Version 2
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Operating instructions
Hybrid landing gear

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1. introduction

The company WEMO-EZFW offers with the hybrid landing gear a completely new designed retractable landing gear especially for gliders with drives like FES, KTW, direct mount or exit turbine.
This means for all models where nose-digging of the fuselage tip during take-off should be avoided.
We can look back on more than 10 years of experience in the production of landing gears and the development of the TRIAS (first 3-stage landing gear).

1.1 Overview

The CFRP/aluminum chassis are offered for

- wheel sizes from 76mm - 178mm
- with and without steering knuckle extension
- conventional with 2 positions
- in hybrid version with 3 positions

A steering knuckle extension is used for FES propulsion systems to provide the necessary ground clearance for the propeller.

We use high quality materials to ensure optimum function with a minimum of weight.

1.2 Scope of delivery

Standard equipment:

- Chassis made of CFK
- Steering knuckle made of high-strength aluminum 7075 (CFRP for 76 mm and 90 mm wheel)
- 2 CFK servo mounts for standard servos integrated in the side panels
- CFK flanges for mounting the undercarriage to the main bulkhead
- Fixing screws to the bulkhead and threaded inserts M4
- Ball bearing mounted FEMA wheel

With the hybrid chassis, there is also a ready-assembled and 180 degree programmed HV servo with linkage with ball heads.

1.3 Delivery options

- Strong braced stainless steel wheel bar with 4 fixing points for opening the landing gear doors

- Deep-drawn and ready-trimmed wheel cover in CFRP look screwed onto a ready-to-install CFRP bridge. This bridge also accommodates one of the abutments for the Bowden cable brake

- Powerful wheel shoe brake with Bowden cable and counter bearing. This is soldered and equipped with a length-adjustable fork head M2

- Rear vibration rubber mount made of CFK with rubber-metal buffer

- Model-independent frame set made of plywood, multiple glued. With milled contours and holes for the undercarriage. The fuselage contour is attached by the customer

- Universal suspension unit.
Complete module ready for screwing on, consisting of flange with adjustable stops, spiral springs with guide and variable
Preload, oil-pull damper and driver adapter

