



BAVARIAN
Demon

INSTRUCTIONS



CORTEX
PRO

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PRELIMINARY INFORMATION

OPERATION PRINCIPLES AND FEATURES

Like the CORTEX, the CORTEXpro stabilizes all three flight axes using its 3-axis gyro sensor: aileron, elevator and rudder. The already well established cutting edge technology of the CORTEX is applied in the CORTEXpro, and has been effectively modified to accommodate the cabling requirements in bigger airplanes using multiple receivers or serial bus cabling throughout the model. In general the unit works totally independently of the airplane's size and weight, and can, equally successfully, be used in smaller airplanes.

All model-specific settings (servo centres, travels and mixers) remain in the transmitter and are automatically transferred to the CORTEXpro during setup, including the input signal type, as well as gyro channel. Ideally, as always, the model should be mechanically and aerodynamically ready to fly without CORTEXpro. Afterwards, and as a result, the system will be integrated and set up to offer the best stabilization possible.

The unit's sensitivity and gyro mode can be adjusted from the transmitter, using the gyro channel, even during flight. This reduces the amount of tuning flights to an absolute minimum.

Up to 16 independent servo channels (24 all together) can be stabilized using a servo distribution box, with up to 7 channels using one serial input, and up to 6 channels using the supplied cable loom. These channels are simply run through the CORTEXpro. If the number of channels is not sufficient, unidirectional servos, e.g. ailerons with identical direction sense, or double rudder servos, can also be connected via Y-cable, which increases the number of controllable servos.

Further options may be configured using the software (Desktop Win+MacOS; iOS+Android via Bluetooth), or via the Jeti radio's device explorer section (from Tx firmware 4.23 or higher).

Software (Win / MacOS) available for download at www.bavarianDEMON.com. Apps (iOS / Android) and B-module in development.

The software apps enable the following additional options:

- Increased servo frame rate for digital servos
- Alternative installation options: both upright and top-down, and also vertical
- Optimization of the stabilization separately for each axis and bank
- Separate selection of gyro mode for each axis and bank
- Gyro gain portion and single channel deactivation for each bank
- Additional tuning options for lock-in behaviour and stick/control feeling for each bank
- Perform firmware updates online

SAFETY NOTES (IT IS ALSO IMPORTANT TO UNDERSTAND ALL FOLLOWING NOTES THROUGHOUT THE MANUAL!)

- (!) Never use the prog port to supply power to the system! It could take severe damage.
- (!) The model must not be flown until the setup operation has been fully verified (signal type and control teach-in), a gyro directional test has been carried out, and the expected bank settings are correct. Incorrect gyro orientation will almost certainly result in loss of your airplane, and physical damage to yourself and others around you!
- (!) In the case of an electric motor, remove the propeller or disconnect the motor for all adjustment work, to prevent the motor from starting up accidentally and the risk of injury!
- (!) Do not move the model during the first few seconds after the power has been switched on, to enable the gyros to initialize, otherwise, the servos will work but the stabilization will not! A successful initialization is indicated by the servos jerking twice and a constantly illuminated LED in red, yellow or green color (depending on chosen bank via gyro channel).
- (!) Each time the system is switched on, the system „re-learns“ the transmitter's neutral signals. Therefore, only carry out a control test once the system has been fully initialised.
- (!) Please note, that using a gyro system will increase the activity of the servos and, therefore, also the power consumption!

INSTALLATION

CONNECTING THE RECEIVER AND SERVOS

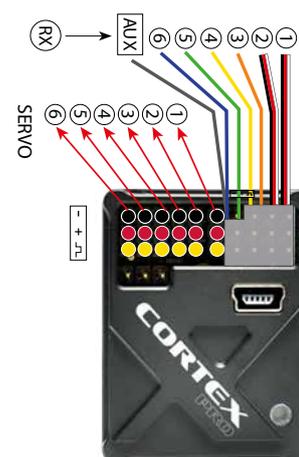
CONNECTION VIA CABLE LOOM / PWM SINGLE CHANNEL OUTPUT

Disconnect all servos, that are meant to be stabilized, from the receiver, and connect them to the CORTEXpro's output ports. Then connect the required cables 1-6 and AUX (gyro channel) of the supplied cable harness to the corresponding receiver outputs, where the servos had been previously connected. Now connect the servos to the CORTEXpro's output ports 1-6. The same assignment applies as for the input side. Cable 1 on the receiver corresponds to output 1 on the CORTEXpro, etc.

