PARAMANIA
POWERGLIDERS

REVOLUTION
User Manual

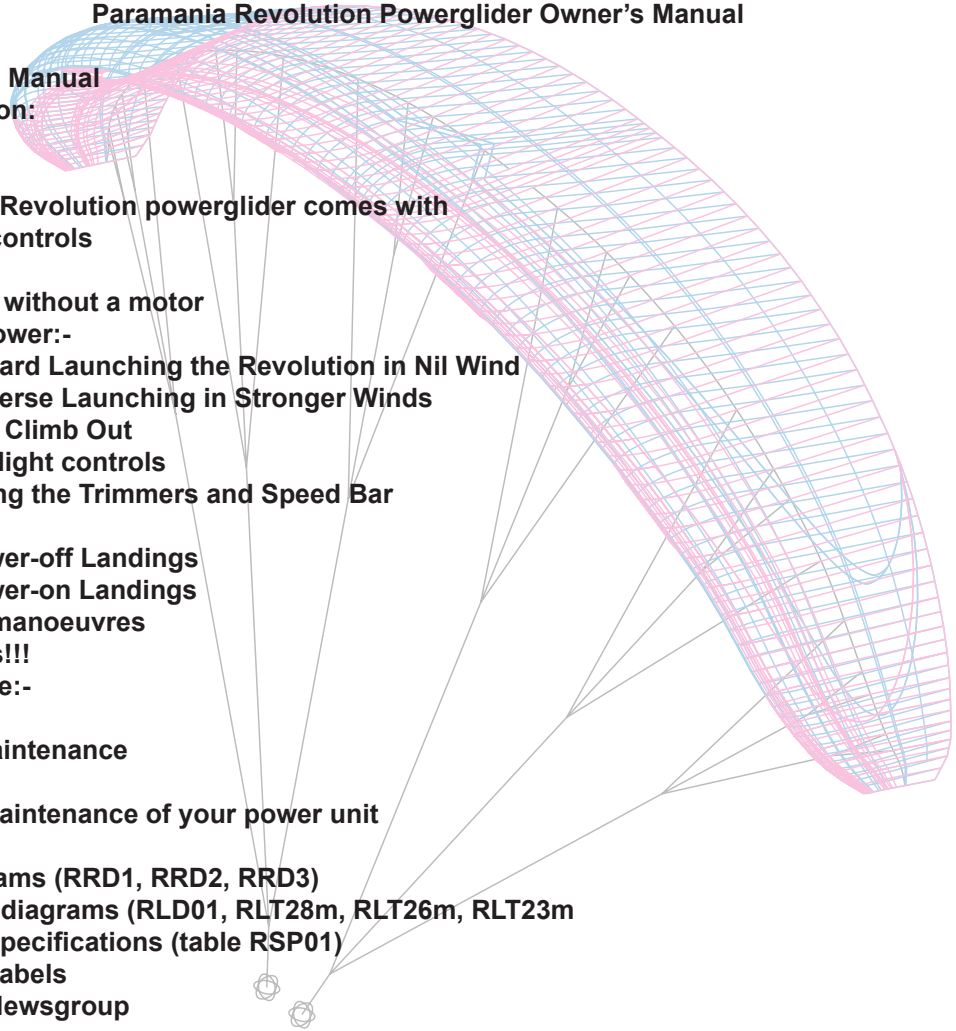
BEGINNER & INTERMEDIATE FREEDOM POWERGLIDER

FREEDOM WING

SPEED STABILITY

Paramania Revolution Powerglider Owner's Manual

Contents



1 INTRODUCTION

The purpose of this manual is to offer guidelines to the pilot in the use of the Paramania Revolution powerglider and is in no way intended to be used as a training manual for this or any other paramotor wing or paraglider. You may only fly an aircraft of any description when qualified to do so or when undergoing training from an accredited School or Instructor.

It must be understood that flying can be a dangerous activity unless undertaken by properly trained people flying in a responsible and disciplined manner. As the owner of a Paramania Revolution Powerglider, you have chosen to fly one of the safest aircraft of its type available.

Nevertheless, in the final analysis, any aircraft is only as safe as the pilot flying it and it is incumbent upon you to make sure that you have the required training and experience to make your own judgements about how, where and when you fly. Paramania, its Directors, Employees and Agents can accept no liability for any consequences arising from the use of their products howsoever caused.

Particular attention must be paid to the danger of injury to the pilot and bystanders from a rapidly rotating propeller, which can break and inflict injury at some distance and the dangers inherent with flammable fuel and other combustible or fusible materials.

Paragliding is a relatively new activity that is still evolving and powered paragliding (paramotoring) is one aspect of this form of sport aviation. Should you have any doubts about the suitability of the wing for the type of flying you wish to practise or should you wish to extend your flying in other ways. We recommend that you seek further guidance from your own instructors or direct from Paramania. Under no circumstances should you attempt to copy the type of flying that may have been demonstrated to you or that appears on any video demonstration of the wing without first receiving proper aerobatics training from Instructors experienced in the use of this wing.

It is essential in order to achieve satisfactory performance that proper consideration be given to the matching of this powerglider with a suitable harness, motor and propeller. While we can make recommendations, the choice and suitability of any particular harness or motor remains outside our control and responsibility.

This manual will soon be available in French, Spanish and German - please contact Paramania should you require a different version.

2 ABOUT THE REVOLUTION POWERGLIDER

2.1 Design

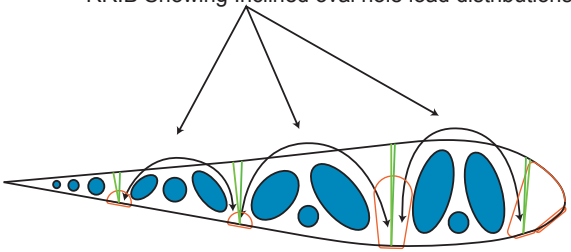
The Revolution has been designed by Mike Campbell-Jones. His history in the development of powergliders that exclusively use Reflex wing sections, coupled with his experience in Microlight aircraft and glider design, means that your Revolution wing benefits from a wealth of knowledge that spans over 28 years, back to the early days of hang-gliding.