- Brake servo HV completely mounted and adjusted to the Bowden cable brake

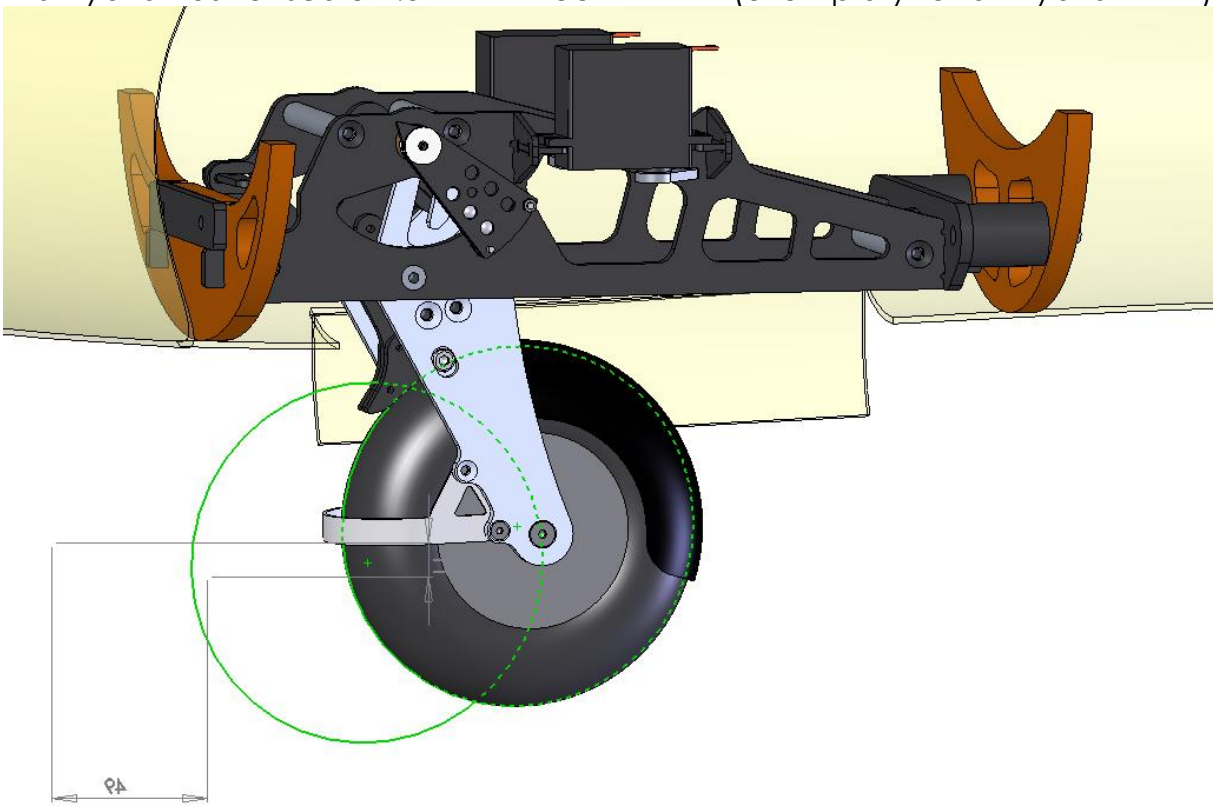
1. Hybrid Technology

This is a landing gear with three positions.

Positions:

- Moved in
- Landing position (wheel axle at the original position)
- Starting position (wheel axle shifted strongly forward, as well as raising the model)

FES Hybrid-130 for scale 1:3 with wheel 112mm (exemplary for all Hybrid-EZFW)



Starting position: 49 mm further forward and 11 mm higher than landing position

Due to the standard design, no enlarged flap cut-out is required (exception: FES chassis with stub axle extension).

The shifted forward starting position is especially helpful with retractable and push-on landing gears, because here the engine power is introduced under a very unfavorable lever arm and the model has a strong tendency to tip forward.

However, this behavior is also present in FES and flap turbine models (although to a lesser extent). In addition, tilting forward must be prevented at FES under all circumstances.

This is ensured by the forward displacement of the wheel axle. In addition to shifting the wheel forward, the model is also lifted. Since FES usually requires an extension of the steering knuckles anyway, this can be reduced by the amount of the lifting by the starting position. This is good for the optics (no stork legs).

In contrast to take-off, you don't want to have the wheel axle shifted so far forward during landing, in order not to increase the load on the tail.
All this is achieved by a separate take-off and landing position.

2.1 Functionality

Basically, the hybrid landing gear is a conventional design, but with two guide rails.
One for the starting position and one for the landing position.
All three positions are mechanically kneeled together with absolute certainty.

As hybrid technology is a complex mechanical system with a lot to consider, the chassis are already equipped and adjusted by us with servo and linkage.
In doing so, an HV servo programmed to 180 degrees is used for the retracting/extending movement. In addition, a servo lever made of aluminum is used here. We reserve the right to choose the respective wheel servo.

<u>The reasons are:</u>

A very powerful servo must be used and it must be ensured that the servo force is sufficient with any power supply to safely operate the balls of the disconnect lever. In addition, the linkage must be connected to the output of the servo at a precisely defined distance, otherwise the travel distances cannot be achieved. This would then also prevent the mechanical knees from being reached and the entire mechanism would therefore not function.

In order to be able to exclude all these sources of error reliably, we deliver the hybrid retractable landing gear only with a servo installed by us.

2.2 Operation

The transmitter uses a toggle switch with 3 positions (three-way switch).