The channels are intentionally marked by numbers only, you are free to assign them as desired. Only the following needs to be taken into account:

- At least connections 1, 2 and AUX (gyro gain channel) must be connected.
- The gyro gain channel (grey cable) should be associated with a transmitter channel to enable gain adjustments, and/or to switch between the gyro's modes in flight. Later on, this should be assigned to a switch (e.g. linked to flight mode).

Channels that are not subject to being stabilized, e.g. gas/throttle, must not be looped through, but remain connected directly to the receiver.

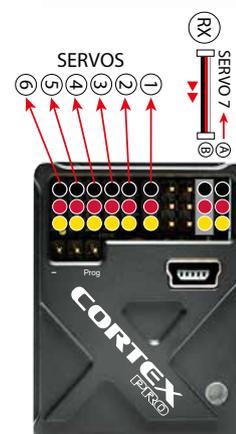


CONNECTION VIA SERIAL INPUT OR SATELLITES / PWM SINGLE CHANNEL OUTPUT

Receivers with a serial output option are even easier to connect, as all channels are carried via a single cable. Connect the receiver's serial output with port B on the CORTEXpro, and the servos per channel assignment in the transmitter to ports 1-7.

Example: Tx channel 2 = Elevator => elevator servo to port 2.

Up to 2 (diversity) Spektrum satellite receivers can also be connected on the side of the system. If only one satellite is used (technically possible, but not recommended), the port closer to the LED is to be used (Master). The satellites are bound either by using a main receiver, or by the software (see Info text for details).



Slave
Master

CONNECTION VIA 2x SERIAL INPUT / 2x SERIAL OUTPUT

Use this option to connect either one or two serial receiver outputs (with redundancy), followed by any power/servo distribution box (if so with multiple serial receiver inputs), e.g. JETI CB200/400, Emcotec DPSI2018, PowerBox Competition SRS, etc.

The CORTEXpro supports all common serial input protocols (see Tech. Data at the end of the manual), and outputs the same signal type as teached in.

Exampel: Input JETI EX-bus => Output JETI EX-bus incl. gyro information.

Depending on the receiver or power/servo distribution box, the CORTEXpro handles up to 16 stabilized channels, up to 24 channels all together. All channels that are subject to being stabilized must be programmed to the lowest 16 channels per assignment in the transmitter. All channels from 17 to 24 will only be run through without stabilization. Same for ones in the low 16 channels, which are not moved during teach-in. Thus, these can be used as „normal“ channels too.



Connect one receiver to port A, or, respectively, two receivers to the ports A and B. Ports 5 and 6 output the serial protocol, which can be used for either one or two inputs into a distribution box.

(!) Note that if using one receiver only in this serial setup, this receiver needs to be moved from port A to port B after the signal type was taught, and before starting the control teach-in!

Using this option enables up to 16 stabilized channels, and up to 24 altogether. So, all channels that are subject to being stabilized must be programmed to the lowest 16 channels per assignment in the transmitter.

Note for Jeti connection:

For Jeti integration and telemetry feedback from a suitable distribution box through the CORTEXpro (e.g. Jeti CentralBox, Emcotec DUPLEX-Edition, etc.), the EX-bus protocol must be used!

The primary receiver must be connected to port B on the CORTEXpro, the secondary receiver to port A. Then connect output 6 to CB's Rx1 port, output 5 to Rx2. In addition, route a standard patch cable (signal line can stay) from any CB servo output port to port 4 on the CORTEXpro.

NOTE

The CORTEXpro assigns the internal gyro axes to the corresponding servos automatically during the teach-in process. The same applies to any mixer. Any functions can, therefore, be combined. For example, ailerons can be stabilized, even if they also have an elevator function (which can also be stabilized). In spite of this, these ailerons can still operate a (un-stabilized) flap function. Therefore, if necessary, functions that should not, or only optionally be stabilized, can also be passed through.

If the receiver also features individual output/servo connections alongside its serial output, any non-stabilized channels (throttle, flaps etc.) can either remain connected directly to the receiver, or can be passed through the CORTEXpro, by not driving the signals during teach-in.

CONTROL TEST WITHOUT GYRO

Now, all of the servos must run correctly and identically as before (without gyro assistance). Failing this, check the assignment of the connections on the unit or of the channel assignment in the transmitter.