Microlights where initially developed as powered hang-gliders that later favoured more powerful engines and smaller more stable wings. It soon became clear that the faster your wing, the more often you could use it!
Naturally it follows, that the concept of a utility paramotor flying machine requires the same philosophy. So the pilot can spend less time and effort flying actively, in response to every lump and bump and more time navigating, whilst getting comfortably from A to B or performing other tasks, such as photography, observation or general flying. This is the revolution ! Although your Revolution wing has been designed to fly like a conventional paraglider, the reflex wing section means that it has an elevator built into its shape. The wing no longer completely dependents on payload as its only source of stability, It maintains its own attitude in pitch, rising and falling through thermals and turbulence, whilst remaining stable above the pilot's head, requiring minimal control input.
The trimmer system allows you to raise the rear of the airfoil, effectively reducing the chord and surface area by some 30%, giving the wing a higher wing loading and increased speed without changing the angle of attack. The centre of pressure also moves forward adding further to the pitch stability. This redistribution of loading gives the wing exceptional tuck-resistance and increases the working aspect ratio the result is a faster, more efficient wing under power and at speed, much like a traditional powered aircraft.
When requiring more lift at lower speeds, the rear section can be trimmed down to restore a fully flapped airfoil, the Revolution changes its characteristics, becoming closer to a conventional paraglider with smooth sporty handling, short slow take offs and steep climb outs. So like having two wings in one.

2.2 Construction

Your Revolution's strength and durability has been achieved through careful choice of modern materials and innovative design. All materials from which it is constructed are batched and every stage in its manufacture can be traced to a named operator and checker.
The top and bottom surfaces are made from the hardwearing Porsha-Marine NCV, 44 and 37gm respectively. The wing tips, leading and trailing edges are reinforced using a mix of load tape and Mylar. The semi-closed leading edge improves the air-dynamics, whilst stabilizing lateral movement between surfaces, giving it a more solid/rigid feel once in the air.

RRIB Showing Inclined oval hole load distributions



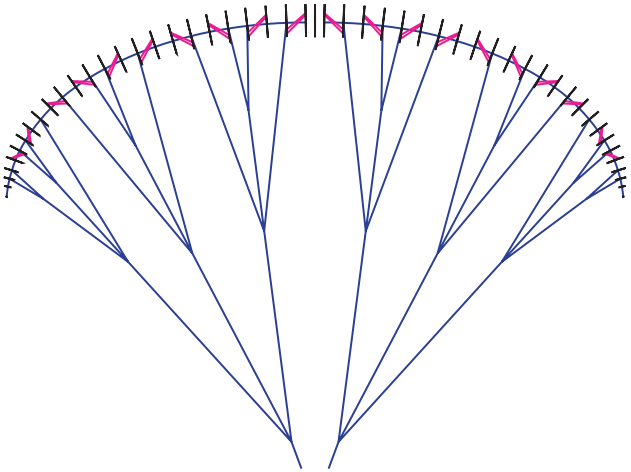
& general Revolution rib reinforcements

The structural ribs have been designed with inclined oval ports that allow air to flow to the areas within the wing where internal pressure is needed most. They open like valves to increase their area during inflations when the ribs are off-loaded, and minimize distortions normally created by conventional holes and distribute the loads efficiently from the line attachment points into the top surface. Suspension line attachments are reinforced in 3 dimensions, vertically with the main rib, then at an angle with diagonal ribs and 90 degrees with bottom surface lateral tape. The ribs are heavily reinforced with Mylar wherever the loads are substantial, i.e. around the “A” and “B’ line attachments.
The line configuration and diagonal rib structure are sharing the same angles throughout the wing, enhancing the load distribution, whilst ensuring that the lines are evenly loaded. This we have found gives much quicker inflations.

All lines are made of Gin Arimid Technora, the latest in line technology and incorporates the best qualities of its predecessors, Kevlar and Dynema, It is both strong and flexible whilst remaining temperature stable, and less prone to shrinkages when lightly loaded.

The lines are split into 3 categories, Thirtaries, secondary and primaries. Line diameters are 0.6, 1.1, 1.3, 1.6 & 2,3 mm respectively.
The larger diameters being the primary lines,
The malions to which the lines are attached to the risers, are made of polished stainless steel, which avoids corrosion and gives excellent strength and durability. The riser material is 1.2K / 25mm polyester webbing. The main attachment points are reinforced with Cordura, to protect against wear from the karabinas. The Revolution has been built with paramotoring in mind and when new, has a safety factor of some 50% over and above its tested loading. it has been engineered to perform to its specifications for about 400 hours.

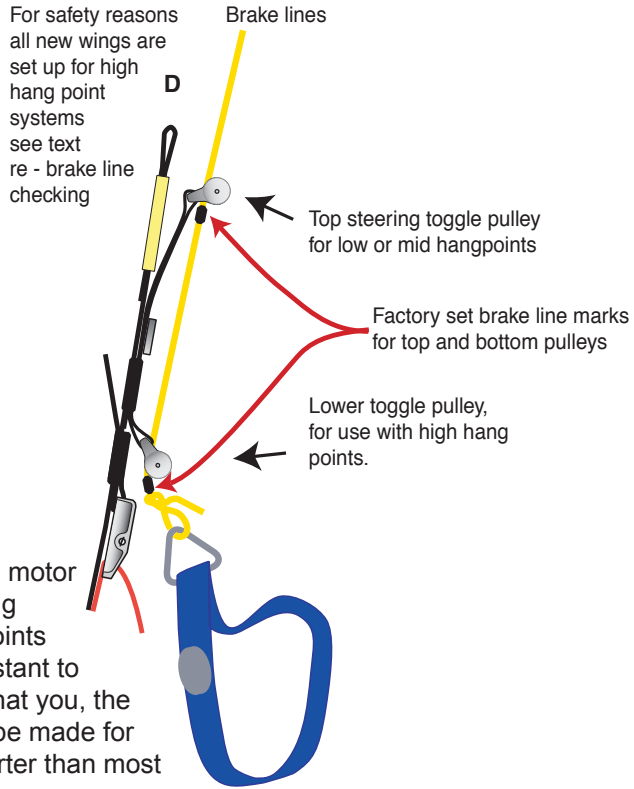
RFV Revolution front view showing diagonal ribs and their consistent angle relationship with the lines



2.3 What your new Revolution wing comes with

The Glider
User manual
Paramania Ruck-sack (reversible, normal or field)
Stuff sack & compression strap
Speed bar
Basic repair kit
Paramania T-Shirt, Helmet stickers & mini wind socks x2

The Revolution is a high-end quality product –
As such it has been fully inspected, firstly by the factory and secondly by your local Paramania dealer. Should you not be entirely satisfied with your Paramania Powerglider. Please contact your dealer directly. (And if you're happy contact them anyway).



2.4 Setting up the controls

Hang check- The following is best carried out by an instructor or at the very least an experienced motor pilot. Before flying your Revolution with a motor unit, we recommend that you do a static hang test. This is done by hanging your motor unit from an appropriate structure from the wing attachment points by using a strong rope or strap, then by sitting in the harness, get an assistant to measure up the risers from the hang points up. The aim is to make sure that you, the pilot, are able to reach the brakes whilst in flight. Allowances should also be made for the wind blowing the toggles out of reach. The Revolution's risers are shorter than most conventional paragliders, which reduces the potential problem.

