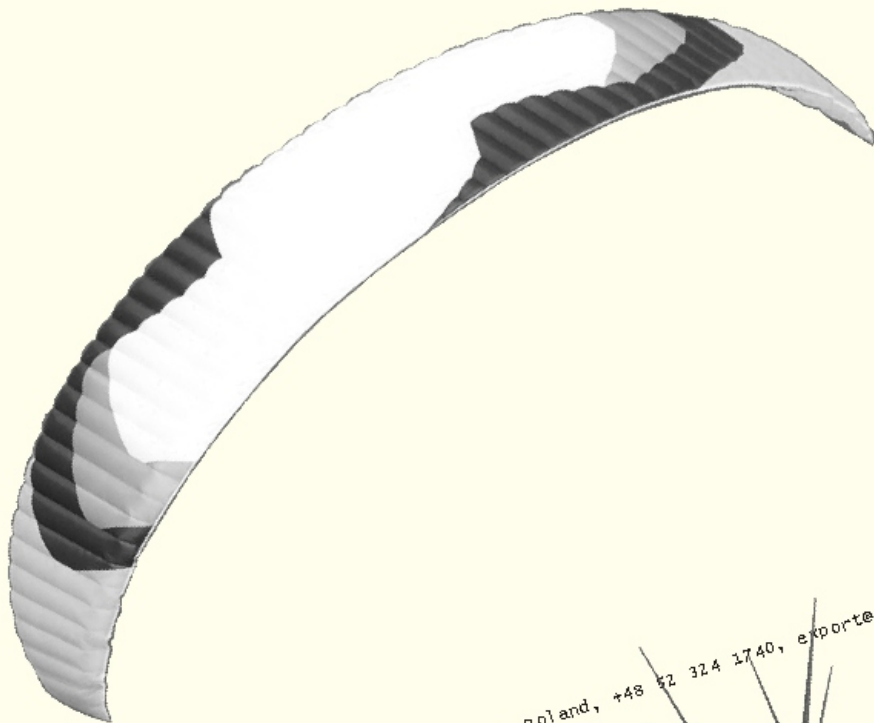
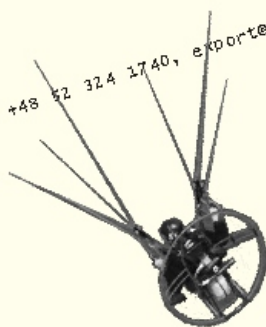


Synthesis

User Manual



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www.dudek.eu

NOTE!

Please read this manual before your first flight

IMPORTANT:

Remember to fill in and send us the registration card, sewn on to the trailing edge of the paraglider. When we receive it, we will send you the Warranty or AeroCasco confirmation (whichever you choose). You will also receive some small gifts along.

The confirmation will allow us later to identify the paraglider, to categorise it in its proper insurance group and to determine the insurance expiry date.

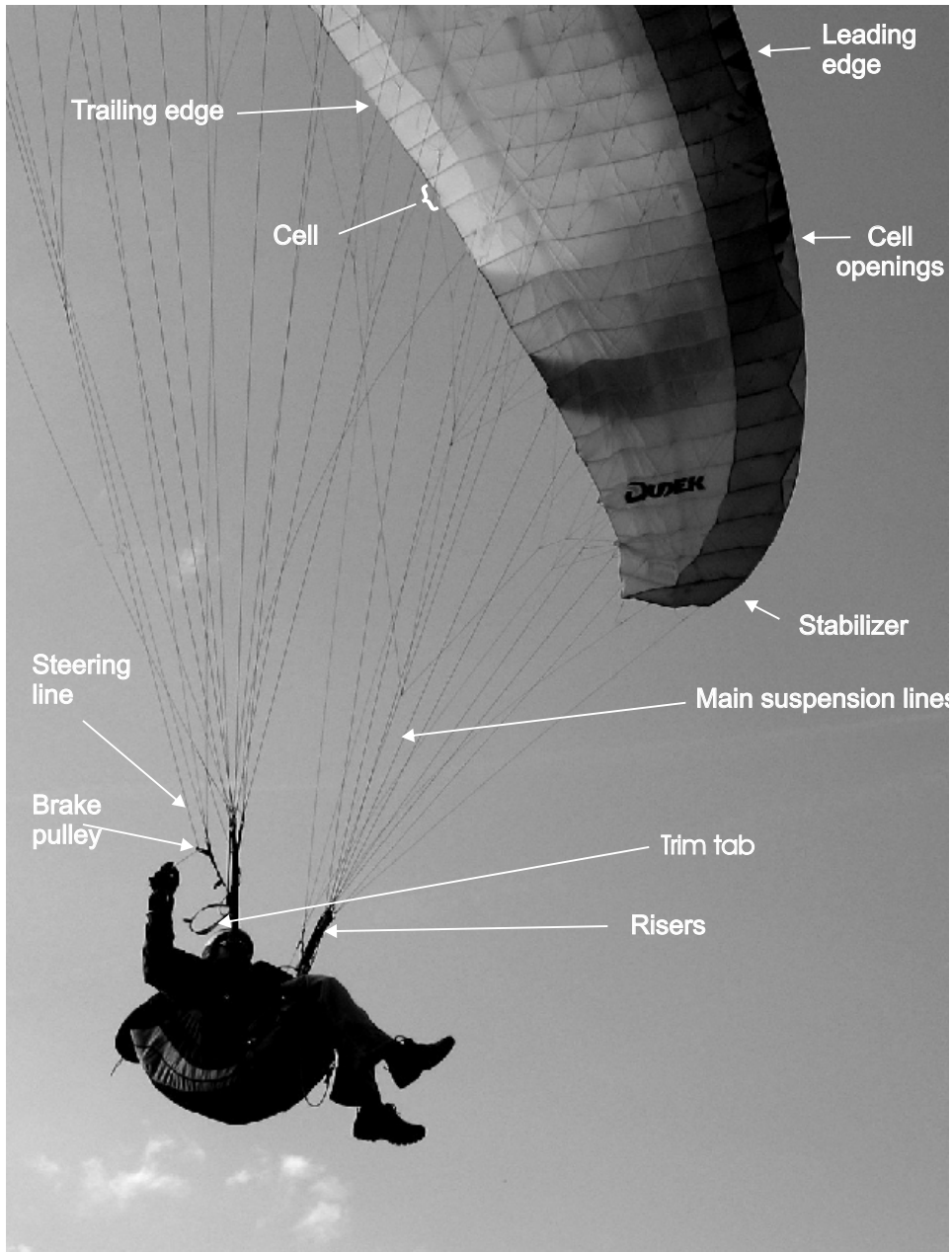
Also, the confirmation will be useful in future, in case of selling the paraglider (it will allow the new owner to keep all the benefits).

NOTE! If you are not the first owner of the paraglider, you should send us the registration confirmation together with a copy of previous users' logbooks (total of flying hours) within 14 days from the date of purchase, in order to be able to keep the warranty.

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Leading edge

Trailing edge

Cell

Cell openings

DUDEK

Stabilizer

Steering line

Main suspension lines

Brake pulley

Trim tab

Risers

1. INTRODUCTION

CONGRATULATIONS!

We are pleased to welcome you among the growing number of Dudek Paragliders pilots. You've become a proud owner of state-of-the-art Synthesis paraglider. Extensive development, application of the most modern methods and thorough testing make the Synthesis a user-friendly paraglider, offering the pilot a lot of fun combined with great performance.

We wish you many enjoyable and safe flying hours.

DISCLAIMER

Please read this Manual carefully and note the following details:

- The purpose of this Manual is to offer guidelines to the pilot using the Dudek Synthesis wing and it is by no means intended to be used as a training manual for this or any other paraglider in general.
- You may only fly a paraglider when qualified to do so or when undergoing training at an accredited School or with an Instructor.
- Pilots are personally responsible for their own safety and their paraglider's airworthiness.
- The use of this paraglider is solely at the user's own risk! The manufacturer and distributor do not accept any liability connected with this activity.
- This paraglider on delivery meets all the requirements of the EN 926-1 and 926-2 regulations. Any alterations to the paraglider will render its certification invalid.

NOTICE

Dudek Paragliders warns that due to the constant process of development the actual paraglider may differ slightly from the one described in the manual.

2. THE WING

WHO SHOULD FLY Synthesis?

Whether you have already tried paramotoring or you're only learning it – you know it is your game. You are excited with the possibility of taking off almost anywhere. You need a wing that is both agile and easy to control, that will allow you to discover freedom of three-dimensional journey – there is an endless number of distant and beautiful spots to visit from the air.

Mostly you will be just enjoying your time, but if you one day would like to try yourself out in a competition, you wouldn't like your wing to confine you. So your paraglider has to be versatile, relatively slow and easy at take off (running around with 40+ kg on your back is not necessarily your ideal of pleasure). Yet it has to be equipped with a set of trimmers allowing it a wide speed range, with possibly high top speed. Of course you would like it to be safe and stable too, both in thermals and in chance turbulences, including top speed configuration (full trim +speedbar).

Synthesis does fulfill all of these seemingly contradicting requirements. It is simply a synthesis of desired powered-wing features with gentle characteristics of free-flying paragliders.

2.1 DESIGN

After a long success story of our Action and ReAction paragliders we've set us another ambitious goal: to create a PPG wing that could be flown by pilots of all skill levels, combining great reflex-wing performance with free-flying paragliders ease of take-off. We succeeded and in the Synthesis our dream came true.

While designing it we put a lot of effort into flight safety, pleasant handling, good performance and wide speed range, so that it will satisfy a great many pilots. In many prototypes leading to final Synthesis version we have tested several airfoils based on our own Dudek Reflex Airfoil. Often we tried to decrease its stability in order to achieve take-off and handling, but invariably we ended with worsened safety at full speed with little improvement elsewhere.