(!) Even if the servos are running correctly, do not fly before the setup of the CORTEXpro and gyro directional test are completed! Incorrect gyro orientation will almost certainly result in a crash!

MOUNTING THE CORTEXPRO

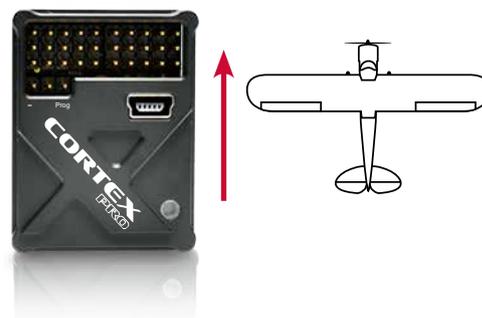
The illustrated mounting orientation shows the factory default: connector side up and in flight direction.

An additional 23 installation options are available and can be programmed via the software. In this case, the correct orientation setting needs to be carried out before starting the main setup.

We recommend the use of the supplied adhesive foam tape. Use the thin tape (,acro') for electric, nitro and turbine powered models and for vertical installation. The thicker and softer tape (,soft') is recommended primarily for gasser models.

Any dirt must be removed before applying the tape so that the device does not become loose. The model would still be flyable with a deactivated gyro, but would become uncontrollable with an activated but loose gyro.

Also, do not tie the housing down with any straps in order not to restrict the dampening effect of the foam tape. For the same reason, do not tie the connection cables (servos and receiver) tightly, but in a loose loop.



START-UP

SETUP

- (!) For setup, the transmitter must already be programmed ready for flight, so that the model could be flown, or has already been flying without the CORTEXpro.
- Servo directions, possible mixers, throws, etc., as well as correct trim settings for normal flight, must have already been set up correctly.
- (!) Switch off dual rates, i.e. use highest rates recommended by the airplane manufacturer, while carrying out the setup. Initially, keep the sticks (except gas) in neutral position when starting the setup. Set all remaining functions (flaps, possible flight modes, etc.) in the position used during normal flight.
- (!) The setup must be repeated if a mixer in the transmitter has been used, or if a channel assignment on the receiver or transmitter has been changed.

TEACHING THE INPUT SIGNAL TYPE

First, power on the radio, receiver and CORTEXpro, then connect the jumper to the programming port. The LED will start blinking a fast blue, then after a few seconds will switch to a slow blue blink. This means the the signal type has been detected and set.

(!) On each and any occasion that the input type is taught, this **MUST** be followed by the complete setup process, incl. mounting orientation and bank setups, as this step sets the unit to factory default state!

(!) The input signal type can only be set in this way, as described above. It's not possible to change or set it via software, as this is not necessary.

TEACHING THE STICK INPUTS

Plug in the supplied jumper as shown in the illustration, then power on the device.

The LED will now issue a series of green flashing signals, after the starting initialization. The servos respond to this, same signal with a 'bump' of the surfaces. The following instructions are requests for stick movements, specified in the following table, to be carried out after the corresponding signal. Follow these instructions exactly, and only move the designated function on the transmitter.

EXAMPLE

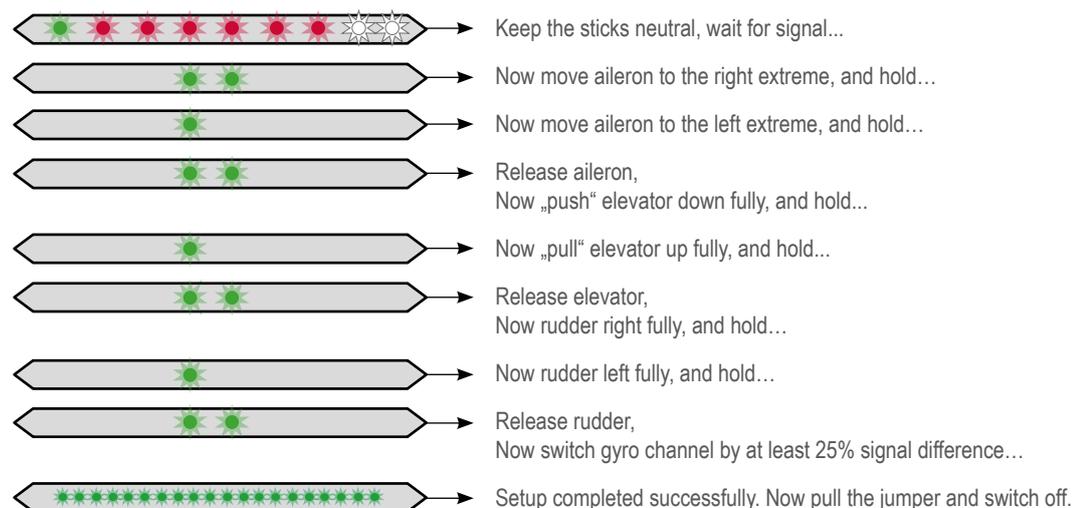
system initializes after powering on (green-red-white flashing), followed by a double green blink, together with double bump on the surfaces. Now move the aileron stick to the right end and hold, until the following signal (single blink and surface bump) confirms that the command, just given, has been correctly identified and gives the signal to apply the next one in the sequence, which is aileron left, and so on.