1. **„Moved in“** (Recommendation: switch position direction pilot)
2. **“Middle Position“** (Recommendation: Switch in the middle)
3. **„Moved Out“** (Recommendation: Switch all the way to the front)

When extending the landing gear at the transmitter, the landing position is always taken!
To reach the take-off position, the "center position" of the servo (1500us) and then pull the wheel forward in a quick and jerky movement until it stops. This changes to the starting position.
During this procedure the mechanical connection between the servo and the two-part actuating lever of the landing gear is disconnected (balls disengage). Now the connection between servo and landing gear is disconnected.
Then the 3-step switch is moved to the "extended" position, which restores the mechanical connection between the servo and the actuating lever (balls re-engage).

It is of utmost importance that after the start position has been set by hand, the 3-way switch is set to "Extend" so that the separated lever locks again. This must not be forgotten under any circumstances, as otherwise there is a risk that the landing gear will collapse during take-off due to vibrations. This would have fatal consequences for the propulsion system, the propeller, the landing gear doors and ultimately for the entire model.

When the landing gear is retracted after take-off, the mechanism automatically jumps back to the landing position setting and remains there until the take-off position is next inserted by hand.

2.3 at the airfield

Proceed as follows to engage the forward starting position:

- lift up the Model by Hand
- set the switch to the middle position. (The landing gear moves a little bit out of the fuselage)
- pull the wheel forward quickly and jerkily by hand until it stops (lever with the balls unlocked)

- -now set the switch to "landing gear extended"(lever with the balls locked again)
- now the model can be put down

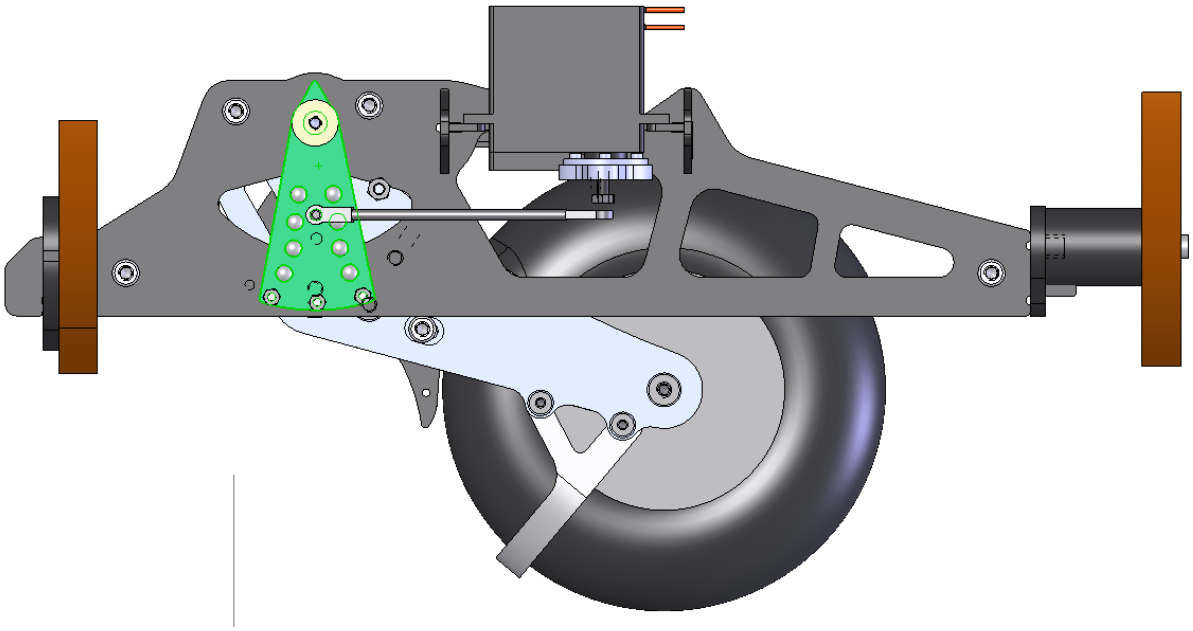
Practice has shown that it also works when the model is first parked and then the switch is set to "landing gear extended".
This procedure is more comfortable in handling, but not as safe as the other way round.

