you can adjust factors to support the governor and compensate the different loads of the drive caused by collective and cyclic control commands in advance.

The slider **From Pitch** sets how high the additional throttle is dependent on collective commands. The increase of the throttle output is proportional to the collective pitch, so it virtually forms a linear V-curve.

When you activate the check box **Use collective pitch curve**, you can alternately use a 9-point pitch curve. You can define an individual throttle value dependent on the current collective pitch amount to support the governor.

From aileron defines the additional throttle for aileron inputs, **From elevator** for elevator inputs.

In addition to the static compensations, the governor can be supported by a short dynamic throttle boost. The boost is activated at fast collective or cyclic control inputs. You can define the strength of the boost with the slider *Acceleration*.

Commonly
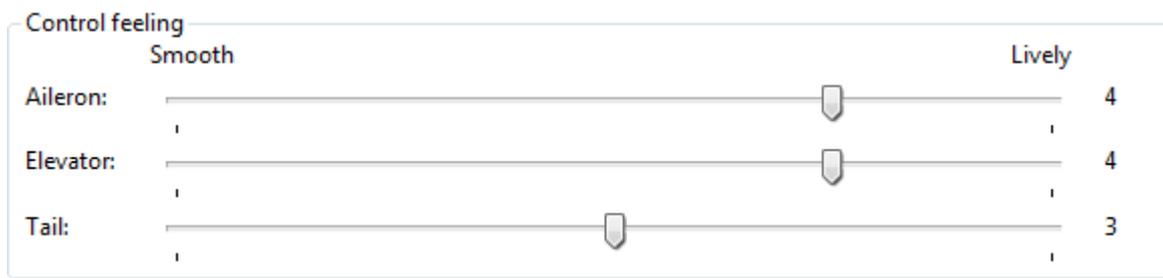
With the parameters in *Control feeling*, the reaction of the helicopter on control inputs can be influenced.

If the slider is moved more in direction *Smooth/smaller*, the helicopter reacts softer to control inputs. If the slider is more in direction *Lively/larger*, the control behavior is more direct and angular.

A control feeling more in direction *Smooth* can prevent elevator wobbles on fast stops.
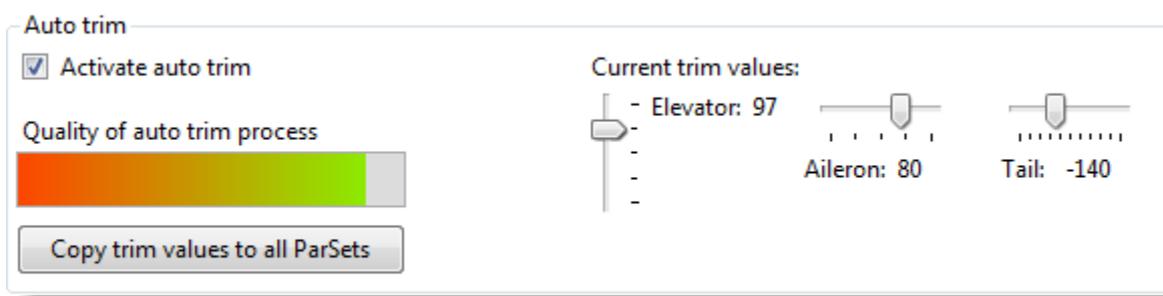
Even after an almost perfect mechanical setup helicopters usually need a little bit of electronic trim to really fly straight and give the control loop the best base for operation. This trim can be done with a special trim flight, which should take place at a mostly windless day. The trim flight itself is performed mostly automatically.

The trim flight is activated by checking the *Activate auto trim* checkbox.

At the next power up of the 3Digi the collective stick on the transmitter has to be in the mid position (this corresponds to a collective value between -30 and 30 in the live data). After the 3Digi is completely initialized, the activation of the trim mode will be signalized by a short break between the 2 initialization rotations of the swashplate. Now put the collective stick to full negative for a short moment (about 1 second). After that you start and can take off normally.

The actual in-flight trimming process starts and continues, when aileron, elevator and tail sticks remain in nearly neutral position and collective is in hovering position. The control waits then for about 5 seconds to let the helicopter calm down and then begins recording the trimming data. If the helicopter drifts away during the flight, you can get him back with small aileron, elevator or tail control inputs. The control inputs should not be too large, because otherwise the trim procedure would be interrupted or you would get wrong results caused be the helicopters movement. You should make sure that you have the helicopter at

all times under the control and the safety is not compromised! Optionally, you can repeat the procedure described in this paragraph during a flight several times.

The longer the trimming process has lasted, the further to the right into the green area the quality bar will be. The bar is on the far right, if the trimming procedure lasted at least 30 seconds. But also shorter trim flights can lead to success.

If you land after the trim flight, remain in the same parameter set and put the collective stick for about 3 seconds in the negative range (Live data collective value below -30), the trim values will be automatically saved. The helicopter has to stand still and should not move for that.

The values will be shown using the sliders on the right side and can be manually adjusted if desired. Use the mouse to move the slider knob or the cursor keys to fine-adjust.