After several prototypes our efforts paid up and we arrived at a wing with great maximal speed (61 km/h), wide speed range on trim (37 to 49 km/h) and as easy a start as possible with reflex profile. Main feature of reflex airfoil paragliders, i.e. passive safety, remained intact.

We feel safe to declare the Synthesis to be the best wing available in its class.

The fundamental feature of a good PPG wing is its great stability and tuck-resistance. A good PPG wing must be a very stable and tuck-resistant craft.

When this is achieved, the user does not have to concentrate all the time on piloting, thus saving energy for navigation, taking pictures or simply enjoying the flight. In addition the faster and safer your paraglider is, the more often you can fly.

While the Synthesis was designed to retain all the features of a conventional paraglider, the application of a reflex aerofoil section added several new qualities. First of all, using that profile means that the wing stability does not depend exclusively on the pilot's weight and actions. It maintains its own pitch attitude, rising and falling through thermals while remaining stable above your head, without need for so much pilot input.

Generally speaking the reflex profile is a special kind of aerofoil section. The specific static pressure distribution creates a situation where at low attack angles, only the wing fore part (some 60% of the chord) is producing lift, while the rear 40% of the chord creates an effective stabiliser against excessive decrease of the attack angle.

The trimmer system allows you to considerably raise the rear part of the airfoil, thus effectively reducing projected chord and surface area by some 30%, giving the paraglider a higher wing loading and increased speed without change in the angle of attack.

The centre of pressure also moves forward, adding enhanced pitch stability. Such a shift of loading gives the wing exceptional tuck-resistance and increases projected aspect ratio, resulting in much better flight data, especially at full speed. Should you require more lift at lower speeds, the rear section can be pulled down to restore a full airfoil, effective along the whole chord.

Piloting the Synthesis actually reminds one more of flying a conventional powered aircraft than a paraglider.

Below we will try to give you a closer look at some of the remarkable Synthesis features.

2.2 DESIGN

The Synthesis 3D body was designed in our **CSG** (Canopy Shape Guard) system, comprising many elements resulting in exceptional coherence and stability of the shape. Below you will find a short description of CSG subsystems.

The Synthesis has an elliptical planform with slightly rearward swept tips. Every second cell is divided in two, with ribs additionally supported by diagonal **VSS** (V-shaped supports) system. Such arrangement ensures a smooth top surface, exact aerofoil reproduction across the entire wingspan and yet more importantly, minimal number of suspension points.

The lower surface has a **RSS** (Reinforcing Strap System) applied in the wing's interior. RSS is an ballooning-independent reinforcements system made entirely of paragliding fabric, effectively stiffening and stabilizing the canopy.

Synthesis' aerofoil is another product of our Dudek Reflex Airfoil technology. It was calculated with our previous experiences in mind and thoroughly tested with numerical methods

The suspension points areas are additionally reinforced with laminated fabric so that loads are equally distributed on three planes: vertically (with the ribs), diagonally (with VSS system) and level through RSS.

All crossports have been prepared using **OCD** (Optimised Crossports Design) technology. Carefully designed shapes of the openings and their optimal placement between stress lines guarantee efficient pressure distribution in the canopy and its quick inflation. These openings are scaled together with the ribs, so that their replicability is flawless and they do not disturb the aerofoil in any way.

The Synthesis' leading edge is closed to airflow, and its precise shape is supported by reinforcements of laminated fabric.

Cell openings are positioned on the undersurface in the vicinity of leading edge. Their position was chosen very carefully, so that they got maximum ram effect in possibly many flight situations. In several places the leading edge features our **CCS** (Closed Cell Structure) system – this is a number of closed cells in most important locations. It's goal is to hinder the backflow form the cells out and thus to facilitate their refilling and canopy recovery in case of a collapse.

Each wingtip consists of four additional cells creating stabilizers. They maintain correct tension of the canopy, improve directional stability and play important role in keeping your turns efficient and even. In the very tips there are cleaning slots, placed there for easy removal of dirt form inside the wing.

Careful selection of modern fabrics and design solutions brings about great strength and durability of the Synthesis. All materials used come from marked production batches, and each production step can be verified down to identification of specific worker and controller.

Fabric

Each kind fabric has it unique features and characteristics. We composed them so that their interplay creates a perfect blend.

The Synthesis' upper surface is made of Porcher Skytex 45 Evolution fabric (formerly named Aquatic), perfectly proven in our earlier wings. Basically it's a nylon material covered with superb E85A impregnate, introduced into mass production in January 2002 after a series of extensive laboratory and

real flying tests. Such covered fabric is not very stiff and - what's most important - has increased tear, stretch and UV resistance. It is not siliconed, so minor repairs can be easily made with self-adhesive strips.

The lower surface is made of Skytex 40 Classic with E38A impregnate. This fabric has a great weight/resistance ratio and is one of the greatest Porcher successes in providing proper materials for the paragliding industry.

The ribs must be as rigid and stretch-resistant as possible. We found these qualities in Skytex 40 Hard with E29A impregnate. All reinforcements are made of SR-Scrim.

Rigging system

All of the Synthesis suspension lines are sheathed by a coloured polyester layer which is covering brownish Technora core. Low number of lines required such composition, featuring high strength and stretch-resistance.

The rigging system consists of individual lines looped and stitched at each end. The main lines are made of Technora and depending on their location, have 1.8 mm, 1.5 mm, 1.3 mm or 1.2 mm diameters. Such diversity stems from different loads on the line groups concerned. Lines of the middle and upper layers are made of 1.2 or 1.3 mm Technora.

The upper level lines (gallery) start at the attachment points. Every two lines join one middle layer line. These in turn connect by twos or threes to the main suspension lines, which are attached to the risers with triangular quick links (maillons). To prevent their slipping off, the lines are kept together with a rubber 'O ring'. All the maillons are made of corrosion resistant, polished stainless steel, ensuring excellent strength and durability.

Brake lines run from the trailing edge through consecutive cascades to the main steering lines, which are lead through pulleys connected to the rear risers and then fixed to the brake handles.

Steering lines do not carry any load until the brakes are applied. Some of the steering lines (of the FC group) are additionally led through rings sewn into the trailing edge. Because of this feature the trailing edge is shortened on application of the brake, so that steering becomes lighter and more effective.

All the lines are distinguished with colours depending on their strength and diameter as follows:

- 2,3 mm; strength: 420 daN; colour: celadon (willow green),
- 1,8 mm; strength: 280 daN; colour: red and orange (the latter for pulling big ears),
- 1,5 mm; strength: 190 daN; colour: violet,
- 1,3 mm; strength: 140 daN; colour: green,
- 1,2 mm; strength: 90 daN; colour: blue.

(given colours are subject to slight changes).

The risers

For the Synthesis we have chosen four-way risers equipped with:

- **ELR** (Easy Launch Riser) system. This is an specially marked A rises (gold ribbon)
- speed-system affecting A, B and C risers when engaged,;
- trimmers of red band with visible scale (red – slow and blue – fast trim setting), designed for quick and easy replacement in case of deterioration;
- two levels of the pulleys, to be used depending on the hangpoint
- Tip Steering Toggle system (see details on pages 10).

For quick and easy recognition in emergency, some of the risers are distinguished with coloured band as follows:

- A - gold (used for launching)
- A' - blue (used for big ears)
- B - red (used for B-stall)
- D - grey (needed to keep the glider down in strong winds or interrupting the launch).

Main A row suspension lines connect to an A riser (gold) and A' (blue). B and stabiliser lines go to B riser (red), C lines (black) go to C riser, and D lines to D riser (grey), which through pulleys keep the steering lines too.

Brake handles are attached to the steering lines at optimal places, guaranteeing safe and effective operation. On the main brake lines there are two points marked, higher and lower, to be used depending on the harness hangpoint. On adjusting the steering lines see chapter 3.1.

Our newest brake handle used in Synthesis besides its robust yet light design features:

- **DCT** (Double Comfort Toggle) system,
- **EK** (Easy Keeper) system - look below

3. FLIGHT OPERATION

3.1 STEERING LINES AND SPEED SYSTEM ADJUSTMENT

We strongly advise following actions to be supported by an instructor or at least an experienced pilot.

A brand-new Synthesis has its steering lines positioned for powered flight in high hangpoint configuration.

The risers of the Synthesis are shorter than in most paragliders, so the differences in hangpoints present somewhat smaller problem. Still, there are two sets of pulleys prepared, higher and lower (see risers scheme on page 37). Also on the main steering lines there are two spots marked for brake handles to be accordingly fixed.

When flying with lower hangpoints (or free-flying) the brake lines are to be run through the higher pulleys only, and the brake handles should be positioned at higher marks, thus shortening the brakes in general. The rule is simple - higher hangpoints require longer brake lines, lower hangpoints require shorter lines.

Before you take your Synthesis on powered flight, we strongly advise to try out everything first. Hang up the entire PPG unit with ropes, sit in the harness and have someone pull up the risers. You must make sure that in flight you will always be able to reach the brake handles, even if the airflow blows them away.

While being suspended in this way, you have a perfect opportunity to adjust the speed system too. The speedbar should not be pulling pull its lines (and risers) when it is not applied. Neither should it be too loose, for it could catch the propeller then.

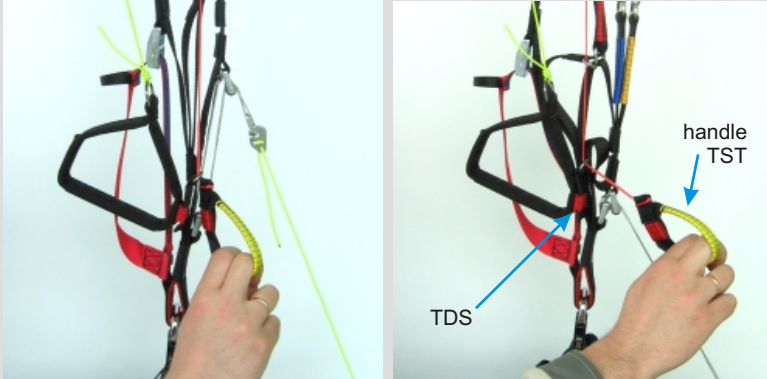
An additional way to check the whole configuration out is to visit take-off site in steady winds. With the engine off, fill the wing and take it up over your head. When it stabilises, check that the brakes are loose and are not pulling the trailing edge. There should be a spare inch or so before they activate. Remember that it is always safer to set the margin of play too big than too small. And, most important, the setting must always be symmetrical.