Brake line lengths- The Revolution brake lines are clearly factory marked in two places. The risers have a secondary lower pulley system, to allow for high hang point power units These brake positions should need no adjustments see diagram GTR1 for details. Higher hang points require longer brake lines, lower hang point's shorter ones.
Note: we recommend that brakes are not set too short othwise full Reflex effect may be lost. (see DTD 3)

With an ordinary harness or your motor unit on your back, ground-handle the wing above your head. When the wing is nicely level, check that when the brakes are up against the brake pulleys that the trailing edge of the wing is not being pulled down. Then as you gently pull the brake you should have only a few centimetres of movement before the brakes start to pull down on the trailing edge of the wing. Make sure it is the same length on both sides. Note: - it is safer to have this adjustment too long than too short.
Note: - When free flying the wing should be set up though the top pulley and with the shorter lines
New gliders leave the factory rigged for high hang points.

3 FLIGHT OPERATIONS

3.1 Flying With and Without a Motor

Although the design philosophy of the Revolution is that of a high-speed paramotor wing, which performs well as a free flying glider and may be flown as such with no adjustment. Slower trim settings, reduce internal air pressure and consequently give a lighter feel to the brakes and a better sink rate.
The main difference in the Revolution compared with other paragliders is the increased resistance to tucking, both on launch and in flight; its greater speed range and stability means that generally, it can be flown in stronger conditions safely.
Basically the glider becomes more stable the faster you fly.

First Flights
We recommend that, to give yourself the chance to get used to it, your first flights should be made on the just below the neutral range of trim settings, where, the Revolution will feel more familiar, like a conventional wing. With this trim try flying with a small amount of brake - at the point where they just begin to feel heavier. In practice, this point will be encountered at about the one-quarter-brake position.
When you have become fully confident in your wing, try experimenting with slower and faster trim-settings, weight-shift and speed bar and enjoy the extra speed and security the Revolution gives you (See GTR 02 for details).
Note- To ensure that the trim system grips efficiently, simply lift the webbing adjustment loop in the opposite direction after each adjustment, (this helps the webbing material over the teeth of the cam buckle).

Double-checking brake line lengths (a useful tip)
Again it is better to seek the advice and assistance of a local instructor or experienced pilot.
Choose a day when there is a steady breeze of about 10Kph. Then with an ordinary harness or your motor unit on your back, visually check lengths,

3.11 Launching

Forward launch

We recommend that when the wing is laid out, that all the lines are at full length with little or no slack between wing and pilot. Then pull the brake lines in, to ensure that the middle inflates first. The Revolution is easily inflated by using “A” riser’s only. When launching simply move forward from this position pulling on the “A” risers, whilst keeping the pressure balanced between each side (meaning the tension on the “A” risers). The glider shows little or no tendency to dive overhead, so frontal collapses which so often lead to failed launches, are rare. Instead the glider almost waits for you to catch up with it.
Note:- Too forceful a pull on the “A’s” may crumple the leading edge and hinder the launch. Indeed in certain trim positions the Revolution requires no pull at all, just accelerating forward movement only.

Reverse launch

Yet again, the glider is very easy to launch because it does not over-shoot, so the pilot has little or no need to hold the wing back before making the turn. Reverse launches on this wing can be carried out in as little as 5 Kph.

In Flight

In flight the greater speed range of the Revolution may require some management. But once you have mastered how to use the speed to your advantage it becomes pure fun. Its tight handling allows you to make the best use of thermal cores, and its glide at speed means less time is spent in sinking air masses before reaching the next thermal. Limits have been provided to the range of the trim settings to avoid the danger of stalling when flying with the trim pulled right down and with maximum brake. With the trim fully released, the wing takes on more solid characteristics, carving through the air with even more pitch stability. The brake pressures increase and so does the range of movement prior to the stall point. Turns and rate of roll are linked in a linear fashion to the progressive feel of the brakes.

Use of the speed bar

The bar increases the speed by approximately 30%. Unlike most wings there is little or no loss of stability, in fact the wing seems to cut through turbulence even better than before application. However, if any instability is encountered due to excessive conditions it is recommended to release the bar for recovery and to return to normal flying mode. The brake pressures also increase when the bar is used, so it is more for use during straight and level flight.
As you become more experienced, careful release of the bar whilst entering turns gives an effect, similar to pulling the stick back in a conventional aircraft.
Although the speed bar can be used with confidence throughout the whole range of the trim settings, it is obviously most effective when used with the trims off I.e. on the fast setting.

Landing

The Revolution has a reasonable glide so good planning is required on approaches. The brakes, light at first, become progressively heavier over a healthy amount of travel, giving plenty of warning of a stall. With trims on slow the wing lands like any other paraglider, plenty of air speed on approach, progressive flare, converting speed into lift, till the moment of touchdown. When landing with the fast trim on, the process of bleeding off the extra speed to land can take longer and require more space. In this mode there is a lot of stored energy, so you may find yourself climbing out again if you aren't that smooth on the controls. Having said that, the brakes are very powerful. The last bit of brake travel really shuts the wing down and slows you up. It does not take long to develop the confidence to fly in stronger winds than normal, but great care must be taken when flying fast near the ground. The Revolution stores energy well, so whilst it is possible to bleed off your speed without losing height before touch down, respect must be shown for the higher speeds possible, especially in slope landings. On landing in high winds the glider may be collapsed with confidence using a strong pull on the rear or B risers.

3.2 Flying Under Power

NOTE: Thorough pre-flight checks for glider, harness and engine are essential prior to any launch. For powered flight many of the characteristics are the same as in the previous section (3.1), However there is a certain amount of additional information, particularly where the addition of the thrust of the power unit and correct matching of the wing to the motor unit is concerned. Paramania cannot be held responsible for the multitude of combinations that may get used, however if you wish to contact us we can offer some advice.

3.2.a Forward Launching the Revolution in Nil Wind

While there may appear to be no wind this is rarely the case and it is essential for aircraft of this type to take off and make the initial climb out to a safe height (depending on the surrounding terrain) into wind. This makes maximum use of the wind and avoids the danger of losing airspeed when climbing out steeply through wind gradient. Particular attention must be paid to trees, power lines and other large obstacles and any rotor that they may generate.

Preparing the wing : Lay the glider out, downwind of the motor, so that the lines are fully extended and as if attracted to the motor or central focal point, then lay the risers down ready to clip in. Set the trimmers to the take off position (Faster settings may be desirable in stronger conditions, see diagram RR2). Make sure that when warming up the engine you do so upwind of the wing, then stop it whilst clipping in.

After carrying out the following checks: -

Pilot prepared – clothing safe?
Helmet on and fastened?
Malions on risers?
Trim set?
Nothing likely to foul the prop?
Speed bar system running freely and out of harm's way?
Steering toggles and brake lines free and not twisted?
Engine delivering full power?
Airspace is clear for take off?