Possible reasons, why the trim procedure did not activate in flight:

- Trim flight not activated in any parameter set
- At power-on of the 3Digi collective stick was not in neutral position or after the swash initialization movement stick was not or not long enough in negative position
- Wrong parameter set (without trim flight activation) selected in flight
- Collective position too low when hovering
- Too large stick movements made in flight
- Direction of collective channel reversed

Possible reasons why the trim flight was not saved after the flight:

- Wrong parameter set (without trim flight activation) selected when landing
- Helicopter did not stand still long enough after landing or collective stick not long enough in negative position

> **TIP:**
> You can see if and when a trim procedure was performed in the event log within the flight data!

The button **Copy trim values to all parsets** transfers all the trim values of the current parameter set into the other parameter sets.

The **Initial response optimizer** helps to bring the initial response part of the control loop for aileron and elevator into a good range adapted to the heli mechanics. During the flight, a correction value for the initial response parameter is determined.

In flight, various maneuvers with aileron and elevator flips must be flown. The pilot should therefore have the corresponding flight skills.

Activate the optimizer flight by clicking the **Activate optimizer flight** check box. The final activation is then done similar to the trim flight. The collective pitch stick must therefore be

in the neutral position when the 3Digi is switched on. The activation is then indicated by a brief pause between the two activation rotations of the swash plate.

The values are saved similar to the trim flight procedure by placing the collective pitch stick for about 3 seconds in the negative range after the landing.

The **Quality of optimization** bar indicates how long the aileron and elevator control commands were in the favorable range for optimization. The further the bar is filled, the longer the optimization phase was. The bar should be in the upper third after the flight.

Aileron and **Elevator** specify the correction values determined by the optimizer. These can also be edited and customized manually.

The correction values work in addition the **Initial response** value that is specified in the common control loop parameters and are so to say added to that value.

> **TIP:**
> Among other parameters, the initial response affects how the heli "feels" in flight. It can therefore be quite useful to adjust the values determined by the optimizer manually in order to achieve a somewhat different flight feeling.

If the **Activate speed flight optimizer** checkbox is clicked, the system attempts to detect speed flight passages in flight. In these passages, different control parameters are then adapted internally in order to improve flight behavior.

Sensors

The gyroscopes always tend to some noise around the zero point, which means the value always varies a little. With the settings of **Deadband** can define a small area which is to be regarded as a neutral value. An entry of 5 means for example that values in the range of -5 to 5 are interpreted as 0.

Too high values make the 3Digi "Blind" around the neutral point, which may result in a spongy flight behavior in hover. Generally you should try to keep the deadband value as small as possible and not to go beyond a value of 5. Even values of 0 are possible, but may result to a slight runaway tail or swash plate in heading hold mode on the ground.

With the settings of **Filter**, a moving average of the sensor values can be activated. By this possibly short disturbances and fluctuations can be filtered out. The higher the value, the more values are used to form the mean value.

A value of 0 deactivates the filter.

In heavily vibrating helicopters (for example nitro powered) or if it is determined that a servo gets too hot due to high activity, a higher value can be set here. This preserves the servos, especially at high P values.

Too high filter values can lead to a delayed reaction of the control loop and hence to swinging.

RC input

	Aileron	Elevator	Tail
Deadband:	10	10	10

With the **_Deadband_** settings you can define a small range for the input channels to be viewed as neutral value. Often the input sticks of the transmitter have the property, not to go back to exactly 0 positions when the stick is released, but to fluctuate around 0. To not to get unwanted control inputs caused by this, you can define that for example values between -10 and 10 should be interpreted as 0.

Slight change of course in flight on aileron, elevator or tail can be a result of a too small deadband range. In such a situation you could check for example the flight data and make sure, that the control inputs really were at neutral position and eventually increase the deadband, if not.

Area Par. Comparison

The table in this area makes it possible, to show an overview of all 3 internal parameter sets, to load additional external sets temporarily and compare them altogether.

Parameter	Par.set 1	Par.set 2	Par.set 3	BasisParameter.4dp(1)
⊟ Aileron				
⊟ Aileron control				
Agility	90	85	80	80
Overall gain	35	40	40	40
Initial response	90	90	100	90
P	35	40	35	35
I	40	35	40	40
D	10	10	10	10
⊟ Elevator				
⊟ Elevator control				
Agility	90	85	80	80
Overall gain	65	70	70	70
Initial response	90	90	105	90
P	55	60	55	55
I	45	40	45	45
D	55	55	55	55
⊟ Swashplate				
⊟ Pirouette optimiza...				
Activate piroue...	On	On	On	On

In the table the different parameters are shown sorted by adjustment groups. By using the **+** and **–** signs, the groups can be expanded or collapsed.

You can tag a single column by clicking on the headline. Values in other columns, that are different from the values in the tagged one, are shown in reddish color and are to identify at first view.

Parameter set	
Select in table:	Par.set 1 ▼
Parameter set to compare:	Load... Remove...

With the combo box a column can be selected and tagged. This is the same as clicking on the heading of the column.

By clicking on the **Load** button one or more parameter sets from other setup files can be loaded and shown additionally in the table. The internal parameter sets of the 3Digi will not be changed by this!

The button **Remove** opens a dialog, where one or more parameter sets can be selected to be removed from the table.