3.0 Setting the servo travel

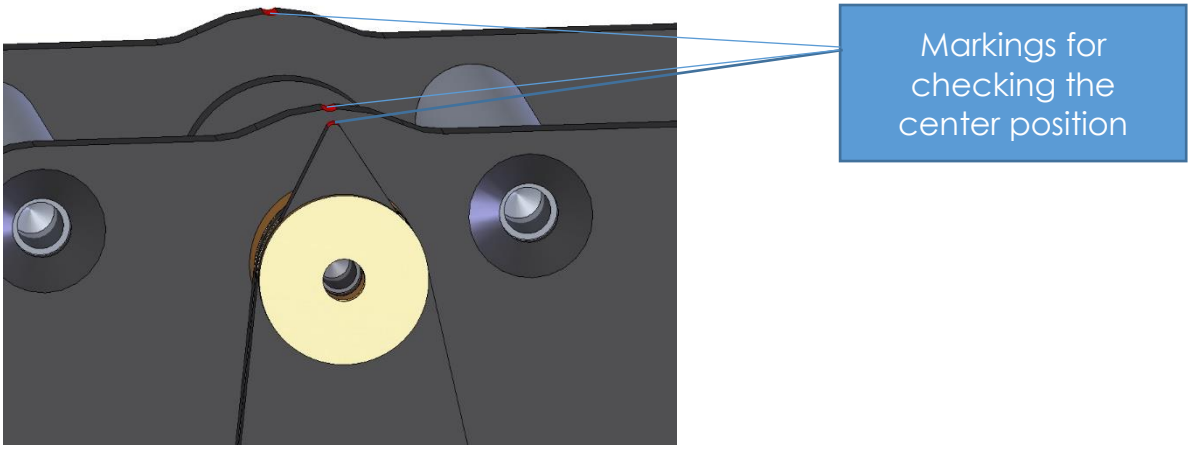
The programming is done by a free three-way switch on the remote control.

Since the servo is already programmed to 180 degrees, only the travel in + and - is adjusted on the remote control so that the servo lever is set to 0 degrees or 180 degrees in the opposite direction. This also relieves the servo gear in these two positions. The linkage with ball heads as well as the servo lever (distance from ball head to servo output) are already exactly designed for this ex works.

Then follows the adjustment of the servo center position. For this purpose the three-step switch is moved to the middle position. Now the servo travel is adjusted in the servo programming until the actuating lever (green component in the picture) is aligned vertically.



To check this position, even when installed, a mark has been made on the side panel which should be flush with the tip of the CFRP actuating lever (areas marked in red here). For this purpose a piece of wire can be placed on both side parts.



This completes the servo travel setting.

4.0 Mounting the landing gear in the model

The landing gears from a wheel size of 100mm upwards is equipped with a completely redesigned attachment to the main bulkhead. These are flange plates made of CFK. These replace the previously often used pivoted aluminum blocks. They fulfil the same function, but are much lighter (approx. 90 g weight saving). Thus, a rigid as well as a spring-mounted bearing (with sufficient spring travel) can be implemented.