Attach the glider; proceed with the launch (as in section 3.11 Launching).
From now on you should try to control the glider whilst facing forwards. If the wing is low behind you and you turn around the lines will trail over the propeller. However, falling backwards onto the motor is both dangerous and expensive and must be avoided at all costs, even that of a few damaged lines!
During the launch, If the pressure on each of your hands feels even, open the throttle to full take off power, leaning backwards against the thrust so that the engine is pushing you along the ground rather than into it.
It is best to try and leave the brakes alone and just let the canopy come up. If it starts to go off to one side, increase the pressure on the riser on the lower side, whilst moving sideways towards it and the centre of the wing. Where possible maintain the direction of your launch.
If the wing starts to drop backwards, increase to pressure on both “A” risers to help it up, as you increase power, try to maintain a constant angle with the motor and smooth power control. Any sudden changes will alter your course because of the powerful gyroscopic and torque effects.
If the canopy is so far off to the side or behind that it cannot be recovered, kill the engine and abort the take-off and reassess the launch conditions.
As the canopy comes up the drag reduces, it should stabilize over your head without overshooting you. This is a good time to check that your wing is nicely inflated and that there are no tangles or lines fouled, but this must be done whilst on the move and without turning. When you feel the resistance reduce, allow your run to accelerate. Feel for pressure on the brakes, coming down on them as required to steer or to increase lift for taking off.

Points to note:-
* If your propeller protection cage is flimsy enough, the pressure of the lines on it during launch may distort it to the point where it fouls the prop. If this is the case make sure the lines have cleared the cage before you open the throttle.
* All control inputs should be smooth and progressive.
* Don’t attempt to take off if the canopy isn’t roughly level overhead. Dangerous oscillations may result if you apply full power with it too far off to one side.
* Keep your undercarriage down until you are definitely flying!
* The faster the trim setting, the more brake the glider will need to get off the ground.

3.2.b Reverse Launching in Stronger Winds

Because the Revolution launches so easily it is possible to perform a reverse launch with both front risers and one brake in one hand and the throttle and opposite brake in the other. If the wind is appreciable this is the easiest method of launching, but if the wind is light the difficulty of running backwards safely with a motor on makes a forward launch preferable.

Having started and warmed up your motor upwind of the canopy, attach yourself to the power unit, face the canopy, approach the risers and clip them on to the appropriate malions. Build a wall first using front and rear risers simultaneously. We recommend that you momentarily raise the glider off the ground to check for tangles and line snags.
Holding risers, brakes and throttle control as outlined above, pull the front risers up to lift the glider over your head. It is unlikely to over-fly you, especially if it is trimmed to fly fast. This may be contrary to what your paragliding intuition tells you, but on the fast setting (trim fully off) the Revolution's reflex wing section stabilizes the wing and prevents it from pitching forward.
It may even sit back a little but applying a small amount of brake makes it pop forward.
When the glider is steady above you turn round, apply power and take off.
As with forward launching, the trim/power/brake relationship must be established for the best rate of climb and forward speed.

Points to Note:-

*This is a cross-hands reverse launch. You must master this technique before attempting it under power.

Your local Paragliding School will assist you here.

* All control inputs should be smooth and progressive.

* Don't attempt to take off if the canopy isn't roughly level overhead.
Dangerous oscillations may result if you apply full power with it off to one side.

* Keep your undercarriage down until you are definitely flying!

* The faster the trim setting, the more brake the glider will need to get off the ground.
Speed systems may cause problems when clipping in. Don't get your lines crossed !

3.2.c The Climb Out

Once off the ground and flying safely, continue into wind using the brakes to achieve the desired climb rate. Don't attempt to climb at too steep an angle. Attempting to use too much brake to force a higher climb rate will only degrade the climb by creating extra drag and with the addition of lots of thrust could result in a stall or a spin.

3.2 Flying Under Power (continued)

Under power the Revolution behaves more like a powered fixed wing airplane than a paraglider, and it helps to think of it as such. Provided there are no obstacles in your path, it is often safer, and quite spectacular, to fly level with the ground after take-off gaining more speed before converting it into considerable height using the brakes and then easing off into the climb out.
The other reasons for not climbing out too steeply are the risks involved when having engine failure, i.e. a stall and diving recovery. Although the Revolution will not sit back behind you the way that some gliders may, a slow forward speed and high angle of attack is still likely to put you into a near stalled attitude if your power source suddenly goes on strike. In this situation you should always be able to set up a reasonable approach, so don't make things hard for yourself - fly with sufficient airspeed at all times, and keep your angle of attack under control a low altitudes.

Depending on the geometry of the set-up of your power unit, the propeller's torque effect may make itself felt as you leave the ground. Expect it to turn you and, if necessary, steer against it in order to maintain your direction. However, when countering the torque effect during a steep climb on slower trim settings under a lot of power, care must be taken to avoid the risk of stalling.

Because of the large vertical distance between the thrust line of the prop and the wing common to all paramotors, the extent of the power management required is critically dependent on your set up and flying ability.

Power induced Oscillations

Certain combinations of weight, power, and propeller size can cause oscillation where the torque and gyro effects lift the pilot to one side, you then drop back only to swing up again. To counter this you can:-

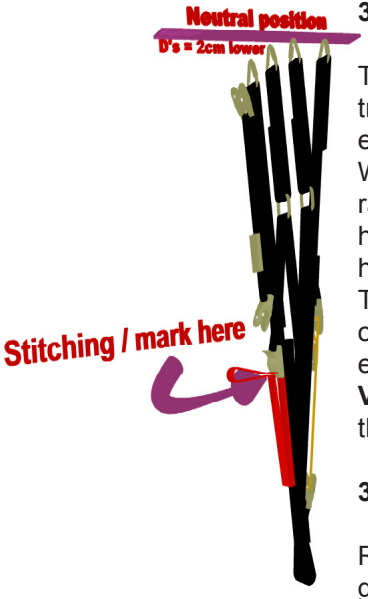
* Alter the throttle setting. And /or
* Adjust the torque strap if fitted. And/or
* Shift your weight in the harness. And/or
* Adjust the trimmers to dampen it out.

Weight shift is the best counter. Oscillation usually occurs on high power settings - more power and a larger propeller causes more oscillation. It could be that your control inputs are amplifying the oscillation. In this case, throttling back a little and flying hands-off should take care of the problem.
Having said all this, it is quite common for inexperienced pilots to be too busy on the controls, this is referred to as pilot induced oscillation, and the simple answer is stop moving your hands

3.2.d Level Flight

On reaching a safe height after take off, and if you wish to go cruising, turn on to your chosen heading, reach up and release the trimmers if on a slow setting and if you like let go of the brakes completely. If conditions are very rough you may wish to keep hold of them, however the Revolution is even more stable at higher speeds, so we suggest you let go and enjoy the flight.
Note –All paramotors should have adequate netting to prevent toggles entering propellers whilst in flight – check yours!