Area Live data

In this area the currently active values of input and control functions are shown.
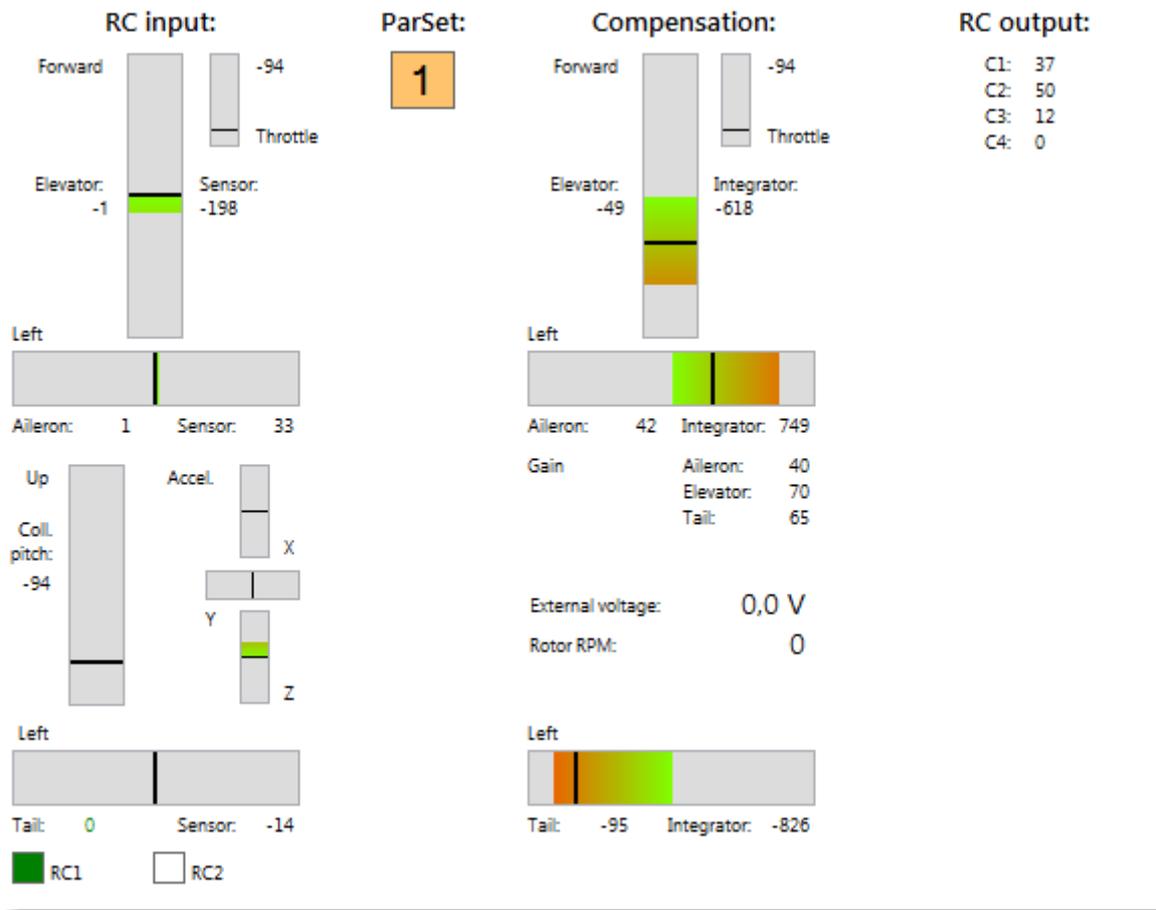
On the left side the inputs (transmitter, gyro and acceleration sensors) are displayed. In the middle you can see the outputs and the values of the integrators (I-part).

On the top right the outputs for the swash servos are shown.

The two squares on the bottom left show the states of the receivers. **RC1** corresponds to the normal receiver input or the Spektrum master input. **RC2** is the Spektrum Slave input. A green color signals a normal reception, red a failsafe. If you hover the mouse pointer for a moment over one of the squares, a tooltip window will be shown. This shows further information, such as number of channels, repetition rate and so on.

Window Flightdata analysis

In the window ***Flightdata analysis*** flightdata files can be displayed and analyzed.
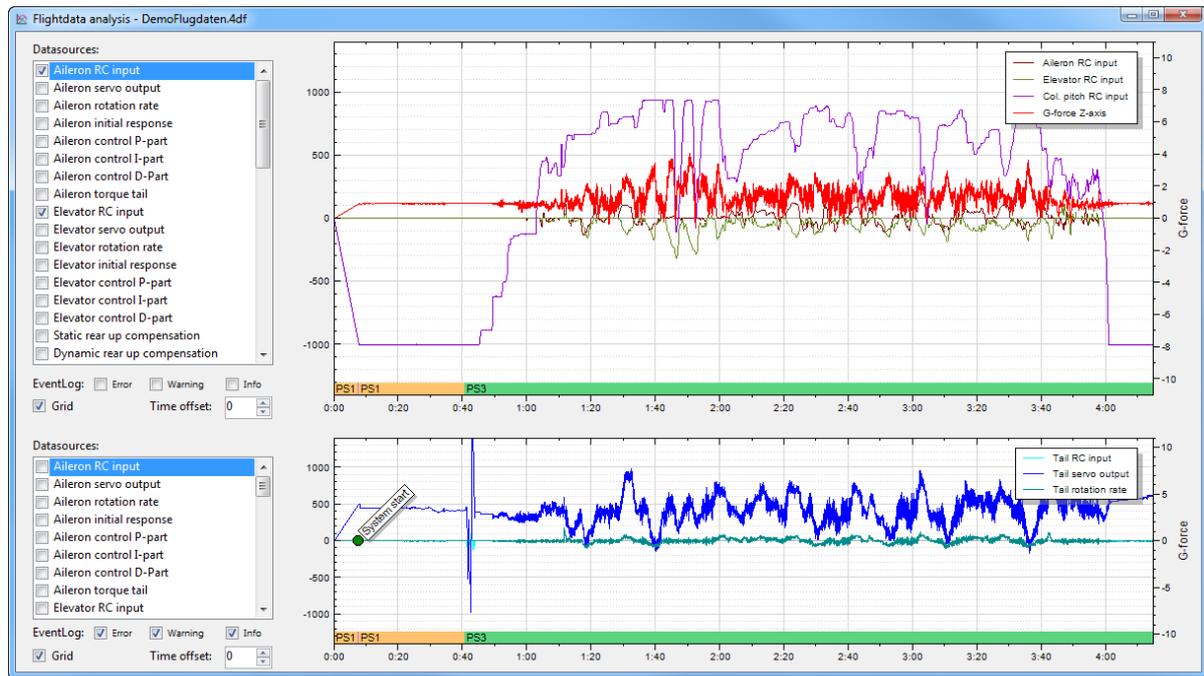
The window is divided vertically into 2 equal portions. The dividing line between them can be moved with the mouse.