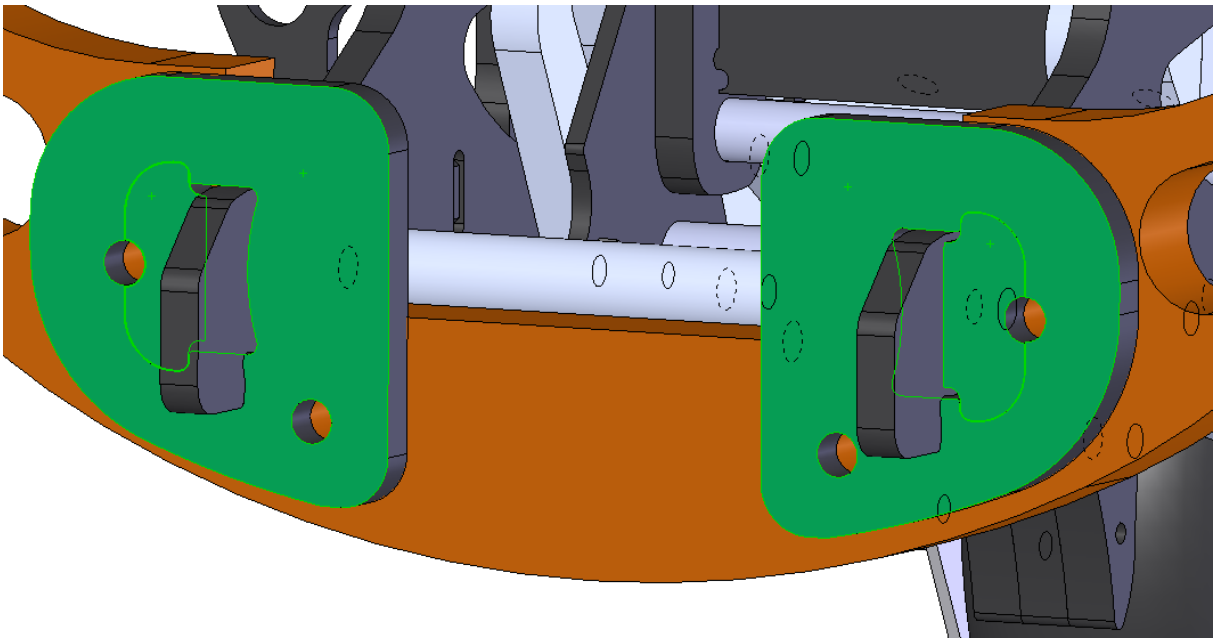
The flange plates are in two parts and are bolted to the main bulkhead via 2 holes each (M4 Allen screws). They are already mounted and secured ex works.

The flange plates are mounted BEFORE the bulkhead (see following picture)

There will be

- 4 lock nuts M4
- 4 allen screws M4 with washers
-

supplied.



4.1 Main frame

Basically, we send all frame geometries as DXF file by email on request. This allows you to mill the formers yourself.

To make life easier, a frame set can be ordered for each landing gear. Here are the geometries plus the holes of the respective landing gear in the frame already milled.

The frames have right / left / bottom allowance accordingly, so that the molded fuselage geometry can then be transferred and cut out.

The landing gear should NOT be attached only to the flange plates in the main bulkhead. Otherwise, shear forces occurring during a landing could destroy the landing gear.

If the landing gear is mounted on the rear side in one bulkhead, as described, the occurring forces are safely absorbed by both bulkheads.