NOTE

Simply skip any axes that are not meant to be stabilized, but run through the CORTEX (do not move the stick, wait for next double blink/bump).



FOLLOW THE LED'S SIGNALS (FLASHING) AND/OR THE SERVOS (SURFACE BUMPS)



NOTES REGARDING SETUP

- Setup sequence only starts in case of correct RC reception.
- Setup can be repeated at any time by power-cycling (with jumper in place).
- If the device is switched off before the end of the setup sequence, no changes will be saved, but a possible previous setup retained.
- If the jumper is pulled out before the end of the setup, the system's condition is undefined. Repeat setup.
- Do not teach any extremely short throws. This can lead to errors, as the system may not recognize any greatly reduced throw as an input.

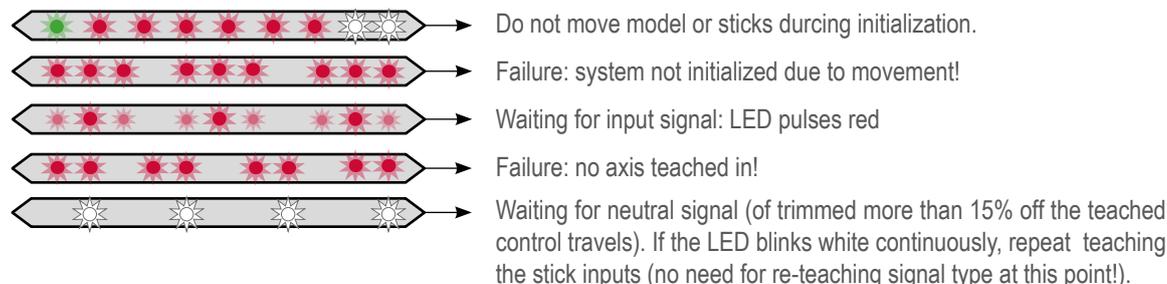
FLIGHT OPERATION

Start the CORTEXpro in normal operation mode, without the jumper connected. The LED will flash for the first few seconds and indicates the system's successful initialization. The model must not be moved during this process, otherwise, the stabilization will remain inactive (device flashes red constantly), until power-cycled again.

When the system and gyros have been initialized, the servos will indicate this by a double bump on the surfaces. The LED lights up constantly; its colour indicating the setting (bank and mode) of the gyro channel.

Each time switched on, the CORTEXpro recognizes the transmitter's neutral trims. This is why no control movements must be given until initialization is completed.

LED DISPLAY



After successful initialization, the servos will respond with a double bump.

Constant LED light => ready for operation

GYRO CHANNEL / ACTIVATING THE GYRO

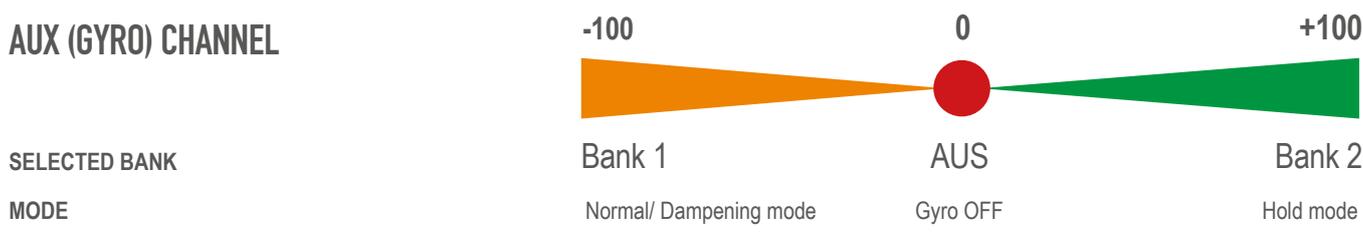
For the first flight, and to facilitate in-flight tuning, it should be possible to adjust the gyro channel, and therefore the gyro sensitivity in flight, in order to find the optimum setting quickly, or to reduce it immediately if needed, e.g. when sensitivity is too high.