The two areas are equivalent in the representation of data, which means they have access to the same data. It is thus possible, for example, to display the values of the swashplate in the upper part and on the bottom the tail data or vice versa.

In the list boxes on the left side you can select the values to be displayed.

> **TIP:**
> If you Ctrl-click an entry, a dialog appears in which the color for the presentation of this entry in the graphic can be chosen.

At the bottom of the graphics of the active parameter set PS1, PS2 or PS3 will be displayed.

The checkboxes right to ***EventLog*** display important events recorded during flight. This may be infos, warnings or error messages.

The checkbox ***Grid*** displays a grid on the graphics surface.

The value at ***Time offset*** can be used to move the time axis. This is convenient to synchronize the time of the flight data with a flight video for example.

If you click with the left mouse button in the graphic area and hold the button, you can move the data displayed by moving the mouse in the corresponding direction.

A click with the right mouse button in the graphics area opens a context menu, which can be used to print the graphics shown or copy it to the Clipboard for further processing with a graphics application. In addition the normal view can be restored here.
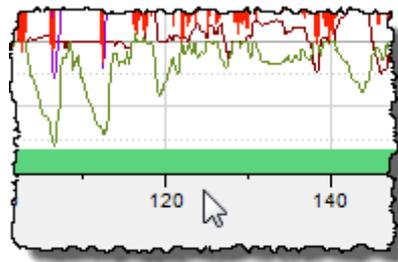
If you click with the left mouse button on the X-axis label and hold the button, you can move the mouse left and right to change the scaling of the X axis and zoom in or out certain areas.
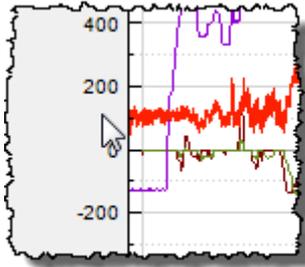
If you click with the left mouse button on the Y-axis label and hold the button, you can change the scaling of the Y axis by moving the mouse up and down.

Window Vib-Data analysis

The **Vib-Data analysis** window displays the data of the vibration analysis recorded during a flight. These are be loaded from the file, which was stored on the SD card.

There also exists a mode in which this data can be displayed live.
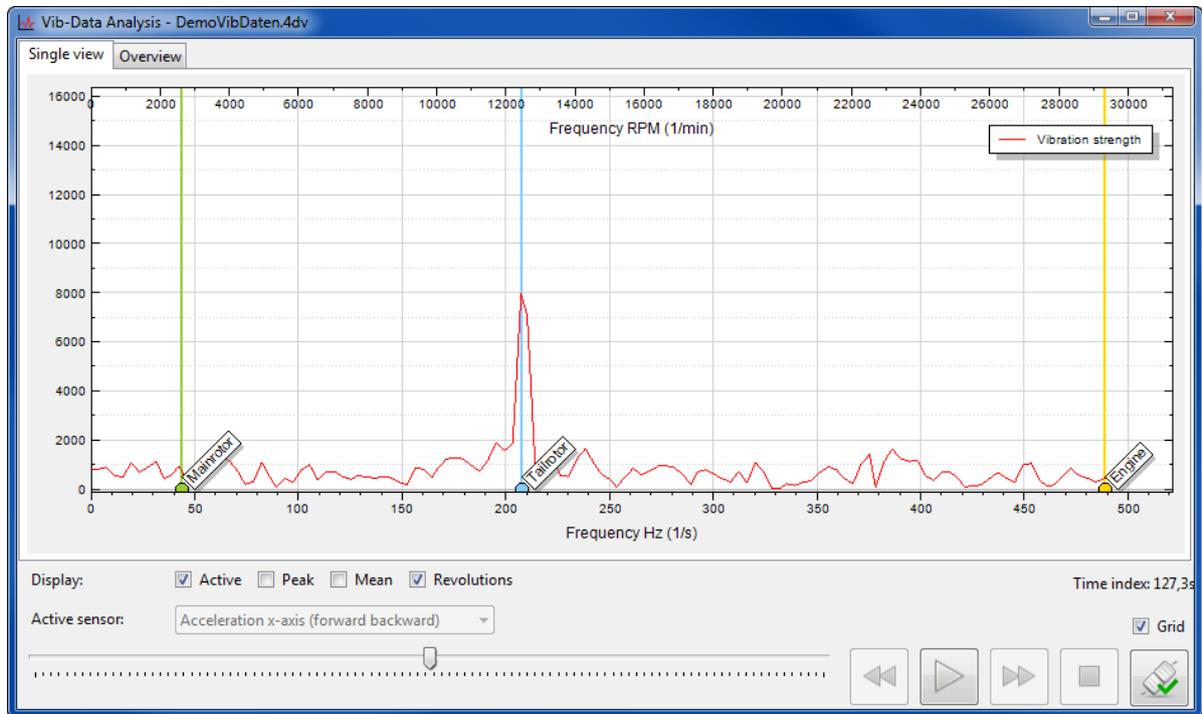
The red line in the graph indicates the measured magnitude of the vibration at certain frequencies. The higher the line in the vertical Y-axis, the stronger the respective vibrations are. The horizontal X axis at the bottom of the graph shows the frequency of the vibration in Hz. At the top the value is displayed converted into the appropriate rotational speed in RPM.