If you have one, keep an eye on your alti/vario. in level flight - it is easy to creep into a climb without noticing. Use the information from your instruments to optimize your forward speed and reduce drag and fuel consumption. This will all be specific to your own set up. With its hands-off flight capability, the Revolution is good at letting you do this.
With a sound understanding of the current wind conditions at different altitudes and intelligent use of any thermal activity, wave, convergence, ridge or frontal lift it is possible to conserve your fuel and greatly extend your operating range. The engine of course makes it easy to put you in the right place at the right time to exploit the conditions. Don't be afraid to throw the Revolution into a tight thermal to gain height and save fuel - you will find it is particularly good at coring thermals. Using slower trim settings will allow you to climb faster in thermals.



3.2.e Using the Trimmers and Speed Bar

The Revolution's reflex wing section is unique in this way, it basically has a huge range of trims and speed bar waiting for you to explore. We only ask that you explore the full flight envelop at a safe height and with adequate training and experience.
When the Revolution was tested under the AFNOR system, it was awarded a "standard" rating at the slower trim settings and a "performance" rating at the faster settings. Despite it having improved tuck resistance at the faster settings. The extra speed involved, means a higher energy recoverys.
The exact trim position where the Revolution, changes over its rating category is clearly outlined in the diagram beside. (It is the same for all current sizes). However some of the earlier models are only marked where later models are stitched.
VIP Note: - So when a pilot unstitches or uses the trims above this position he/she is flying this wing in the performance category.

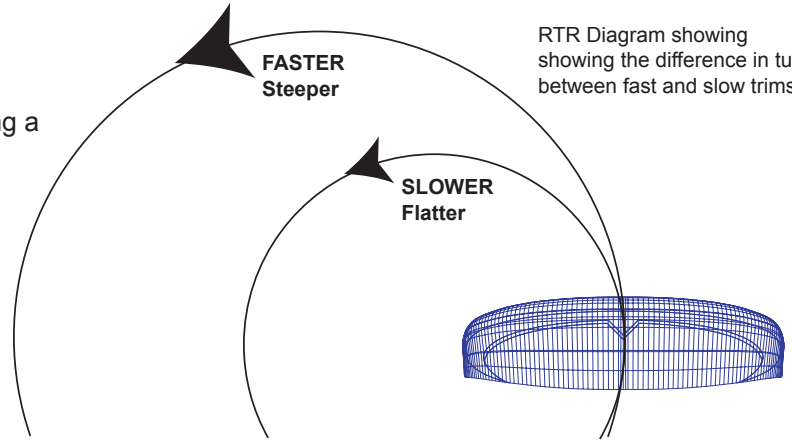
3.2.e Using the Trimmers and Speed Bar (continued)

Remarkably, the Revolution has a huge and relatively safe speed range, nearly 4 1/2 times greater than its stall speed compared with most air-craft that only have between 2-3 times. With the trimmers fully off the wing's speed and stability increases and hence its ability to cut through turbulence and go places improves.
On faster trim or speed bar settings, brake pressures generally increase and weight-shift or a wing tip stabiliser becomes more effective. On the slower settings, sink rate improves and handling becomes lighter enabling you to make best use of thermal cores. Whilst giving you an improved climb rate and shorter slower take-offs and landings. See diagram RTR below describing differences in turning radii. For correct usage, first study the RRD diagrams 1,2 & 3, showing trim and speed bar movement as well as speed bar hook-ups.The diagrams also show you the effect on the wing shape relative to the different settings.
At all speed settings the differential application of both brakes while banking allows you to make very effective turns by increasing the lift to assist the turn when the lift axis is canted over in the bank. Likewise engine thrust and speed bar can be applied at certain times to increase turn rate etc. These techniques come with more experience allowing you to get the most from your wing you to achieve fully coordinated, smooth turns, much like those possible on a three axis aircraft.

Points to Note:-
* Remember, trims and speed bar are controls are extra items for your pre-flight checks!

3.3 Landing

There generally seems to be two philosophies about landing a paramotor - either with or without power.



RTR Diagram showing showing the difference in turns between fast and slow trims

3.3.a Power-off Landings

Cut all power at about 50m and glide in like a paraglider. This minimises the risk of propeller damage but you only get one go at it - you have to get it right!
With or without power the Revolution rides out turbulence much better on a fast trim setting, so if it is rough come in fast, allow yourself plenty of room (like a hang glider) and bleed off speed before you touch down. The Revolution stores energy quite well, and it may be necessary to round out and 'float' level with the ground, converting your excess speed into lift while you slow down, before flaring to touchdown.

If you aim at a precision or tight landing, or in nil-wind conditions, it is advisable to use half or even full trim (maximum lift configuration). This will hardly alter your glide angle but will decreases your sink rate; these decisions become more critical at higher wing loadings.

3.3.b Power-on Landings

At a steady tick over, lose height at a shallow angle, then as you near the ground level out and bleed off speed before flaring to touch down. Kill the motor as your feet touch the ground. The advantage of this method of course is that if you get it wrong you can power up and go round again at any time. The disadvantages are the increased risk of (expensive) prop damage if you stuff it up, the dangers involved in falling over with the engine running and getting your lines in the propeller if you forget to switch off before the wing deflates.

Points to note:-

* If possible, know all about your landing area before you take off.
* Check the wind direction before you set up your approach.
* Power-off landings probably need less space.
* If in doubt, practise your approach until you are sure you can land safely.

Advanced manoeuvres

The Revolution has achieved a AFNOR rating for the manoeuvres prescribed by the test authorities. However it is essential that pilots take proper training before attempting certain aerobatics.
We also suggest that you seek advice from instructors or experienced pilots before conducting ANY of these manoeuvres or go flying in extreme conditions, and that you carry a reserve parachute if this type of flying is for you.

Big ears.

This method is a good safe way of descending, However care should be taken when pulling down the outer A lines, not to pull them too far, the Revolution has a lot of load on the “A’s” especially on the faster trim settings. A spiral may be a more efficient way to get down. Note;- we do not recommend using big-ears with power, There is a risk of stable stall and it defeats the object.

B-Lining

The revolution B-Lines well however we recommend that you undertake proper training as recovery characteristics change through out the trim range. A spiral is a much safer more efficient way to get down,

Adverse flight reactions

Cravats

Despite the intensive testing that has taken place. The Revolution is a modern wing, and in the name of performance it has an efficient line configuration. This means more gaps in between lines, so always a possibility of a cravat, this being when some of the canopy makes its way between lines after recovery from a deflation, either induced by the pilot or through severe turbulence. Normally pumping the brakes unravels the wing, if not then a sharp pull on the B’s or D’s usually does the job.