3.2 FREE FLIGHT (no power unit)

Although the Synthesis according to its design book is a fast PPG wing, it behaves surprisingly well as a classic paraglider too and can be used as such without any changes.

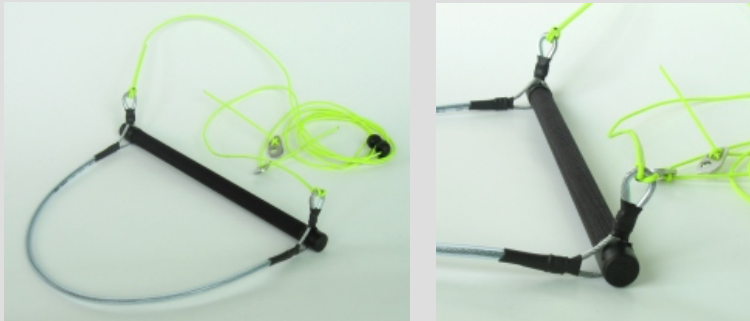
The essential difference between Synthesis and classic paragliders means is due to its increased tuck-resistance (both during start and flight) and greater

Tip Steering Toggles (TST)



In order to facilitate steering the wing while at maximum speed configuration (opened trimmers and full speed-bar) we've invented our own novel system of controlling the stabilizers. Prior to grabbing miniature TST-handles (Tip Steering Toggles) pilot places the main steering handles in a special Toggle Docking Stations, equipped with strong neodymium magnets. In this way you can comfortably steer the wing via TST handles, not worrying about the brakes getting tangled.

Easy Catch bar



The Easy Catch Bar is a medicine for all those having troubles with finding bar inflight. It is designed so that the bar always remains forward of the lines. The bar itself is very durable – it is going to serve you long.

Double Comfort Toggle (DCT)



DCT: in order to satisfy different needs of our clients we have created a Double Comfort Toggle system. With this solution it is possible to have your brake handles in stiff or soft configuration, with no need to buy another set of toggles and replace them every time. All you have to do now is take out the stiffening rod and there you are - the soft handle is ready to use.

Easy Keeper (EK)



Easy Keeper is the name of our new indigenous way to hold the brake handles at the risers.

The strong neodymium magnets keep them firmly in place, while both attaching and releasing goes smoothly and easily. This idea was developed especially for the PPG dedicated paragliders, for there is often a need to take your hands off the brakes to check or fix things. With Easy keeper you can easily secure the brakes in flight, thus minimizing danger of their contact with the propeller.

speed range it can be safely flown in strong conditions. Generally (and paradoxically from traditional point of view) the faster you fly, the safer is your flight.

3.2.1 TAKE-OFF

In case of **classic launch** we recommend that after laying out the wing all lines be taut, without unnecessary play. The Synthesis is pulled up with A risers only. The optimal trim setting is "0" (when launching for powered flight) or fully closed (when launching free-flight). Applying steady pressure on the A risers move forward. The wing practically does not overshoot, so the front collapses that otherwise happen quite often at launch, with the Synthesis occur rarely. Instead it kind of waits for you to catch up with it.

In case of **reverse launch** we also recommend abovementioned trim settings. Due to lack of overshooting take-off is easy, pilot has only to brake slightly. Reverse launches can be executed without any problems even in weak wind (1,5 m/s).

Caution!

During take-off it is important to keep the risers under pressure until almost airborne. Reflex profile used has an inherent tendency to increase the angle of attack. In effect, Synthesis can lag behind the pilot when not pulled up appropriately.

3.2.2 FLIGHT

The increased speed range of Reaction may demand some attention. Nevertheless, once you have mastered these additional aspects, flying will become pure pleasure. Good handling will let you make the best use of thermals, and increased speed on glides means that your presence in sinking air will be shorter.

To avoid stalls when braking with slow trims setting (red area), their movement is restricted by the tape sewing. (Note: it is possible to push the sewn tape through the buckle with both hands to replace it, but normal operation range is restricted by said place.

When the trims are fully opened (blue area) the wing becomes faster and stiffer, increasing its stability even more. The brake forces increase too, as well as the distance to the stall point. The radius and

bank angle in turns grow proportionately to the growing brake forces. If the trims are set fast (or fully opened) and the wing is not flown near the ground, a switch to TST steering is advised (see page 10). TST system can be used in all speed system & trim configuration.

Speed system use

Full application of the speed system increases flight speed by some 30%. In contrast to most paragliders it does not decrease wing stability, in fact Synthesis seems to counter the turbulence even better than. Still, if you encounter serious trouble, it is advisable to release speedbar. With application of the speed system the brake forces increase considerably, and brake effectiveness decreases. At maximum speed and fully opened trims we strongly recommend steering the wing with TST system. Turns executed in this way will be slightly wider, but strength needed to initiate turn will be smaller and there will be no decrease in speed.

The speed system can be safely used at all trimmer settings.

3.2.3 LANDING

With closed trimmers (red area) Synthesis lands like any other paraglider. The brake forces, initially low, are growing proportionally, giving ample warning before stalling. Still you should be careful when flying at low speeds until fully familiar with brake operation.

When landing with trims set fast (blue area) may require proportionately more space, as the paraglider has a lot of kinetic energy and careless application of brakes may even cause the wing to climb.

Most pilots get to know the wing relatively fast and quickly gain enough trust to fly it in stronger conditions than they did ever before. Still, you should always be careful when flying low. Remember that Synthesis flies faster than ordinary paragliders and sometimes it can be of importance (e.g. when landing on a slope).

After landing in strong wind the paraglider can be safely put down with B risers, or with a strong pull on the rear D risers.

3.2.4 WINCHING

Synthesis is not designed for winching. As mentioned before, reflex profile used in the wing has an inherent tendency to increase the angle of attack. While in normal flight such a disposition makes it safer, during winch start it can be dangerous.

Nevertheless, a lot of successful winches on Synthesis have been made.

Experience shows that it should only be done with opened trims (blue area).

To sum it up: **winching can be done, but proper attention must be paid.**

3.3 POWERED FLIGHT

CAUTION: Before each start it is necessary to have a thorough check of the wing, harness and power unit.

In powered flight most of the wing characteristics remain as described above (chapter 3.2). Still there is additional information needed, concerning power output, proper matching of the wing/engine/propeller etc.

Dudek Paragliders cannot take responsibility for all possible combinations, but if you contact us we are always ready to help.

First flights

In order to get familiar with your wing we recommend flying with closed trimmers at first (read area), because in this configuration Synthesis behaves as a standard wing. Flying like that try pulling the brakes some until you feel resistance, usually it will be at about 1/4 of the range.

Once you feel competent with your wing, you can start experimenting with faster trim settings and speed system. Learn to use all the additional speed and safety of the Synthesis.

3.3.1 TAKE OFF

Classic launch with no wind

Even when it seems that there is no wind at all, it is rarely so. Therefore always be careful in determining the conditions, as because in PPG flying it is most important that the launch and initial climb are performed with a head wind (the danger of losing your airspeed while crossing the wind gradient is greatly reduced). Special attention must be paid to trees, power lines and other obstacles, including the possibility of emerging rotors.

Wing preparation

Lay out the paraglider downwind of the power unit, with all suspension lines taut and pointing toward center of the power unit. The risers are to be laid on the ground. Set the trimmers at "0" (see fig. 2). In strong conditions faster settings (blue area) can be advised. Make sure that you warm up the engine while standing windward of the wing. Stop the engine before clipping in the risers.

Now have a quick check if:

- the helmet is on and locked,
- the risers are clipped in the carabiners,
- the trimmers are set,
- nothing will get in propeller's way,
- speed system is running without problems,

- steering lines and handles are free and not twisted,
- engine delivering full power,
- airspace is clear for take off.

When you are sure everything is OK, you can clip in the wing and execute launch as described in paragraph 3.2.1.a.

From now on you should steer the paraglider facing forward, without looking back over your shoulder (when the wing is low behind you, turning can cause some lines to get in the propeller). Also, possibly falling on your back and the propeller is dangerous (and costly!) so this should be avoided at any price, even that of some damaged lines!

During launch, when you feel that the strain on both risers is equal, open up full power and lean back to counter the engine thrust, so that it can push you forward rather than to the ground. The best option is not to use the brakes, allowing the paraglider to rise as it was laid out. If it starts to swerve from its course, just pull the opposite riser and run under the centre of the wing while preserving starting direction. If the wind suddenly weakens, give a stronger pull on the risers.

If the paraglider drops to one side or back too far to be lifted again, kill the engine, interrupt launch and check the conditions once again.

As the wing rises, the forces grow lighter and it should stabilise above your head without overshooting. This is the best moment to check if it is inflated well and the lines are not tangled, but do it without stopping nor turning. If you feel the forces on the risers decrease, run faster and let go of the risers. See whether there is any opposition on the brakes and, if necessary, use them to correct direction or to increase lift at take-off.

Remember:

- If the cage of your power unit is not stiff enough, the risers strained during launch can deform it to the extent of collision with the propeller. Before giving it full power, check that the cage does not catch any lines.
- Any brake operation (or steering inputs in general) should be smooth and gentle
- Do not try to take off until you have your wing overhead. Hitting power before that can cause dangerous oscillations
- Do not sit in the harness until you are sure you are flying!
- The faster the trim setting is, the more brake input is required to take off
- The lower the hangpoints of your power unit are, the easier is the launch.