When a sensor for sensing the RPM of the motor is connected to the 3Digi, the frequencies or RPM of the motor, the main and tail rotor at the time of the measurement are displayed as colored vertical lines. This can be useful to be able to assign certain maximum values in the vibration intensity to the vibration sources.

Near **Display** there are various checkboxes with which certain parts of the graph, such as average and maximum values, can be shown or hidden.

The measurement of the vibration is continuously performed during the entire flight. At the bottom of the window is a slider, with which any time of the flight and the vibration intensity at this time can be displayed.

With the 4 buttons right next to the slider the flight can be replayed virtually. The buttons work like the control buttons of a CD player with start, stop and playback speed adjust.

At the right edge the time index in seconds of the currently displayed vibration measurement is displayed. This time index can help making a connection with the recorded flight data and maybe certain flight conditions, which have led to the vibrations.

The button at the right bottom of the window activates the live mode of the vibration display. Measured vibrations are displayed immediately and live. This is very practical to make measurements on a helicopter on the workbench.

With the combo box **Active Sensor** the displayed measurement sensor can be selected. Depending on the sensor measurements can vary because vibrations can occur at the helicopter on different axis and various ways.
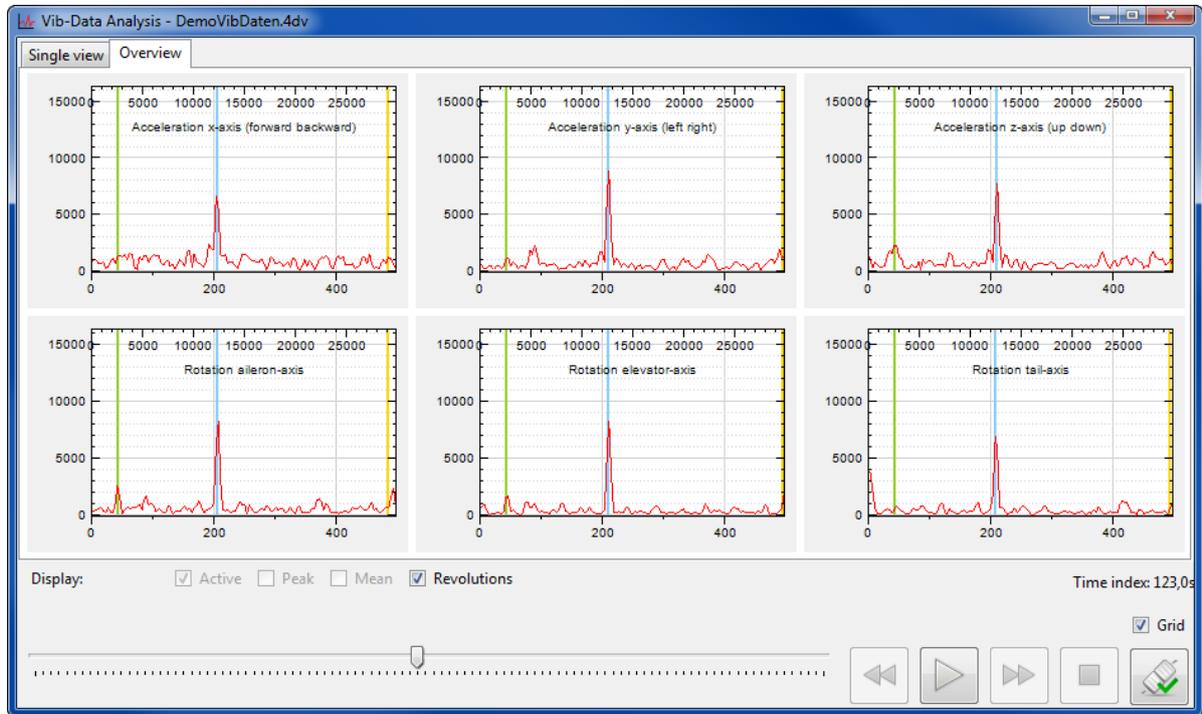
The Vibdata analysis also has an overview, in which the data of all sensors can be displayed simultaneously. The precondition is that a recording of all sensors has been made.