Stable stall

When any wing has many hours or has been over-loaded, one of the first signs of degradation is a tendency towards stable stalling. This may occur whilst exiting a high-energy or advanced manoeuvre.
When a power unit is added, it can even occur during a low airspeed take-off. Especially when a very powerful engine relative to the pilot weight and wing loading is used. It is also more likely on the slow speed trims.
Should you find yourself in this situation, In flight The quickest recovery is achieved by – coming off the power (if any) – give a short sharp pull on the brakes in unison, followed immediately by a firm but even pull on both A's at once.

During take-off

ALWAYS ensure that your wing is definitely flying with enough air speed, before opening the gas or pulling on any brakes during any launch. If it does happen that you have managed to leave the ground but are not fully flying, DO NOT add more power and more brakes but smoothly come off them, If the wing does not accelerate, just land. Re-assess the conditions as it may well be you are trying to climb out through a wind gradient.

Remember: - Stalling is common to all aircraft that take with insufficient air speed and then try to climb. The trust line on a paramotor is well below the wing, so adding power adds to the problem.

All or the previously mentioned manoeuvres and recoveries from them, are taught on SIV courses.

Contact a local instructor or paragliding club for more Information about SIV.

3.4 GOLDEN RULES !!!

* Never place your engine downwind of your wing.
* Check, check and re-check the fuel system for leaks.
* Have you enough fuel to get you there? Better too much than too little!
* Check for any loose articles that could trail or fall into the propeller while flying and fasten them securely.
* If you spot a problem, no matter how small, deal with it NOW !
* Always put on and fasten your helmet before clipping in to the harness.
* Always carry out full pre-flight checks before launching.* Try to control the glider on the ground facing forwards so as to keep the lines out of the prop. You should only turn to face the glider to avoid falling backwards onto the motor.
* Don't fly into danger - over water, trees, power lines etc. where an engine failure will leave you in trouble.
* Try not to fly into the turbulence of your own wake or that of others, especially at low altitude.
* It is unwise to fly hands-off below about 100m. AGL. as an engine failure below this height may require you to make immediate control inputs to set up a landing approach.
* Never rely on the engine: it may cut out at any moment. Always fly as if it will,
so fly the wing – NOT the motor
* Except for collision avoidance, making a sharp turn against the torque effect during steep climbs can be dangerous: you may rapidly stall and enter a spin.
* Avoid downwind low flying: it drastically reduces your options!
* Be sensitive to mechanical problems early. A noticeable change in engine tone or a new vibration may spell trouble. Land and check it out.
* Make sure your navigation is up to the job.
* Remember, not everyone enjoys your engine noise.
Care must be taken when flying near livestock.

4 Care and maintenance

The safety and life-span of any aircraft, however well designed, built and flown, depends in the end upon how well it is cared for. Confidence in your equipment and the quality of its maintenance is essential to good flying. Even a product as well engineered and carefully constructed as the Revolution can quickly deteriorate if neglected or abused. The better you look after your wing, the better it will look after you.

4.1 Basic Care

As with any paraglider, the basic rules for looking after your Action wing are:-

* **Keep it Cool** : Prolonged exposure to excessive heat in places like the car, the loft or the airing cupboard as well as contact with hot engine parts can damage and significantly shorten the life of both cloth and lines.
* **Keep it Dry** : Packing or storing a wet wing may make it mouldy, damage the coating of the fabric, corrode the metal fittings and in extreme cases rot both the cloth and the lines. Salt water is particularly harmful (as salt crystals form an abrasive coating). You should avoid immersing your wing if at all possible. If it does happen, rinse it thoroughly in fresh water and dry it out completely, preferably in the shade, before packing it away.
* **Keep it dark**: U V light degrades coatings and drastically weakens fabrics. Never leave your wing laid out for long periods beneath holes in the ozone layer. Fold or pack it away when it's not in the air. Some dirt can be highly corrosive. Clean off any such contamination as soon as possible using clean, fresh water. Don't use detergents: they can cause as much damage as the stains, if not more. In particular, store and transport your wing away from the motor (never in the same bag) to avoid any contact with oil or petrol.
* **Keep it Clear** : Sharp, hard or abrasive items such as helmets, flight instruments, harness buckles and the like can accelerate fabric wear and evenhole the wing. The drawstring stuff-bag provided with your canopy affords a measure of protection but you should still try to ensure that you store and transport it clear of contact with anything likely to damage it.
* **Keep it Lonely** : Insects, such as grass-hoppers and ants will simply eat their way out if rolled up with the wing.
Grazing cattle can literally lick the coatings off the fabric and mice love to make homes in canopies!

(We suggest hanging up your wing in its bag during long term storage)

Above all, remember that for all its portability, your paraglider is an aeroplane and deserves to be treated as such !

4.2 Periodic Maintenance

Although your Revolution powerglider, is designed and engineered to give you at least 400 hrs of air time, regular maintenance is essential to pinpoint any problems that may arise as a result of routine wear and tear and is especially important after any incident which may have resulted in fabric or line damage that may not show up in the course of pre-flight checks. Paramania or its accredited agents will, for a small charge, carry out a specified programme of maintenance checks designed to keep your wing in tip-top shape and certify its condition in a written report that will become a valuable part of its service history.
Paramania takes great pride in the quality of both its product and the service that supports it. Feedback from periodic maintenance checks performs a vital role in its quality assurance procedures. They are therefore just as important to us as they are to you and you can be confident that all such checks carried out by the manufacturer are comprehensive and thorough.
We recommend that these inspections are carried out annually or after every 100 flying hours, whichever is the sooner. They are, of course, an essential addition to rather than a substitute for the canopy and line inspections that form part of your own pre-flight checks.

4.3 Repairs

A repair kit is provided with your Revolution powerglider that allows you to carry out small-scale emergency repairs. It consists of about 1 metre of each nylon fabric used in its construction, in self adhesive rip-stop tape and two spare suspension lines, looped at both ends and of the same length and thickness as your longest primary.

Damage beyond the scope of this kit to deal with and more major repairs that may be necessary to loaded parts of the wing's structure, such as seams, line attachments, ribs, risers, leading and trailing edges etc. should on no account be carried out by anyone other than a Paramania accredited agent or at the very least a qualified parachute rigger.
The manufacturers can accept no responsibility for repairs, however minor, carried out by anyone other than themselves nor for any damage to the wing resulting from accident, neglect, negligence or abuse. In all such cases any statutory rights and obligations of guarantee are automatically cancelled.

4.4 Care and Maintenance of your Power Unit

This manual refers only to your Revolution powerglider and any issues to do with the Power Pack you are using is beyond its remit. Refer to the relevant literature for details of care, maintenance, servicing and repair concerning your motor and harness. However we can offer advice if requested.