Check the function of the gyro channel by adjusting the modes/banks via the transmitter and comparing the LED's colour reaction.

It is possible to determine whether bank 1 or 2 is activated from the polarity of the gyro channel signal. Negative signal activates bank 1 (normal mode: LED = yellow orange), positive signal activates bank 2 (Hold mode: LED = green).

A missing or neutral gyro channel signal (LED = red) switches off all gyro functions (manual flight).

AUX (GYRO) CHANNEL



Functions assigned as default (can be changed via software) :

APPLICATION	Normal flight	Unstabilized aerobatics	Hover / Torque / Harrier
	Aerobatics	aerobatics	Deactivate for take-off
	Take-off	(tailspin etc.),	and landing, or switch
	Landing	manual flight	to normal mode

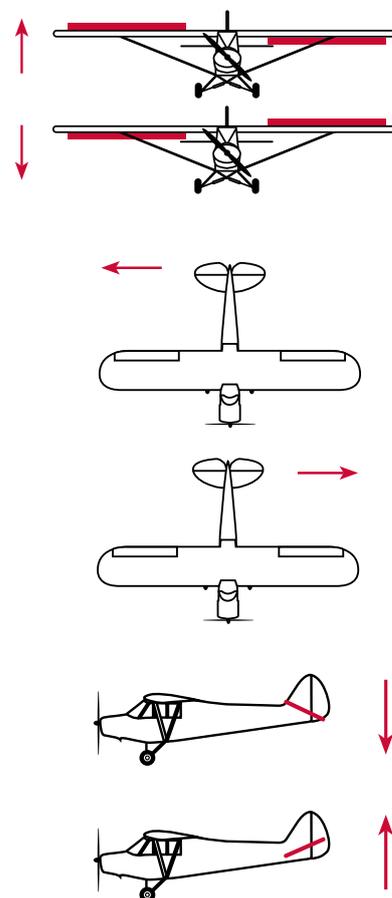
GYRO DIRECTIONAL TEST

This is absolutely required before the initial flight, and following any change to the installation orientation, or in the RC system (servo direction, channel assignment etc.). For the direction test, first ensure that all gyros have been activated (on the gyro channel and/or configuration by PC).

Sole exception is if individual axes have deliberately not been taught so as not to enable the corresponding gyros, these will not give any gyro reaction.

Now tilt the model in each axis and check that during the movement the corresponding surfaces move in the opposite direction, i.e. work against the tilt. Check both directions for each axis and also check that only the concerned surfaces move.

If the surfaces deflect incorrectly, either the setup process has been unsuccessful or the installation orientation of the device is incorrect (or the transmitter was incorrectly programmed prior to setup).



TEST / SET-UP FLIGHT

Only take off after a successful gyro directional test!

Setting the sensitivity

Start with a low sensitivity gain setting in the gyro channel, maximum 20% and initially only in normal mode (LED = yellow-orange). To achieve as powerful a stabilization as possible, increase sensitivity carefully as far as possible, without any disruptive vibrating movements (oscillations) occurring.

If oscillation occurs, reduce sensitivity by 5-10%. Test the setting at high speed first, as in this situation, the control reaction will be strongest, and therefore the tendency to oscillation is increased.

Under normal conditions, the gyro will produce an effect similar to expo. Therefore reduce the expo-setting or switch it off completely.

Once the optimum setting has been found, program a 3-position switch on the transmitter with the corresponding endpoint/ATV setting in order to be able to switch between the required modes (bank 1 / Off / bank 2). This can also be achieved by using other functions in combination, e.g. flight mode or flap/gear function.