In Live mode it is automatically switched to a recording of all sensors.

Tuning guide

How to tune your 3Digi

IT IS ADVICED TO DO THE TRIM FLIGHT AS SOON AS POSSIBLE TO GUARANTEE THE BEST PREFORMANCE OF 3DIGI. DO THE TRIM FLIGHT AT NO WIND CONDITIONS ONLY!

Trim Flight

First enable the "Activate auto trim" in Parameter set where you want to do the trim flight. It means that the Trim flight is ready once you will have **no wind conditions**. This is very important conditions. Otherwise don't do that!

Turn on helicopter with collective stick at the neutral position. You will see the break during the swashplate dance at the initialization. It means the Trim flight is active for this flight! Move the collective stick all the way down.

Now spool up and fly around. Then get close and hover for at least 20 seconds. 3Digi will recognize that you are hovering and enables the trim process where he finds the trim position of the swashplate and tail. You can apply small corrections by the cyclic sticks, but any bigger stick input will deactivate the trim process. Just fly after at least 20 seconds of hovering. 3Digi will know you are flying back again and the trim process will be deactivated. You can hover again if you like and the trim process will continue, so you get even more precise results.

When you finish flying just land and move the collective stick all the way down. The trim values are stored in the respective Parameter Set.

Now take a look to the PC Terminal "Commonly page" where you will see trim values and the color bar telling you how good the trim flight was. You are looking for all green bars.

Now you have two options!

1) Click the button "Copy trim values to all ParSets" which copies the trim to all PS so it will be all the same from now on

2) Do the trim process in different ParSet. Why? Very different head speed requires different trim of the tail and swashplate. It is advised to do the trim flight in case you fly very different head speeds. That's the only way how to guarantee the very best performance of the 3Digi.

Flight tuning

You have two options available to assist in the proper tuning your 3Digi. Parameter Sets or Live tuning.

3Digi provides 3 separate Parameter Sets (called ParSet). You can make changes to one or more ParSets and see the difference by switching between the ParSets in flight. Live tuning gives you the ability to tune up to 8 different parameters directly from your radio using up to 8 different free channels. You can tune those parameters while flying and directly see the difference. These tools will help you to find the best settings as soon as possible.

If you have the spare channels we recommend setting up Live Tuning. The following parameters are recommended for initial tuning:

- Overall gain tail
- P tail
- Overall gain elevator
- P elevator
- Overall gain aileron (just in case your helicopter will shiver on aileron in a first hover)

Live Tuning gives you a range of ±20 points which should be enough.

Note: We don't include any advice on aileron tuning. This is because the aileron is pretty tolerant on the settings. Other than adjusting overall gain you should not have a problem with the aileron. Of course you can use the same basic tuning process for aileron as outlined below for the elevator.

Start with the tail

The default gain settings should be very close. Raise or lower these as needed in the Parameter Set or Live Tuning.

Next is the elevator

What we are looking for is a nice crisp response with precise stops while flying maneuvers or hovering and giving elevator stick inputs. When testing this make sure you move the TX stick back to center. Do not just let go and allow the stick to come back on its own. The TX stick spring will make its own bounce! As with the tail, the default settings should be very close. We are only looking to do some fine tuning here. If your machine is not flying well at all it is most likely due to something mechanical within the machine or the initial 3Digii setup was not done correctly.

Follow the tuning diagram. Adjust each Parameter by 5 or 10 points. You should see the difference. When changing one point in the diagram doesn't help anymore, move to the next point in the diagram.

Be careful here. It is easy to get caught in a loop by changing too many things by too much. **Remember; the default settings should work quite well** so go back to presets corresponding to your helicopter's size and start again. You can set Preset values to only one ParSet if you like to compare.

Elevator

Large/slow bounce on stop
- Increase the overall elevator gain. Decrease it if it becomes an oscillation or shiver
  - Increase the elevator D - to soften the stop and increase stop precision
    - Increase elevator P if the stop is not "hard" enough

Fast oscillation or shiver on a stop
- Decrease elevator P
- Increase elevator D - helps to reduce the small shiver
  - Increase the elevator overall gain if there is dolphin in forward flight while giving collective input due to the lower P.

Fast/small oscillation or shiver on a stop from flip or when you stop by hard collective movement
- Increase elevator D - helps to reduce the small shiver
- Decrease elevator P - because you have too much gain there
  - You might want to increase the elevator overall gain. Elevator should hold when you pump collective in hover or when you fly forward and give collective inputs
    - Decrease DDecay by 10 points if the D has no influence. You can go up to value 5.

Nose goes up/down while pitch pumping in hover
- Increase elevator overall gain
  - Increase Rear UP compensation by 10 points as addition
  - Increase elevator I by 5 points - it's role is to keep the attitude. The elevator will do the dolphin on its own in fast forward flight if the I is too much.

Doesn't hold in forward flight
- Increase the elevator gain
  - Increase the elevator I
  - Still tendency to raise the nose in forward flight?
    - Incready elevator IRange by 10 points

Dolphin in forward flight (straight flight and giving collective inputs)
- Increase the overall elevator gain → Increase the Rear UP compensation as addition to reduce the dolphin
- Increase elevator I - its role is to keep the attitude. Increase by 5 points each time.