5 TECHNICAL DATA

5.1 Riser Diagram RR1 Showing riser layout and hard ware

Diagram RR1 Revolution Risers (trims in Neutral position)

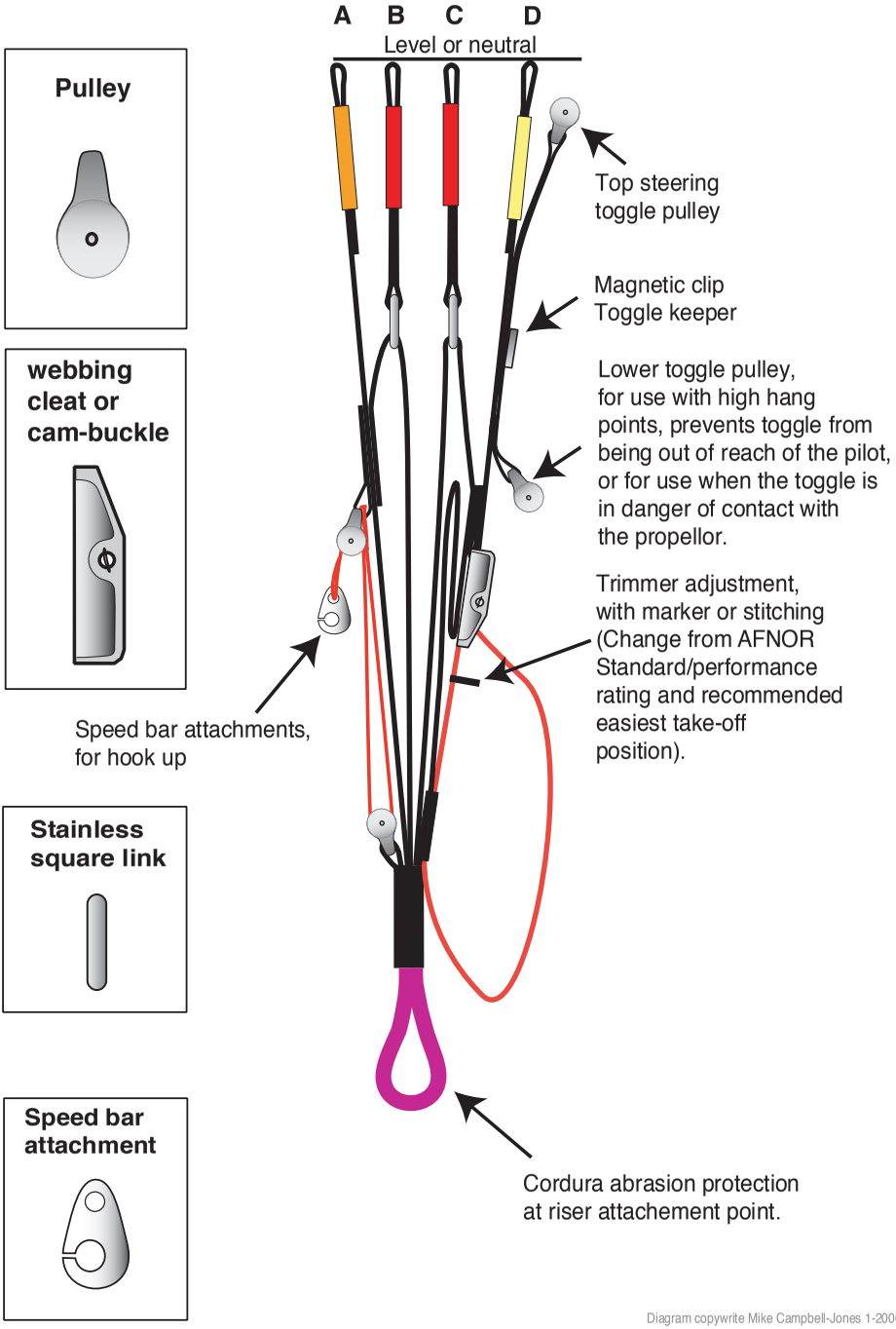


Diagram RR2 showing different Revolution riser trim positions and their effect on the wing section