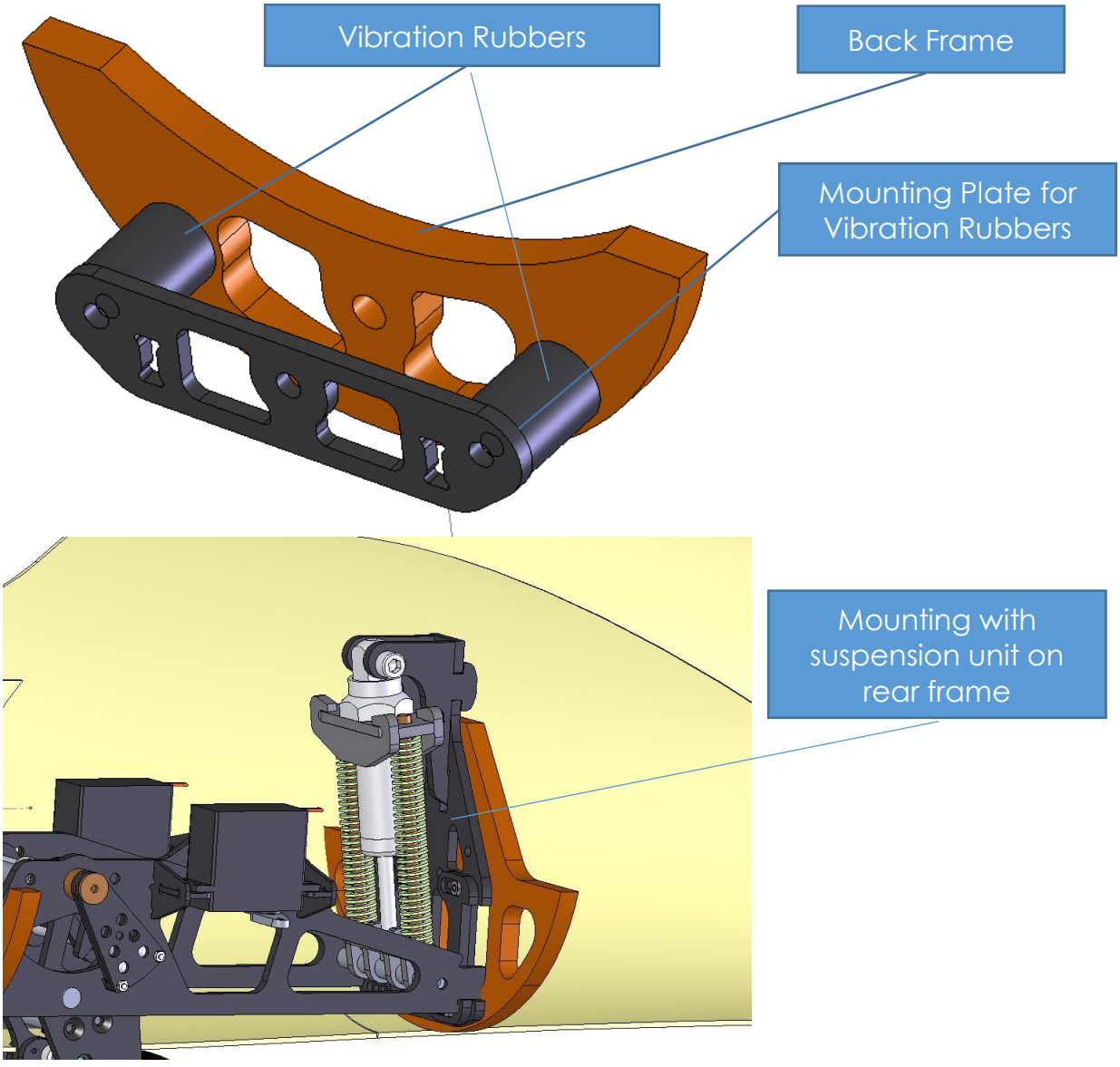
4.2 rear frame

There are two ways to attach the landing gear to the rear.

1. fixed mounting in the rear frame
2. movable mounting for the use of a vibration rubber mounting (picture 1) or the suspension unit (picture 2)

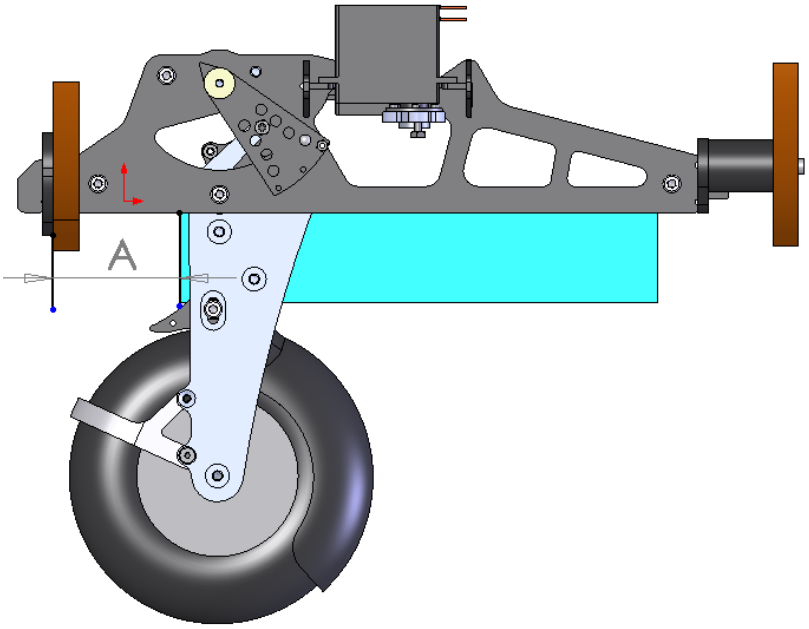
Under **NO circumstances** should the undercarriage be attached only to the flange plates in the main bulkhead. Shear forces occurring during landing could otherwise destroy the landing gear.