USING THE GYRO MODES

The illustration of the gyro channel (shown above) indicates various options. Caution: this only applies to factory programming for bank 1 and bank 2 (standard or default, i.e. without PC software). Via PC software it is possible to re-program the functions for each of the 3 gyros separately. If the transmitter has a flight condition switch, it may make sense to couple the gyro channel setting with various flight conditions. For example, at a higher speed, it is possible to switch to a lower gyro sensitivity.

NORMAL / DAMPENING MODE

Dampens disturbances and smoothens the flight ▯ "wind-off switch".

The gyro tends to reduce agility. The expo setting can therefore be reduced in the transmitter, or even completely switched off. The rudder can also delay a turning movement because of the gyro. This is ideal for aerobatics and makes knife-edge flying easier. However, this can indicate a tendency to lean for normal turns. In this instance use a little rudder.

The normal mode can remain activated during take-off and landing.

HOLD MODE

This mode is ideal for automatic hovering, torque, harrier etc. For technical reasons, this mode is only suitable for normal forward flight under certain conditions:

- 1) The model may vibrate or swing because of the high sensitivity of the sensor as speed is increased.
- 2) The gyros try to hold the model in position against the pilot's control inputs. It may be that the model is being steered more rigorously or swings back somewhat after the stick is released.

It is not recommended to land in hold mode. The model would then no longer be able to follow its physical reactions. Hold mode may influence the surface's neutral setting (drifting away from centre). This only occurs on the ground and is not relevant in flight.

FAILSAFE

For every single channel run through the system, no matter if stabilized or not, a failsafe value can be defined.

To use this option, set all transmitter channels to the desired values, followed by a click on the software's button ‚Learn failsafe values‘. Done.

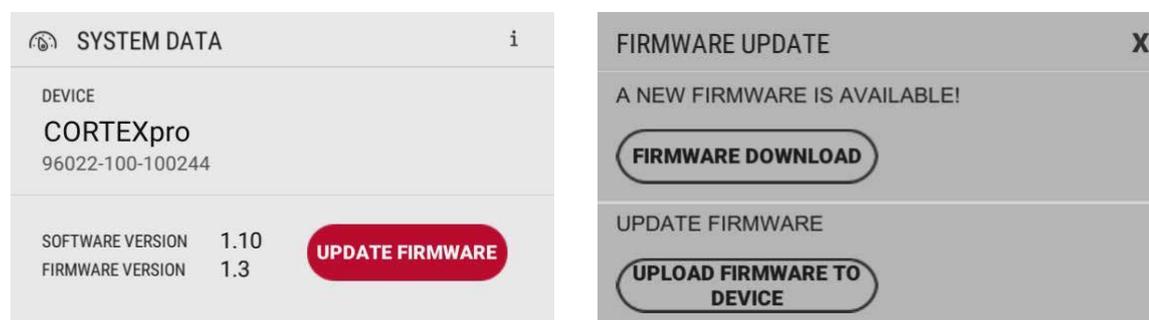
Note: The internal failsafe will only be activated, if there is no „proper“ signal received from the receiver (e.g. connection cut between receiver and system). Thus, if there is a failure in the link between transmitter and receiver, and the receiver's failsafe is activated, the system's failsafe will not activate.

Note: The internal failsafe is NOT available form Jeti EX.bus, as this protocol does not feature a failsafe information for following devices. This is taken care about by the CentralBox.

FIRMWARE UPDATE

To carry out a firmware update, or check if your unit is up to date, connect the system to the software (Windows or MacOS), using the supplied USB cable. The unit does not have to be supplied by an external power, but is powered via the USB cable.

In the ‚DASHBOARD‘ menu you will find the ‚System data‘ window, containing the update button. Push this button, and the update window will open up, supplying information about possible new firmware available for the connected device incl. the download button, as well as the option to update the unit at any time with a loaded firmware file.



The image shows two overlapping windows from a software interface. The 'SYSTEM DATA' window on the left displays device information for a 'CORTEXpro' (ID: 96022-100-100244) with software version 1.10 and firmware version 1.3. A red 'UPDATE FIRMWARE' button is visible. An information icon ('i') is in the top right corner. The 'FIRMWARE UPDATE' window on the right shows a notification 'A NEW FIRMWARE IS AVAILABLE!' with a 'FIRMWARE DOWNLOAD' button. Below, under 'UPDATE FIRMWARE', is an 'UPLOAD FIRMWARE TO DEVICE' button. A close icon ('X') is in the top right corner.