Reverse launch in strong wind

Reverse launch can be executed holding in one hand both A risers and one brake, throttle and the second brake in the other hand. With a decent wind it is by far the best way. In weaker wind it is better to prepare a classic launch, as running backwards with an engine on your back is not an easy thing to do.

It is reasonable not to pull the wing up until you are really determined to launch, especially when it is clipped in.

Lay down the rolled paraglider with the trailing edge facing the wind. Unfold the wing enough to find the risers and check that no lines are looped over the leading edge. Stretch the risers against the wind, separating the left and right one.

We suggest that you lay the risers in the same way as you will be turning during a reverse launch, and place one riser over the other, with the rear risers upmost. It should be done this way because once you clip in, the cage of your power unit will make turning on your own impossible.

Now run the pre-launch checklist.

After warming up the engine put the power unit on, turn to face the wing, go to the risers and clip them in the appropriate carabiners.

Pulling on the front and rear risers open the cells. It is a good idea to pull up the wing briefly in order to check that the lines are not tangled.

Holding the risers, brakes and throttle as described above, pull the front risers and raise the paraglider over your head. On most occasions you will not have to brake it, especially if the trimmers are set for fast flight (blue area). Perhaps it does not agree with our experience, but this is the way the reflex profile works. When the trimmers are opened (set above "0"), the Synthesis profile stabilises the wing and does not allow it to surge forward. It can even stay back a little - in such case pull the brakes a little and the glider will come forward.

Once you have it overhead, turn around, open the throttle and take off. As with the classic launch, in this case too you have to find such combination of trimmers, brakes and throttle settings that will give you the best speed and rate of climb.

Remember:

- You are launching with your hands crossed. You have to really master this technique before trying it with a running engine on your back
- Any brake operation (or steering inputs in general) should be smooth and gentle
- Do not try to take off until you have your wing overhead. Hitting the gas pedal before that can cause dangerous oscillations
- Do not sit in the harness until you are sure you are flying!

- The faster the trim setting is, the more brake input is required to take off

When clipping in the crossed risers, you can find proper connection of the speed system particularly hard. Be careful not to confuse the risers!

Climbing

Once you took off safely, continue heading against the wind, using brakes to correct rate of climb. Do not try to climb too steeply - attempts to increase climb rate by pulling the brakes will have an adverse effect - due to the additional drag actual rate of climb will worsen, and with the throttle fully open even a stall can happen.

In powered flight the Synthesis behaves more like an aeroplane than a paraglider, and it is good idea to think about it in this way. If there are no obstacles present, it is by far safer (and more impressive for the spectators) to fly level for a while after take-off and gain some speed before converting it to height with a brief pull on the brakes.

Another reason not to try climbing too steeply is the risk connected with engine failure at low altitude. Although the Synthesis in a steep climb does not stay back so much as conventional paragliders do, the low speed is more likely to cause a stall. Besides, you should always be able to land safely in case of engine malfunction, so it's better not to take unnecessary chances, and better to fly with a safe margin of speed.

Depending on the power unit geometry, it is possible that after take-off you will notice a propeller torque (turning moment). It will try to turn you around, so be prepared for counter-steering with a brake or harness cross-bracing. If it happens during steep climb on slow trim and full power, beware of the stall possibility.

Due to typical PPG feature - considerable vertical distance between thrust axis and wing chord - the range of safe power operation is closely connected to your skills and equipment.

Power-unit induced oscillations

Certain configurations of engine weight, output and propeller diameter can cause serious oscillations, during which the pilot is lifted to one side by the torque effect, swings down due to his weight, then is lifted again and so on.

To avoid this you can:

- change the throttle setting and/or
- adjust the cross bracing to counteract the torque, if there is one
- present and/or
- shift yourself to the other side of the harness and/or

- change the trimmer setting.

The best method is to fasten opposite cross-bracing, or apply some weight-shift. Such oscillations usually occur at full power - the greater the engine output and propeller diameter, the bigger the swings. In addition there are often too late or wrong pilot reactions, increasing the trouble instead of solving it. In any case the safest way to deal with this question is to close the throttle and release the brakes. Especially less-experienced pilots tend to overreact. It is called a pilot-induced oscillation, and proven solution is to leave the brakes alone.

3.3.2 LEVEL FLIGHT

Once you have gained safe height after take-off and wish to go for a route, you can turn onto the right direction, fully open the trimmers and let off the brakes. If the conditions are turbulent it can look foolhardy, but this is the essential feature of the reflex profile - the faster you fly, the safer your Synthesis is. That's why you really can confidently release the brakes and enjoy your flight.

CAUTION: Some pilots with previous free-flying experience may have a well-grounded habit of keeping the brakes slightly applied at all times. Such a technique, while quite reasonable on a free-flying wings as it allows for quick pilot reactions and decreases sink, is not advisable on reflex-profile wings. When you pull the brakes, the Synthesis profile loses its self-stabilizing features.

If you happen to have a variometer or altimeter aboard – watch it. In level flight it is very easy to start climbing unintentionally. The instruments will help you optimise speed and fuel economy. Of course each flight will depend on current configuration of your gear, but thanks to its ability to fly safely without constant piloting the Synthesis will let you adjust everything to the best effect.

Good knowledge of weather conditions (e.g. wind at different altitudes) and intelligent use of thermals, convergence and other kinds of lift will help you greatly reduce fuel consumption and increase flight range.

Of course the engine is always there to bring you in the right place. Do not hesitate to lead the Reaction into tight thermalling then, and you will be surprised how efficient it is. Possible shortening of the trimmers will make the climb ratio even better.

Trimmers and speed-system operation

The reflex wing section enables the Synthesis pilot to use a wide range of trimmers and speed-system action. You are free to experiment with all

possible settings, as long as you are on safe altitude.

Fully opened trimmers (blue area) increase the speed and stability of the wing, and with it also its ability to cope with turbulences and overall penetration. As forces on the brakes grow at high speeds, the weightshifting or steering with TST system becomes increasingly effective. Turns executed in this way are slightly wider, but needed steering force will be smaller and airspeed will not decrease.

With slow trimmer settings (red area) there is an improvement in sink and steering forces diminish, so exploring the thermals becomes possible.

Worth noting is the Synthesis impressive speed range - the maximum speed is almost three times greater than stall speed.

Study drawings of trimmers and speed-system setting, as well as their influence on the wing shape.

Independent of the current wing configuration and speed, turns can be much tightened and more effective with differential brake operation. Slight use of the outer brake (with considerable amount of the inner one) will diminish the loss of lift during turn. Turns can be much improved by additional use of throttle, speed-system etc. as well. Once with growing experience you will master these techniques, you will be able to execute fully coordinated and effective turns, that will bring to mind the aeroplane handling.

Remember:

- Trimmer setting is another part of the pre-start check list!
- If it will be asymmetric, the wing will be turning all the time. And if you will inadvertently set them off, the reflex profile of the Synthesis will keep the wing level, so after opening the throttle you'll start to descend with increased speed instead of climbing.

3.3.3 LANDING

In PPG flying there are two kinds of landing: with and without power.

Power off landing

At an altitude of 50 metres switch the engine off and start gliding as on a conventional paraglider. It reduces the chances of damaging the propeller on landing, but on the other hand there is only one attempt possible - so it has to be done right!

With or without power Synthesis better copes with turbulence on open trimmers (blue area). So, if the conditions are rough, it is better to make an approach with greater speed, plan a lot of space (as for a hangglider) and wear that speed off before touching down. Synthesis preserves the energy

well, so there is a long float necessary to exchange the abundant speed for lift.

If the landing field is not big enough and you have to land on the spot, we advise you to set the trimmers in red area. It will increase lift coefficient of the wing, simultaneously decreasing its sink rate and speed.

Such an action is especially important when flying with high surface loading.

Landing with power on

Make a flat approach with the engine idling, then level out and lose the speed before final flare. Immediately after touchdown switch off the engine.

The main advantage of this procedure is of course the possibility of a repeated approach in case of any misjudgement. Still, if you forget to switch off the ignition before the wing falls down, there is a considerable risk of damaging propeller, catching lines in it or even suffering injuries connected with falling on your running engine.

Remember:

- If possible, get to know your landing area before take-off.
- Whenever possible, get to know the landing field before taking off.
- Check the wind direction before planning the approach.
- Landing with power off requires much less space.
- In case of any doubt, practice the landing until you feel totally safe.

3.3.4 GOLDEN RULES!

- Never place the power unit downwind of the paraglider.
- Check, double check and then check once again if there is no fuel leakage.
- Do you have enough fuel for the flight? It is always better to have too much than too little!
- Check if there is nothing loose in the harness, that could possibly contact the propeller in flight
- Whenever you encounter a problem, fix it **AT ONCE** however small!
- Always put on and lock the helmet before getting in the harness
- Before each launch run a full pre-flight inspection
- After landing, control the wing facing the direction of flight, as on turning you always risk getting lines in the propeller. Turn only if there is danger of falling on your back

- Do not ask for trouble - do not fly over water, between trees or power lines and other places where engine failure will leave you helpless
- Remember turbulence caused by other gliders or even yourself, especially when flying low
- It is not reasonable to let go of the brakes below 100 meters, because a possible power unit malfunction may require immediate attention
- In general never trust your engine, as it can stop at any moment.
- Always fly as if that's exactly what it's going to do
- Unless it is not absolutely necessary (e.g. collision avoidance), do not USER MANUAL execute tight turns against the torque direction. Especially when climbing you can easily enter a stall and consequent negative spin
- Do not fly at low altitude with a tail wind, as it pretty much narrows your options !
- Do not wait for the problem to grow - any change of engine sound or a vibration can indicate some trouble, or even serious trouble. You'll never know until you land and check it out
- Be certain of your navigation
- Remember that not everyone is fond of your engine noise. Do not scare the animals.