If the landing gear is mounted in one bulkhead at the rear, as described, the forces are safely absorbed by both bulkheads.



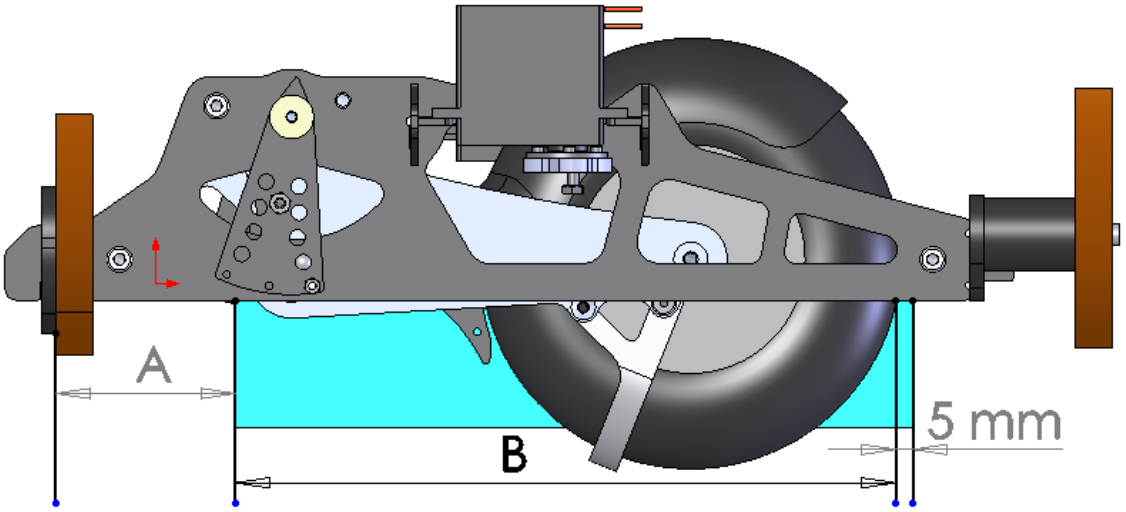
4.3 Landing gear doors

When the landing gear doors are removed, the dimension "A" shows the beginning of the door well. Here it is already taken into account that with hybrid landing gears the flap shaft must move 4 mm further forward due to the starting position.



Scale	Wheel Sice	A	Flap width
1:4,0	76 mm	30 mm	54 mm
1:4,5	90 mm	30 mm	62 mm
1:3,5	100 mm	49 mm	74 mm
1:3,0	112 mm	49 mm	82 mm
1:2,5	127 mm	48 mm	82 mm
1:2,5	140 mm	53 mm	82 mm
1:2,0	153 mm	53 mm	89 mm
1:2,0	165 mm	57 mm	89 mm
1:2,0	187 mm	63 mm	94 mm

To determine the length of the flap shaft, move the wheel by hand to the position as shown here:



Dimension B at the end of the wheel plus 5 mm gives the length of the flap shaft. We cannot give this as a general rule here, as the landing gear is manufactured individually and has wheel legs of different lengths (FES).

Please make sure that the landing gear doors move smoothly, otherwise the operating lever could unlock unintentionally.

Our hybrid landing gears are technically sophisticated mechanisms. Much more demanding than a standard landing gear.
In order to ensure that the joy of our suspensions remains unclouded and a perfect function is guaranteed, great care should therefore be taken when handling them, but especially when installing and adjusting them.

5.0 Note on standard landing gears

The standard landing gears are supplied with a wheel drive lever which has a special feature.

This can be used for 120 degree as well as for 180 degree servos (explanation see following picture).

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