For informationen about the update process, please use the info (,i‘) button at the right top of the system data window.

Note: Do not double-click the firmware file, trying to open or execute it! This can corrupt the file, which, in effect, may not let the updater process recognize the file as valid data any more. The file is only meant to be supplied to the updater by supplying the file's path.

MISCELLANEOUS

WE RECOMMEND FOR YOUR SAFETY

- Always observe a sufficient safety distance from persons and objects, including yourself.
- Do not underestimate the inertia and momentum of rotating prop blades.
- Always observe legal regulations.
- Keep your distance from radar stations, transmission masts and other radio interference sources.
- When passing on the model to third parties, always pass on these warning notes as well!

DISCLAIMER

Installation, adjustment and operation of the system, and RC model airplanes in general, require appropriate skills. Errors and lack of attention can result in accidents involving severe personal injury and/or property damage, or even traffic accidents. As the manufacturer and seller have no influence on correct handling, these risks are expressly pointed out. Liability for all manner of damage resulting from operation, even due to disruptions of the built-in instruments or signal transmission, is fundamentally ruled out, insofar as legally possible.

WARRANTY

We assume a warranty of 24 months for this device.

Any repairs performed will not extend the warranty period. During the warranty period, we will remedy any occurring malfunctions or manufacturing or material flaws free of charge. Further claims, e.g. in the event of consequential damages, will be ruled out. The unit must be transported to us at no expense to us, and it will also be returned at no expense to us. We cannot accept unpaid consignments. We cannot assume any liability for transportation damage and loss of your consignment. We recommend appropriate insurance.

THE FOLLOWING PREREQUISITES MUST BE MET FOR PROCESSING OF YOUR WARRANTY CLAIMS:

- Purchase receipt included with the consignment.
- The devices have been operated in compliance with the operating instructions.
- The device has not suffered any moisture damage, unauthorised tampering, excess voltages, overloads or mechanical damage.
- If possible, include a description or symptoms of the perceived fault.

NOTE

This document contains legally protected information. All rights reserved.

The content of this document can be amended or adapted without prior announcement.

The bavarianDEMON may be modified at any time on the basis of ongoing tests and resulting improvements. Please inform yourself regularly about current versions of the instructions, bavarianDEMON firmware and any software.

The manufacturer provides no warranty for operability and usefulness in specific applications.

The manufacturer is not liable for errors in this documentation and resulting damages in connection with equipment, performance or use of the material.

ACCESSORY / SPARE PARTS

Foam tape ‚Acro‘ ACP (3 pcs)	No. 96097
Foam tape ‚Soft‘ ACP (3 pcs)	No. 96098
Cable loom L150 ACP (150mm)	No. 96099
Cable loom L250 ACP (250mm)	No. 96100
B module (Bluetooth, under development)	No. 96845

TECHNICAL DATA

Dimensions:	40 x 30 x 14 mm
Supply voltage:	4...10 V (2S-LiPo-compliant, min. 5.5 V for Spektrum satellites)
Current drain:	ca. 70 mA
Temperature range:	-15°C...+55°C, 5°F...130°F
Max. turn rate:	500°/s on all axis
Switching servo framerate (via software):	Digital1 (166 Hz) / Digital2 (200Hz) / Digital3 (333Hz) / Analog (55Hz)
Maximum combined servo currents:	total 15 A (permanent load, 18 A short-term)
Weight:	27 g (without cable loom)
Supported receiver connections:	Cable loom (PWM single channel), PPM sum (Jeti PPM sum pos. + Graupner SUM-O), Jeti EX-bus, Futaba S.BUS1, Graupner HOTT SUM-D (SRXL), Multiplex M-Link (SRXL), JR X.bus (Mode A + B/SRXL)
Supported pulse width range (output):	950-2050 ms

SCOPE OF DELIVERY

- Device (sensor unit)
- One mounting tape each, ‚Soft‘ ACP und ‚Acro‘ ACP
- Connection cable loom to the receiver, 150mm (optional longer cable available, see accessories)
- Mini USB cable
- QuickStart-Guide (brief installation and setup manual)

Software (supported by Win 7 + MacOS 10.8, and higher) available for download on www.bavarianDEMON.com.

VERSION 1.5

IMPRINT

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SERVICE AND REQUESTS

Visit our website www.bavarianDEMON.com for dealers and contact information.

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