3.4 QUICK HEIGHT LOSS

3.4.1 BIG EARS

In order to get the big ears you have to pull down the outer lines of the A' risers (usually distinguished with blue colour) by about 50 cm.

While inducing big ears you should never never let the brakes out of your hands.

After tucking the tips in, Synthesis will continue to fly straight with increased sink rate (up to 5 m/s). You can steer the wing pretty efficiently with weight-shifting.

After releasing the lines, the paraglider will usually open up on its own or you can assist it with a long stroke of the brakes.

For the sake of safety (the possibility of a parachutal stall) it is reasonable to engage speed system after pulling big ears in order to lessen the angle of attack of the wing centre. Executing big ears with open trimmers is very difficult due to the reflex profile stabilisation.

CAUTION! See the PARACHUTAL STALL chapter.

Never try to pull big ears during powered climb, as the increased drag can lead to increase of the angle of attack and a parachutal stall.

Besides, pulling the ears while climbing is pointless anyway.

3.4.2 SPIRAL DIVE

A spiral is characterised by reaching the highest sink rates possible. Significant G-forces, however, make it difficult to sustain a spiral dive for long, as it can place high loads on both pilot and glider. Never do this manoeuvre in turbulence or at too high bank angles. Control the dive and do not exceed 16 m/s sink. If the dive is not stopping after releasing the brake, assist the glider with the outer one.

NEVER DO BIG EARS IN A SPIRAL!

In this manoeuvre smaller number of lines is carrying an excessive load multiplied by the centrifugal force, what can lead to damage of the lines or even the paraglider itself (load of a single line can be much higher than passed in certification trials (i.e. 8 G).

3.4.3 B-STALL

To enter a B-stall, simultaneously pull down both B-risers (red tape) by 10 – 15 cm. The wing will collapse across the entire span along its B-row, the airflow over top surface will break and canopy surface will be decreased. Forward movement will be almost completely stopped.

Further pulling B-risers is not advised, as it increases wing instability. If the canopy forms a horseshoe with both wingtips in front of the pilot, gently apply both brakes to recover.

To exit a B-stall, the risers should be released in a smooth and decisive manner.

On quick and symmetrical releasing B-lines the airflow will reinstate and the wing will surge forward, returning to normal flight. In contrast to standard paragliders, in case of Synthesis there is no need to counter this surge with brakes - yet another feature of the reflex profile!

CAUTION: see Parachutal Stall.

All rapid descent techniques should be practised in smooth air and only with sufficient height! Full stalls and spins are to be avoided as recovery procedures, since irrespective of paraglider type they may have dangerous consequences!

BY FAR THE BEST TECHNIQUE IS SAFE AND CORRECT FLYING, SO

THAT YOU WILL NEVER NEED TO DESCEND RAPIDLY!

3.5 ACRO FLYING

Synthesis is not designed to do any aerobatics.

3.5.1 WING OVER

You make a wingover by performing a series of consecutive, alternating turns with growing bank angle. Too much banking connected with some flaws in co-ordination and execution can evoke pretty dynamic collapse.

CAUTION: Steep turn with bank angle over 60 degrees is a prohibited aerobatic manoeuvre!

3.6 EXTREME FLYING MANOEUVRES

CAUTION: EXTREME FLYING MANOEUVRES SHOULD ONLY BE CARRIED OUT DURING SAFETY TRAINING COURSE (INSTABILITY TRAINING) UNDER PROPER GUIDANCE!

WHILE PROVOKING OR EXITING REAL SITUATIONS THERE IS A DANGER THAT YOUR ACTIONS WILL PROVE TOO QUICK OR TOO STRONG, SO YOU SHOULD ALWAYS EMPLOY GOOD JUDGMENT, STAY CALM AND TAKE MEASURED ACTIONS.

Since all actions required to exit or prevent dangerous situations on Synthesis are typical and pilots flying this wing should already have proper experience, we are going to describe only the characteristic features of Synthesis.

Description of standard methods dealing with extreme situations can be found in textbooks.

3.6.1 ONE SIDED COLLAPSE

Even when the trimmers are fully opened or the speed system is engaged, collapses practically do not occur and can be induced only by a very strong turbulence.

Still, if it happens, a little counter-steering is enough to keep the Synthesis on course. In normal conditions with collapses up to 50% of the wingspan, Synthesis will reinflate instantly and spontaneously.

3.6.2 FRONTAL COLLAPSE

The reflex profile of the Reaction makes it practically impossible, especially at higher speeds.

During tests we succeeded in creating this situation only with fully closed trimmers. Such forced collapses were very deep, so recovering required pilot action (short and equal application of both brakes).

3.6.3 FULL STALL AND NEGATIVE SPIN

Practically do not occur, may happen only as a result of serious neglect or intentional action of the pilot. You have to be careful when flying at low speeds until fully familiar with brake operation.

Wing recovers spontaneously in initial phase of stall, otherwise use standard procedures.

3.6.4 PARACHUTAL STALL

Under normal conditions does not occur.

If you want to prevent it happen at all, simply stick to a couple of rules:

- after B-stall, release the risers quickly and evenly. Don't be afraid - Synthesis does not jump forward excessively;
- after big ears execution, engage the speed system. This will increase both the sink rate and safety margin, as big ears constitutes an aerodynamic brake with significant loss of speed.

Nevertheless, if such a parachutal stall happens e.g due to strong turbulence, simply apply some pressure to the speed bar and/or push the A risers forward. You can release the trim too.

3.6.5 LINE OVER and CRAVATTE

Synthesis is a modern wing which, in order to decrease drag, has fewer suspension lines and greater distance between them. Therefore it's always possible that after a tuck stabiliser may tangle in the lines. Usually a couple of pulls with a brake settles the matter. If it's not enough, try to untangle it with big ears or a stronger pull on the risers.

In case of any doubts you should always consider throwing a rescue chute. It is there as a normal equipment part, not just an ornament.

3.6.6 STEERING IN EXTREME SITUATIONS

In case of any malfunction that renders normal steering impossible, you can safely steer and land Synthesis using the D-risers (grey marking) or stabilo lines.

4. CANOPY CARE

Looking after your paraglider will prolong the life of your Synthesis

4.1 STORAGE

Store the paraglider in a dry place, away from chemicals and UV exposure.

Never pack or store the glider when wet, as it significantly shortens life of the fabric.

Remember that the wing becomes damp even while lying on green grass in full sunlight, as the grass transpires.

A good precaution to avoid dampness and/or UV when you have to wait in a start queue is to use quick-pack after rigging up.

Always dry the glider thoroughly before packing or storage.

While drying, never expose your paraglider to direct sunlight.

To avoid excessive paraglider fabric wear, do not pack it too tightly.

Please note that with frequent playing on a field or a small hill your paraglider will deteriorate more quickly due to its repeated rising, falling and being dragged around.

4.2 CLEANING

Clean the paraglider with water and a soft sponge. Do not use any chemicals or alcohol, as these can permanently damage the fabric.

4.3 REPAIRS

Repairs should only be carried out by the manufacturer, authorised distributor or authorised workshop. It is acceptable to fix minor cloth damage with the self-adhesive patches included in the package.

4.4 DETERIORATION: A FEW TIPS!

The Dudek Synthesis is made mainly of nylon - a fabric which, like any other synthetic material, deteriorates through excessive exposure to UV rays that come with the sunlight. Hence it is recommended to reduce UV exposure to a minimum by keeping the paraglider packed away when not in use. Even when packed in a bag, it should not remain in the sun for long.

Synthesis' suspension lines consist of Technora inner core and polyester sheath. Submitting them to excessive loads in flight should be avoided, as it can cause irreversible damage.

Keep the paraglider clean, since getting dust in the lines and fabric will reduce their durability.

Be careful to keep snow, sand or stones from entering the cell openings: their weight can slow or even stall the glider, and sharp edges can damage the cloth.

Prevent lines from catching anything, as they can overstretch or tear. Do not step on the lines.

Uncontrolled strong wind takeoffs or landings can result in the leading edge of the canopy hitting the ground hard, which may seriously damage the ribs, sewing and surface material.

Knots can chafe suspension and/or brake lines.

Check line lengths after tree or water landings, as they can stretch or shrink.

A line plan is included in this manual or may be obtained from the dealer when needed. After landing in water you should check the wing fabric as well, since the wave forces can cause the fabric to distort in some areas. When taking the wing out of the water, always do this by trailing edge, so that water can flow out freely. After a sea landing, rinse the paraglider with fresh water. Since salt crystals can weaken the suspension lines even after rinsing in fresh water, you should replace the lines with new ones immediately after contact with salt water.

Every second year Synthesis should undergo technical inspection by the manufacturer or authorised distributor.