Rotor disk is not flat in stationary pirouettes
- Do the "Trim Flight"

Tail
- Doesn't stop equally on both sides → Do the "Trim flight" → Check your mechanical neutral. You might want to move it a bit. Try both directions.
- The stop is very soft → Increase the overall tail gain
- Doesn't react fast enough on sudden collective inputs → Increase the overall tail gain. → Does it oscillates in fast flight? Then you have too much overall gain. Reduce it by 5 points.
- Increase tail P - you might need to descrease the overall gain after this step → Increase the Torque compensation From Collective Pitch by 10 points. Increase only if you hear overshooting right when you give collective input and it's not the oscillation
- Overshoots stops and comes back → Increase tail D by 5 points → Increase/descrease tail P. You have to try that.

Rotation rate is not fast enough
→ Increase the Agility for aileron/elevator/tail

Tic toc isn't fast enough and you feel behind
→ Increase Agility for aileron/elevator
→ Increase Initial reponse

Piro maneuvres are hard to control
→ Use cyclic expo in your radio. Start with 15%
→ Try different Control feeling 3 or 4
→ Do the "Trim flight" if you haven't done it yet

Sudden cyclic/tail inputs are not strong enough
→ Increase initial response

Stick movements are not smooth enough
→ Decrease Control feeling
→ Control feeling smooths out your inputs. For example if your hands shakes then lower this value to get the smooth helicopter move. Tail works well with value 3

Want more responsive stick movement
→ Increase Control feeling
→ Too high value will interpret every single small stick movement.
→ Recommended highest values for Cyclic=4, Tail=5

Collective reponse on sudden moves is not strong enough. Helicopter stops behind
→ Increase Pitch pump by 5 points each time to find the best value for you.

Appendix

Firmware update

From time to time new firmware for the 3Digi will be published on the website www.3digi.de in the download area. An indication for that will be shown in the **Area Information**.

Connection
State: Connected
Communication port: USB

                                                    Start
                                                    Setup Assistant

Device info
Serial number: 05D8FF39.33394746.43118040
Version hardware: 3.1
Version firmware: 1.0.6   Update available: V1.0.7
Version Terminal: 1.1.0.0

This new firmware might have been extended and new features been integrated and should therefore be updated on the 3Digi.

Before the update, you should read the existing release notes!

> **TIP:**
> Before updating the firmware you should first save the current setup of 3Digi to a file. For major version changes of the firmware, it may be necessary to perform a reset of the 3Digi after the update. All settings will then be deleted. After that the setup could be reloaded from the file.

With the menu *Extras|Firmware update* the following dialog will be shown.

Firmware upload

◉ Update with online version V1.1.0

Releasenotes Firmware 1.1.0

- Flight performance revised and optimized
- Standard parameter adjusted
- Older stored setups are no longer compatible. Stored setups from older firmware versions can still be loaded, but it is advised to setup the helicopter completely new. This is the only way to benefit directly from the new

◯ Update from local file

C:\temp\3DigiR_V1_1_0.4dh   ...

          OK   Close

It is possible to automatically download the latest firmware directly in the update procedure. For this you must select the upper option *Update with online version*. If you click on *OK*, a connection to the 3Digi web server is made and the file with the firmware temporarily downloaded to the local file system.

Otherwise, if local file used for the update, the file with the firmware must first be downloaded from the download section of the website to a local directory on your PC.

In the middle part of the dialog you can select the downloaded file with the actual firmware. Normally this file has the extension „4dh".

Connect the 3Digi for the firmware update via USB to the computer.

Then click *OK*. The dialog connects to the 3Digi and the special mode for the firmware update is started. Both LEDs are flashing alternating red and green in quick succession.

The two progress bars in the dialog box show the progress of the operation.

If the mode for the update cannot be started automatically, the dialog asks for short disconnecting of the 3Digi power supply. Follow the on-screen instructions.

> **Hint:**
> After updating the firmware, the 3Digi must again be connected to the Terminal program to complete the process. The red LED is then on continuously and the green flashes one time. You then can possibly check or correct settings or load a stored setup.

Connections

In the following chapter, the external connections of the 3Digi will be explained.

Spektrum ports

Pins from left to right:

1. VCC 3,3V
2. GND
3. RXD

Installed are 3-pin JST ZH jacks.

Special port

Pins from left to right:

1. RXD
2. TXD
3. GND
4. VCC 3,3V

Installed is a 4-pin JST ZH jack.
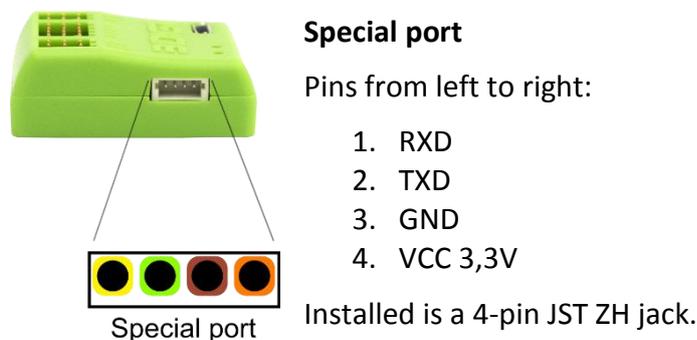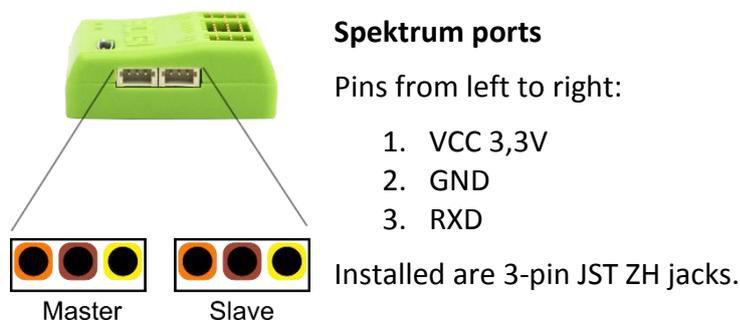
> **Hint:**
> The outputs (TXD) use a signal level of 3.3V. The signal level at all inputs (RXD) should also be 3.3V. Higher voltages could damage the 3Digi!

Bluetooth module

Bluetooth modules must have specific settings for the operation on the 3Digi.

Serial interface:

- 115.200 Bit/s
- 8 data bits
- No parity
- 1 stop bit

If you want to use a Bluetooth module you have to activate this functionality in the **Area Configuration** in the tab *Diverse* in *Variable ports*.

The Bluetooth Module HC-06 is especially supported by the 3Digi. The required module settings can be made from 3Digi Terminal. For this connect the module to the special port. Then connect the setting program via USB connection to the 3Digi. By calling the menu *Extras|Special|Init Bluetooth module HC06* the initialization of the HC-06 is performed automatically and the appropriate commands for the module will be sent.

The PIN for the connection to the PC will be set to "1234". After this you can still use the menu *Extras|Special|Change Bluetooth module HC-06 PIN* to change the PIN.

> **Hint:**
> When connecting a Bluetooth module to the 3Digi the TX and RX lines must be crossed, that means the RX line of the 3Digi must be connected to the TX line of the Bluetooth module and RX from Bluetooth with TX from the 3Digi!

GPS module

The GPS Module must have specific settings for the operation with the 3Digi.

Serial interface:

- 115.200 Bit/s
- 8 data bits
- No parity
- 1 stop bit

GPS settings:

- Update frequency 5Hz
- NMEA Output only RMC and GGA

The GPS settings can often be made with special programs provided by the module manufacturers (for example u-center for ublox modules) or you can send special command sequences to the module using a serial terminal program.

The output of the module on the serial interface should look like this:

```
$GPGGA,114836.00,5133.74780,N,00810.46808,E,1,10,0.86,137.7,M,46.5,M,,*5C
$GPRMC,114836.20,A,5133.74776,N,00810.46798,E,0.260,,100415,,,A*72
$GPGGA,114836.20,5133.74776,N,00810.46798,E,1,10,0.86,137.6,M,46.5,M,,*50
$GPRMC,114836.40,A,5133.74776,N,00810.46804,E,0.095,,100415,,,A*76
$GPGGA,114836.40,5133.74776,N,00810.46804,E,1,10,0.86,137.5,M,46.5,M,,*5F
$GPRMC,114836.60,A,5133.74775,N,00810.46797,E,0.199,,100415,,,A*7F
…
```

Generally modules are recommended, which can save the configuration permanently, and which have a so-called backup battery. These store satellite link information and enable faster launch and satellite fix.

The 3Digi indicates the status of the satellite link by the green LED. When the green LED is interrupted once briefly, the GPS receiver is enabled and it is waiting for a satellite fix. If the LED is interrupted twice, the GPS module has a satellite fix.

The GPS coordinates are written to a file on the SD card. The name of each file case consists of the actual flight number and the file extension "4dg".

In addition, the current speed, the height and the number of satellites received are stored in the flightdata. The GPS height is however quite inaccurate.

When the GPS module is connected to the special port (only this has RX and TX lines), it may be initialized each time the 3Digi starts. Then various commands, which must be located in a special configuration file, are sent to the module and configure it for the requirements of the 3Digi.

The file name must be "InitGPS.4di" and this must be stored in the root directory of the SD card.

The contents of the file are sent line by line to the GPS module. Depending on the start of the line, there are some special instructions:

- „//", Lines, that begin with these characters, are seen as a comment
- „@", switches the interface of the 3Digi to the speed in bit/s following after the "@"

Here an example of such a file. This configures a MT3339 module.

```
// Start baudrate
@9600
// Config baudrate 115200
$PMTK251,115200*1F
// New baudrate
@115200
// Config NMEA updaterate 5HZ (200ms)
$PMTK220,200*2C
// Config NMEA output, RMC, GGA
$PMTK314,0,1,0,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0*28
```

History of document versions

Version	Datum	Autor	Änderungsgrund / Bemerkungen
1.1.0	27.12.2015	Disc	First public version
1.1.2	12.04.2016	Disc	Changes for new firmware
1.2.0	14.07.2016	Disc	Governor
1.3.0	29.11.2016	Disc	Changes for new firmware
1.3.1	06.01.2017	Disc	Hott sensor type added
2.0.0	08.04.2017	Disc	AutoLevel settings