5. Technical data

Synthesis	25	27	29	31	34
Certification *	EN C	EN C	EN C	EN C	EN C
Number of cells	50	50	50	50	50
Surface area (flat) [m ²]	25,00	27,00	29,00	31,00	34,00
Surface area (projected) [m ²]	21,46	23,17	24,89	26,61	29,18
Span (flat) [m]	11,29	11,73	12,16	12,57	13,17
Span (projected) [m]	9,01	9,36	9,70	10,03	10,50
Aspect Ratio (flat)	5,10				
Aspect Ratio (projected)	3,78				
Sink rate [m/s]	min = 1,2; trym = 1,4 - 2,2; max = 3,5				
Speed [km/h]	min = 23; trym = 37 - 49; max = 61				
Max. cord [cm]	273,91	284,65	295,00	305,00	319,43
Min. cord [cm]	60,35	62,72	65,00	67,20	70,38
Distance pilot to wing [cm]	724,23	752,62	780,00	806,44	844,58
Total line lenght [m]	412,25	428,42	444,00	459,05	480,76
Weight range [kg] ***	70-90	80-105	95-120	110-135**	135-165**
Weight [kg]	5,7	6,7	7,2	7,6	8,2
Lines	Technora: 1,2 & 1,3 & 1,5 & 1,8 & 2,3				
Fabric	SkyTex Evolution 45 g/m ²				
	SkyTex Clasic 40 g/m ²				
	SkyTex Hard 40 g/m ²				
	SR Scrim, SR Laminate 180 g/m ²				
Risers	PASAMON - Bydgoszcz, Polska				





* certified with a speed system, and with trimmers closed (details on www.dudek.eu)

** load test up to 208 kg

*** include equipment: empty engine (without fuel), harness, wing and pilot itself

6. THREE-STAR SECURITY ASSISTANCE ★★★

We are aware that purchase of a new paraglider is a big expense for every pilot. That is why we are offering a security system that will allow you to insure your paraglider against damages. We have introduced Three-star Security Assistance, which includes:

	★ Warranty 	Warranty - for each glider
	★★ AeroCasco 	AeroCasco - optional
	★★★ G. Package 	Golden Package - not available

★ WARRANTY

Dudek Paragliders guarantees free of charge repairs caused by the material or production flaws:

- for the free-flying paragliders warranty covers 3 years or 300 flight hours (depending on what comes first),
- for the PPG paragliders warranty covers 2 years/200 flight hours,
- for the mountain wings (MPG), school or profit users warranty covers 1.5 year/150 flight hours.

If the free-flying paraglider is used for powered flights, every hour spent in the air should be counted as two.

WARRANTY DOES NOT APPLY to any of the following:

- canopy colour fading
- damage caused by chemicals or salt water
- damage caused by incorrect use
- damage caused in emergency situations
- damage resulting from accidents (airborne or otherwise)

WARRANTY IS ONLY VALID if:

- flight is correctly registered in the logbook (incl. marking powered flight for freeflying paragliders)
- the paraglider is used in accordance with the operating manual
- the purchaser has not carried out any repair by him/herself (excl. minor repairs with self-adhesive patches)
- the purchaser has not carried out any modifications
- the paraglider can be unmistakably identified
- the purchaser can prove total flying hours of the paraglider
- the paraglider is inspected according to prescribed timetable

- the purchaser can present warranty confirmation and the paraglider card

We will send you confirmation of the warranty as soon as we receive the registration card, which you will find sewn on the trailing edge of your paraglider. You should remove it, fill it in legibly, sign it and send by registered letter.

When you sell the paraglider, please hand over this confirmation to the new owner, together with a copy of your logbook (and previous owners' logbooks). Only by sending these documents to the manufacturer can the new owner maintain the warranty.

If you are not the first owner of the paraglider, you should send us the warranty confirmation together with a copy of previous users' logbooks (showing total of flying hours from first purchase) within 14 days from the date of purchase. On receiving abovementioned documents, we will send you a new confirmation that will entitle you to all guaranteed repairs within remaining warranty period. If the previous user did not keep any logbook, the warranty becomes null and void, as we are not able to check the paraglider's flying hours.

★★ AEROCASCO

Normal warranty does not cover any repair of damage caused by the user or a third party. As costs of such repair can be considerable, Dudek Paragliding offers an AeroCasco insurance. It covers a one time repair of all mechanical damage, no matter how big, caused by the user or a third party.

The only expenses the purchaser has to pay are shipping costs and the share-of-cost amount (ca. 35 E).

AeroCasco can be purchased for a brand new paraglider (within two weeks from the date of purchase) or within a year from the date of purchase, provided that the paraglider has been inspected by the manufacturer.

NOTE: In case of paragliders used by paragliding schools, the procedure of granting AeroCasco is different. The extent of insurance and general conditions may be different as well.

AeroCasco applies only to damage caused during take-off, flight or landing.

Of course any faults in the material or manufacturing flaws are covered by normal warranty.

In order to be able to receive the AeroCasco repair, following REQUIREMENTS must be fulfilled:

When buying a new paraglider:

- the purchaser must buy the AeroCasco insurance (within Golden Package or individually)
- the purchaser within 14 days from the date of purchase should send a correctly filled registration card (sewn to the trailing edge). After receiving the registration card we will send you AeroCasco confirmation, which must be presented when the paraglider is handed in for the repair. This confirmation will entitle possible new owner to maintain the insurance.

When handing in the paraglider for the repair:

- the purchaser should present AeroCasco confirmation,
- the paraglider's serial number must be identical with that on the registration confirmation,
- the purchaser should pay a fee (as a share of cost – some 35 E).

AeroCasco is valid for one repair only.

There is a possibility of extending AeroCasco for one further year, if no damage occurred during the first year. It can be done provided that the paraglider has been serviced by the manufacturer not later than one year after the date of purchase and the owner has paid the extension fee (according to the price list on the day of servicing).

Remember to include the AeroCasco confirmation when you send the paraglider for servicing.

AeroCasco does not cover any of the following: theft, colour fading, damage caused by incorrect storage or transport, damage caused by chemicals, salt water, and *force majeure*.

★★★ GOLDEN PACKAGE

Golden Package is a combined sales offer of the most wanted gear and services on a fair price. In case of some paragliders, including Synthesis, it is not available. For the details on Golden Package consult your dealer or our web page.


7. WHAT HAVE YOU BOUGHT

The Dudek paraglider that you bought should have the following items:

- the paraglider itself (canopy, lines and risers)
- transport bag (with compression strap)
- MotoBag - specialised double function backpack
- a speed system with Easy Catch bar
- a windsock
- a pocket with paper work and repair wallet including:
 - A piece of self-adhesive fabric (10 cm x 37.5 cm) for small repairs. Note that even small tears located in the vicinity of stitches have to be repaired by an authorised service
 - A looped and stitched suspension line longer than the longest line used in the paraglider that is to be used as a temporary replacement. Do not cut it if you have to replace a shorter line, just tie it at the length needed
 - A paraglider passport with entered date of purchase and valid technical inspection (please check the serial number with the sticker on the wing tip)
 - The User Manual you are reading
- Small gifts.

Remember to fill in and send us the registration card, which is sewn on to the trailing edge of the paraglider.

MotoBag



MotoBag is a dedicated solid backpack for PPG wings, made of proven Cordura fabric. Simultaneously it doubles as a quickpack if necessary.

Beside comfortable shoulder straps to hold it traditionally on your back it has side handles too, so that you can carry it like a suitcase when needed.

After turning it inside out it becomes a quickpack that will shelter your unfolded wing when you are in a hurry.

SUMMARY

If you respect the rules of safe flying and proper glider care, you will enjoy many years of pleasant airtime. Still, you must be aware of possible dangers and face them wisely. You must accept the fact that all air sports are potentially dangerous and your actual safety depends solely on you.

We insist that you fly safely, and this concerns both the weather choice and safety margin during all manoeuvres.

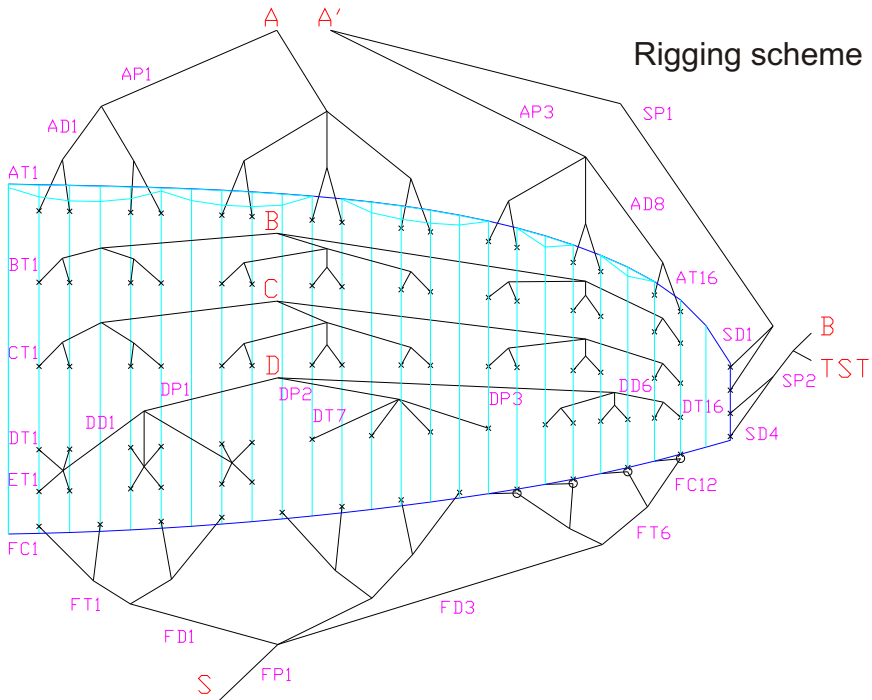
**FLYING THE PARAGLIDER IS ALWAYS YOUR OWN RESPONSIBILITY.
SEE YOU IN THE AIR!**

8. RIGGING TABLES

Lengths are measured with a specialised, computer-operated device. All lines are stretched with a 5 kg load before cutting. Thanks to the abovementioned device and proper procedures, final tolerance of line lengths does not exceed 0.15%.

- XP - main suspension line of x row,
- xD - secondary line of x row,
- xT - third level of x row (near the canopy),
- FC - fourth level of steering lines (near the canopy).

CAUTION!!! Distances given below are to be understood as distances between connection points. When cutting a line for repair, 20 cm extra must be added, as at each end a 10 cm stitch is required to fix the loop. The only exception is the main steering line (EP1), which is looped only at the upper end, while there is 20 cm left on the lower end for fastening brake handle (this means 30 cm extra is needed).



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Lines	A Row			B Row			C Row			D Row			E Row	Steering lines				Stabilizer	
	AT	AD	AP	BT	BD	BP	CT	CD	CP	DT	DD	DP	ET	FC	FT	FD	FP	SD	SP
1	690	1350	4380	675	1340	4635	685	1360	4915	855	2185	4145	965	1130	1250	3145	2950	400	5805
2	645	1335	3715	645	1325	3605	650	1340	3985	815	2160	4395	965	945	920	2675		425	5645+
3	650	2495	3950	645	2465	4055	655	2275	4385	805	2220	4900	940	1130	1170	2795		385	+245
4	670	2440		685	2410		675	2210		785	1450		930	1055	930			430	
5	670	2480		685	2460		675	2260		745	1310		880	1100	670				
6	640	2175		635	2050		635	1795		770	1195		895	930	555				
7	655	2040		650	1940		655	1680		2570				1060					
8	650	1990		645	1925		655	1685		2800				1035					
9	625			615			620			2375				1215					
10	645			630			645			2560				1060					
11	630			615			620			505				1025					
12	585			570			575			435				940					
13	625			595			600			490									
14	585			560			560			430									
15	545			480			465			475									
16	520			470			440			425									
Type	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
Diam.	1,2	1,5	1,8	1,2	1,5	1,8	1,2	1,2	1,5	1,2	1,2	1,3	1,2	1,2	1,2	1,3	2,3	1,2	1,2

Line lengths given in [mm]. T letter stands for line type (Technora).

Total line lengths, measured from lower surface of the wing (stitching) to the inner side of triangular maillons at the risers (+/- 10 mm tolerance).

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Nr Lines	A Row	B Row	C Row	D Row	E Row	Steering Lines
1	6925	6865	6975	7210	7350	8475
2	6890	6835	6940	7170	7310	8290
3	6880	6820	6925	7125	7260	8145
4	6900	6840	6945	7115	7250	8070
5	6895	6840	6950	7125	7260	7895
6	6865	6810	6910	7150	7275	7725
7	6825	6770	6865	7080		7615
8	6820	6765	6865	7010		7590
9	6835	6785	6880	6985		7630
10	6855	6800	6905	6990		7475
11	6770	6735	6815	6870		7325
12	6725	6690	6770	6800		7240
13	6630	6605	6680	6715		
14	6590	6570	6640	6655		
15	6500	6485	6550	6585		
16	6475	6465	6525	6535		
17	6240	6265	6295	6340		

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Lines	A Row			B Row			C Row			D Row			E Row	Steering lines				Stabilizer	
	AT	AD	AP	BT	BD	BP	CT	CD	CP	DT	DD	DP	ET	FC	FT	FD	FP	SD	SP
1	710	1405	5090	705	1390	5045	710	1410	5115	890	2285	4305	1035	1170	1300	3285	3050	415	6055
2	675	1385	3890	670	1375	3860	675	1395	4155	845	2245	4570	995	980	855	2785		445	5895+
3	675	2525	4125	670	2560	4235	680	2380	4570	835	2310	5065	990	1175	1215	2905		400	+245
4	700	2535		695	2505		700	2380		825	1505		965	1100	970			445	
5	695	2575		690	2560		700	2350		770	1385		915	1140	895				
6	685	2260		660	2130		685	1870		800	1245		930	970	580				
7	680	2120		675	2015		680	1745		2775				1105					
8	675	2070		670	2005		680	1750		2795				1075					
9	650			640			645			2580				1270					
10	670			655			670			2680				1105					
11	655			635			645			525				1070					
12	610			595			595			450				975					
13	650			620			620			510									
14	610			580			580			445									
15	565			510			485			495									
16	545			490			480			440									
Type	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
Diarr.	1,2	1,5	1,8	1,2	1,5	1,8	1,2	1,2	1,5	1,2	1,2	1,3	1,2	1,2	1,2	1,3	2,3	1,2	1,2

Line lengths given in [mm]. T letter stands for line type (Technora).

Total line lengths, measured from lower surface of the wing (stitching) to the inner side of triangular maillons at the risers (+/- 10 mm tolerance).

Synthesis 27

Nr Lines	A Row	B Row	C Row	D Row	E Row	Steering Lines
1	7220	7155	7250	7495	7640	8785
2	7185	7120	7215	7450	7600	8595
3	7165	7105	7205	7400	7545	8445
4	7190	7130	7225	7390	7530	8370
5	7185	7125	7230	7400	7545	8190
6	7155	7095	7195	7430	7560	8020
7	7110	7055	7150	7360		7910
8	7105	7050	7150	7290		7880
9	7120	7075	7165	7265		7920
10	7140	7090	7190	7265		7755
11	7055	7015	7100	7140		7605
12	7010	6975	7050	7065		7510
13	6910	6885	6950	6985		
14	6870	6845	6910	6920		
15	6775	6765	6820	6850		
16	6755	6745	6795	6795		
17	6505	6535	6560	6605		

Synthesis 29

Lines	A Row			B Row			C Row			D Row			E Row	Steering lines				Stabilizer	
	AT	AD	AP	BT	BD	BP	CT	CD	CP	DT	DD	DP	ET	FG	FT	FD	FP	SD	SP
1	735	1455	5290	730	1440	5240	735	1460	5320	920	2365	4480	1070	1215	1345	3385	3150	430	6295
2	700	1440	4040	695	1425	4020	700	1445	4325	880	2325	4760	1030	1020	930	2885		460	6140+
3	700	2890	4295	695	2850	4410	705	2445	4760	865	2395	5305	1015	1220	1260	3010		415	+245
4	725	2830		720	2800		725	2380		855	1560		1000	1140	1005			460	
5	720	2870		715	2855		725	2440		800	1415		945	1185	720				
6	690	2340		680	2205		685	1935		825	1290		960	1065	600				
7	705	2200		700	2090		705	1810		2875				1145					
8	700	2145		695	2075		705	1815		2805				1115					
9	675			660			670			2775				1315					
10	690			680			695			2780				1150					
11	630			660			670			545				1110					
12	630			615			620			465				1015					
13	675			640			645			530									
14	630			605			600			465									
15	585			530			505			510									
16	565			510			475			465									
Type	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
Diam.	1,2	1,5	1,3	1,2	1,5	1,8	1,2	1,2	1,5	1,2	1,2	1,3	1,2	1,2	1,2	1,3	2,3	1,2	1,2

Line lengths given in [mm]. T letter stands for line type (Technora).

Total line lengths, measured from lower surface of the wing (stitching) to the inner side of triangular maillons at the risers (+/- 10 mm tolerance).

Synthesis 29

Nr Lines	A Row	B Row	C Row	D Row	E Row	Steering Lines
1	7495	7425	7530	7780	7930	9095
2	7460	7390	7495	7740	7890	8900
3	7445	7375	7485	7685	7835	8745
4	7470	7400	7505	7675	7820	8665
5	7465	7400	7510	7690	7835	8480
6	7435	7365	7470	7715	7850	8300
7	7390	7335	7425	7650		8185
8	7385	7330	7425	7580		8155
9	7400	7350	7450	7550		8195
10	7415	7370	7475	7555		8030
11	7330	7290	7380	7425		7870
12	7280	7245	7330	7345		7775
13	7185	7155	7230	7265		
14	7140	7120	7185	7200		
15	7040	7030	7095	7120		
16	7020	7010	7065	7065		
17	6760	6790	6820	6865		

Synthesis 31

Lines	A Row			B Row			C Row			D Row			E Row	Steering lines				Stabilizer	
	AT	AD	AP	BT	BD	BP	CT	CD	CP	DT	DD	DP	ET	FC	FT	FD	FP	SD	SP
1	760	1505	5485	755	1490	5435	760	1510	5515	950	2445	4850	1105	1255	1390	3590	3250	445	6530
2	720	1485	4195	715	1475	4175	725	1495	4190	905	2405	4915	1065	1050	1025	2990		475	6370*
3	725	2780	4460	715	2740	4580	725	2530	4340	800	2480	5515	1050	1260	1305	3115		430	4245
4	750	2720		740	2685		750	2485		885	1610		1035	1175	1040			475	
5	745	2765		740	2745		750	2520		825	1460		976	1225	745				
6	710	2420		705	2280		710	2090		855	1335		995	1040	820				
7	730	2275		720	2160		730	1870		2970				1185					
8	725	2220		720	2150		730	1880		2895				1150					
9	695			685			690			2870				1360					
10	715			705			715			2875				1190					
11	705			685			695			565				1145					
12	655			635			640			485				1050					
13	685			665			665			550									
14	650			625			620			480									
15	605			590			520			530									
16	580			525			490			470									
Type	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
Diam.	1,2	1,5	2,3	1,2	1,5	2,3	1,2	1,2	1,5	1,2	1,2	1,3	1,2	1,2	1,2	1,3	2,3	1,2	1,2

Line lengths given in [mm]. T letter stands for line type (Technora).

Total line lengths, measured from lower surface of the wing (stitching) to the inner side of triangular maillons at the risers (+/- 10 mm tolerance).

Synthesis 31

Nr Lines	A Row	B Row	C Row	D Row	E Row	Steering Lines
1	7765	7695	7800	8060	8215	9395
2	7725	7655	7765	8015	8175	9190
3	7710	7640	7750	7960	8120	9035
4	7735	7665	7775	7955	8105	8950
5	7735	7670	7785	7970	8120	8760
6	7700	7635	7745	8000	8140	8575
7	7660	7595	7700	7930		8455
8	7655	7595	7700	7855		8420
9	7670	7620	7715	7830		8470
10	7690	7640	7740	7835		8300
11	7600	7560	7650	7695		8130
12	7550	7510	7595	7615		8035
13	7445	7420	7490	7530		
14	7400	7380	7445	7460		
15	7300	7295	7355	7385		
16	7275	7270	7325	7325		
17	7010	7040	7065	7110		

Synthesis 34

Lines	A Row			B Row			C Row			D Row			E Row	Steering lines				Stabilizer	
	AT	AD	AP	BT	BD	BP	CT	CD	CP	DT	DD	DP	ET	FC	FT	FD	FP	SD	SP
1	795	1575	5770	790	1560	5715	800	1580	5800	895	2560	4895	1160	1315	1455	3665	3400	465	6865
2	755	1560	4420	750	1545	4395	760	1565	4730	850	2520	5205	1115	1100	1070	3125		495	6715+
3	780	2910	4700	750	2870	4820	760	2650	5205	935	2585	5795	1095	1320	1385	3285		445	1245
4	785	2845		780	2815		790	2580		925	1690		1085	1235	1090				500
5	790	2895		775	2875		785	2640		865	1530		1025	1280	780				
6	745	2535		740	2390		745	2095		895	1395		1040	1085	650				
7	765	2380		755	2265		765	1960		3110				1240					
8	760	2325		755	2250		760	1970		3035				1205					
9	730			715			725			3085				1430					
10	750			740			750			3010				1250					
11	735			718			728			890				1205					
12	685			665			670			505				1105					
13	730			695			700			575									
14	685			655			650			500									
15	635			575			545			555									
16	610			550			515			495									
Type	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
Diam.	1,2	1,5	2,3	1,2	1,5	2,3	1,2	1,2	1,5	1,2	1,2	1,3	1,2	1,2	1,2	1,3	2,3	1,2	1,2

Line lengths given in [mm]. T letter stands for line type (Technora).

Total line lengths, measured from lower surface of the wing (stitching) to the inner side of triangular maillons at the risers (+/- 10 mm tolerance).

Synthesis 34

Nr Lines	A Row	B Row	C Row	D Row	E Row	Steering Lines
1	8155	8080	8195	8465	8630	9835
2	8115	8040	8155	8420	8585	9620
3	8105	8025	8140	8365	8525	9455
4	8130	8055	8170	8355	8515	9370
5	8125	8055	8180	8370	8530	9170
6	8090	8020	8140	8400	8545	8975
7	8045	7980	8090	8330		8855
8	8040	7980	8085	8255		8820
9	8060	8000	8110	8225		8875
10	8080	8025	8135	8230		8695
11	7985	7940	8040	8090		8520
12	7935	7890	7985	8005		8420
13	7825	7795	7880	7915		
14	7780	7755	7830	7840		
15	7675	7660	7735	7760		
16	7650	7635	7705	7700		
17	7365	7395	7425	7480		

9. RISERS: DESIGN AND ACCESSORIES

Figure 1 Hangpoint setting: A - high, B - low

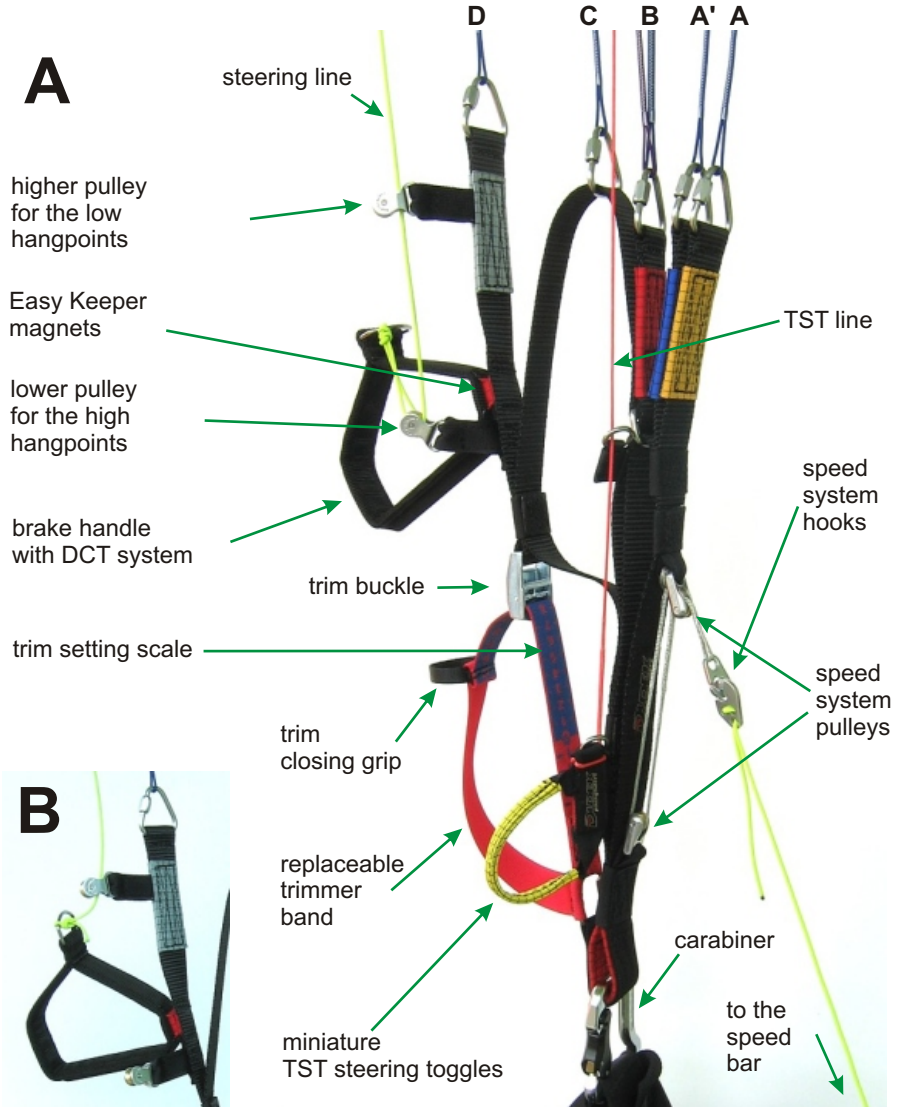


Figure 2 Trimmers influence on the wing profile

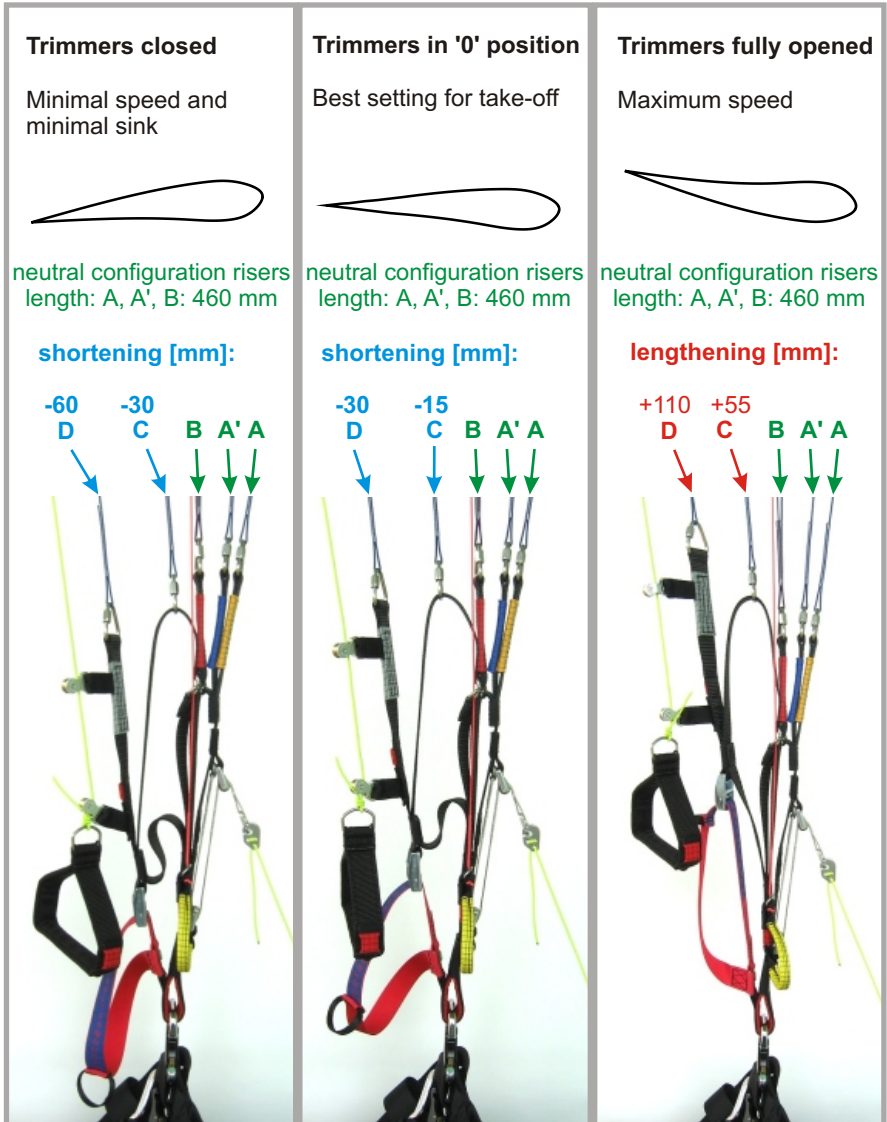




Figure 3 Trimmer settings influence on speed-system action

Lengthening and shortening values are given in respect to neutral risers length: A, A', B – 460 mm

<p>Full acceleration with closed trimmers: good speed, easy steering, decreased stability. Classic speed-system action.</p>  <p style="text-align: center;">shortening [mm]</p> <p style="text-align: center;">-60 -65 -70 -140 C C B A</p>	<p>Full acceleration with opened trimmers: small angle of attack, maximum speed, great stability and hard steering.</p>  <p style="text-align: center;">lengthening [mm] shortening [mm]</p> <p style="text-align: center;">+110 +20 -70 -140 D C B A</p>
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