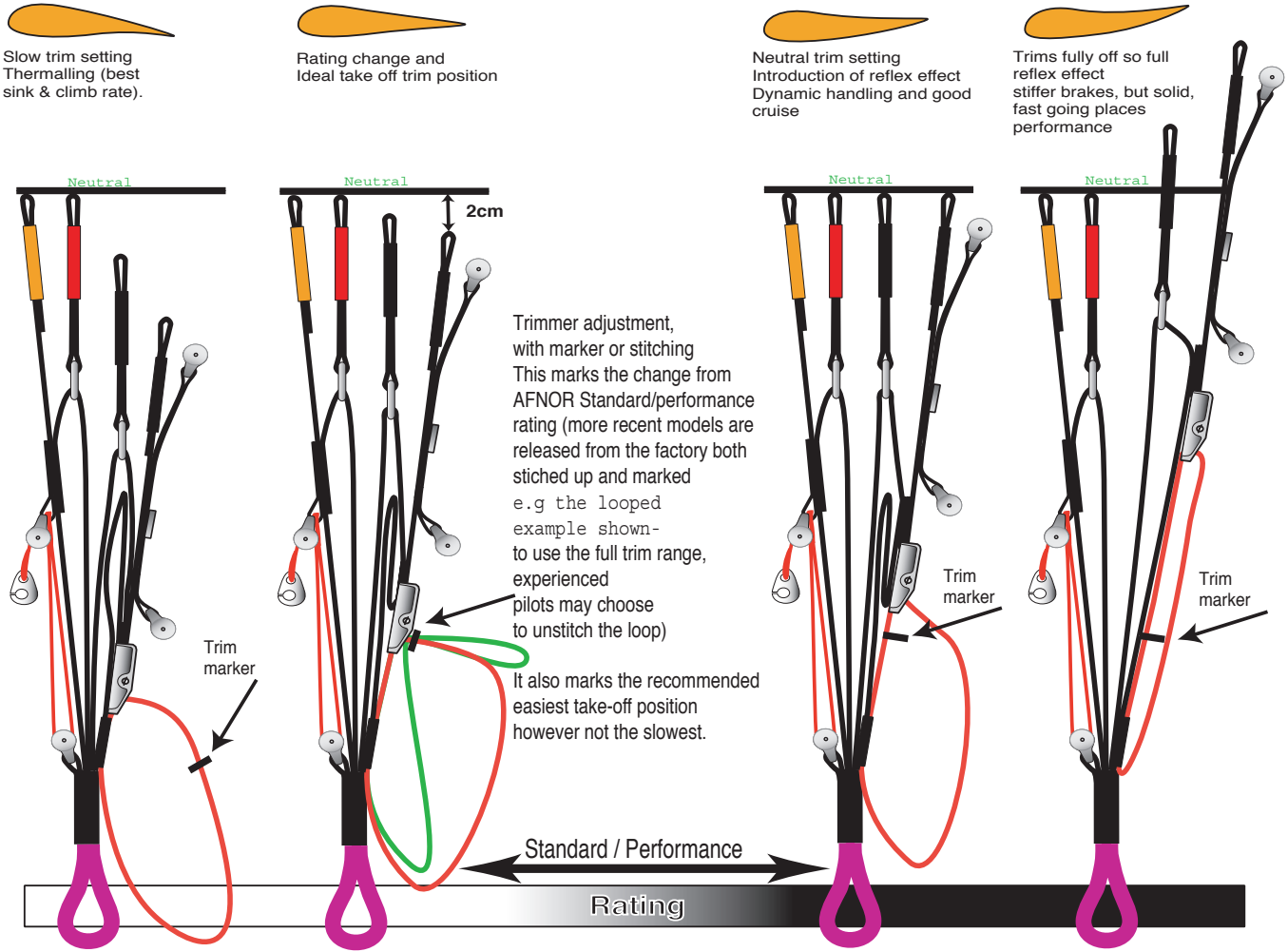
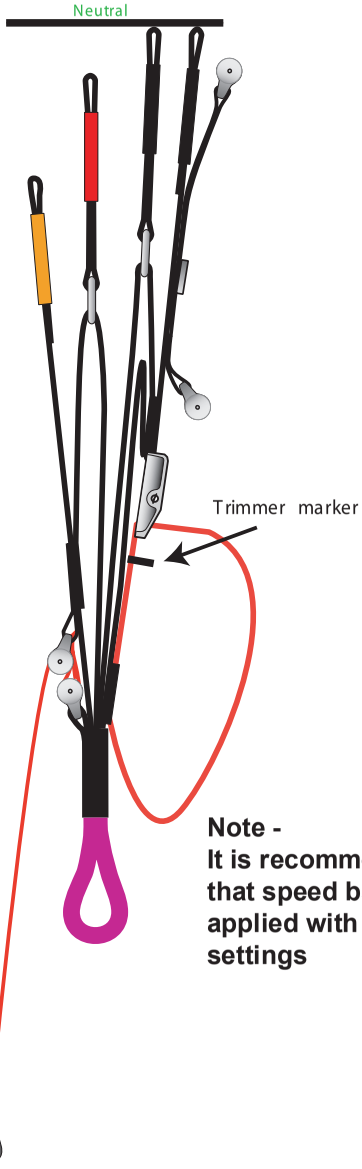
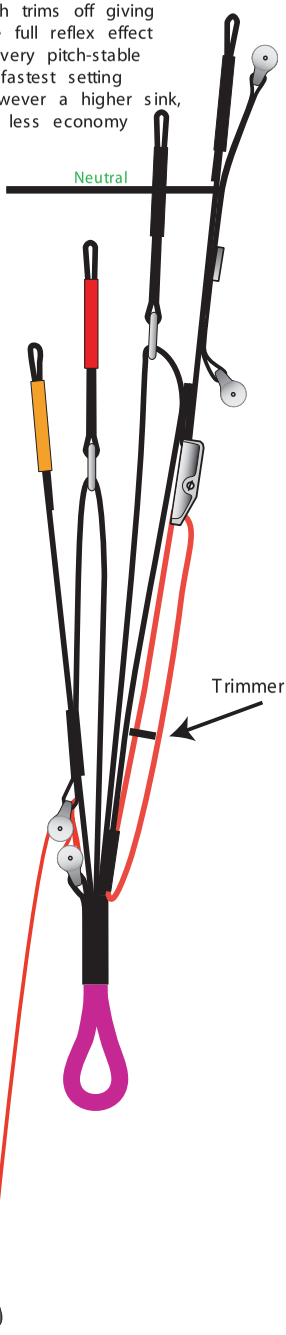


Diagram RR3 showing speed bar usage

Maximum speed bar
with trims on neutral
Good for input with
manoeuvres when experienced
slower than with trims fully off.

Maximum speed bar
with trims off giving
the full reflex effect
A very pitch-stable
& fastest setting
however a higher sink,
so less economy



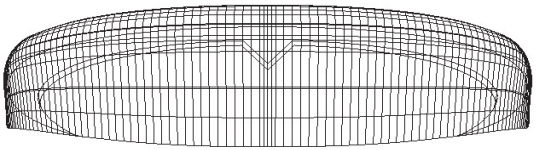


Note -
It is recommended that speed bar is only applied with these trim settings

Technical Data for Paramania Revolution

Technical aspects	Revolution 28m	Revolution 26m	Revolution 23m
Number of cells	47 cells	47 cells	47 cells
Area flat	28.6 Sq metres	27.17 Sq metres	23.17 Sq metres
Max cord	2901 mm	2756 mm	2350 mm
Min cord	699 mm	664 mm	566 mm
mean cord	2196 mm	2086 mm	1779 mm
span	12300 mm	11685 mm	9963 mm
aspect ratio	5.60	5.60	5.60
Span projected	10048 mm	9546 mm	8139 mm
aspect ratio projected	4.58	4.58	4.58
Area projected	25.7 Sq metres	24.42 Sq metres	20.82 Sq metres
Pilot distance from wing	7370 mm	7002 mm	5970 mm
risers	470 mm	470 mm	470 mm
width of hang points	440 mm	440 mm	440 mm

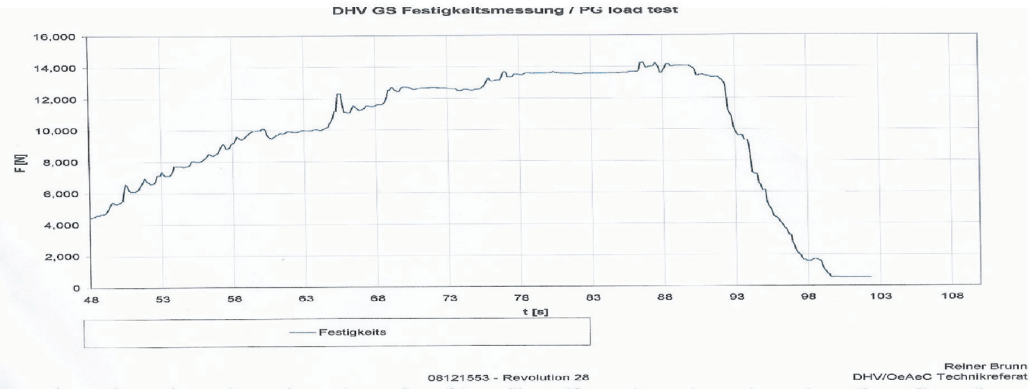
Top



Revolution 30m
47 cells
30.40 Sq metres
Pending mm
Pending mm
Pending mm
Pending mm
5.60
Pending mm
4.58
Pending Sq metres
Pending mm
470 mm
440 mm

28m Load tests - the DHV graph below represents 184kg @ 8g

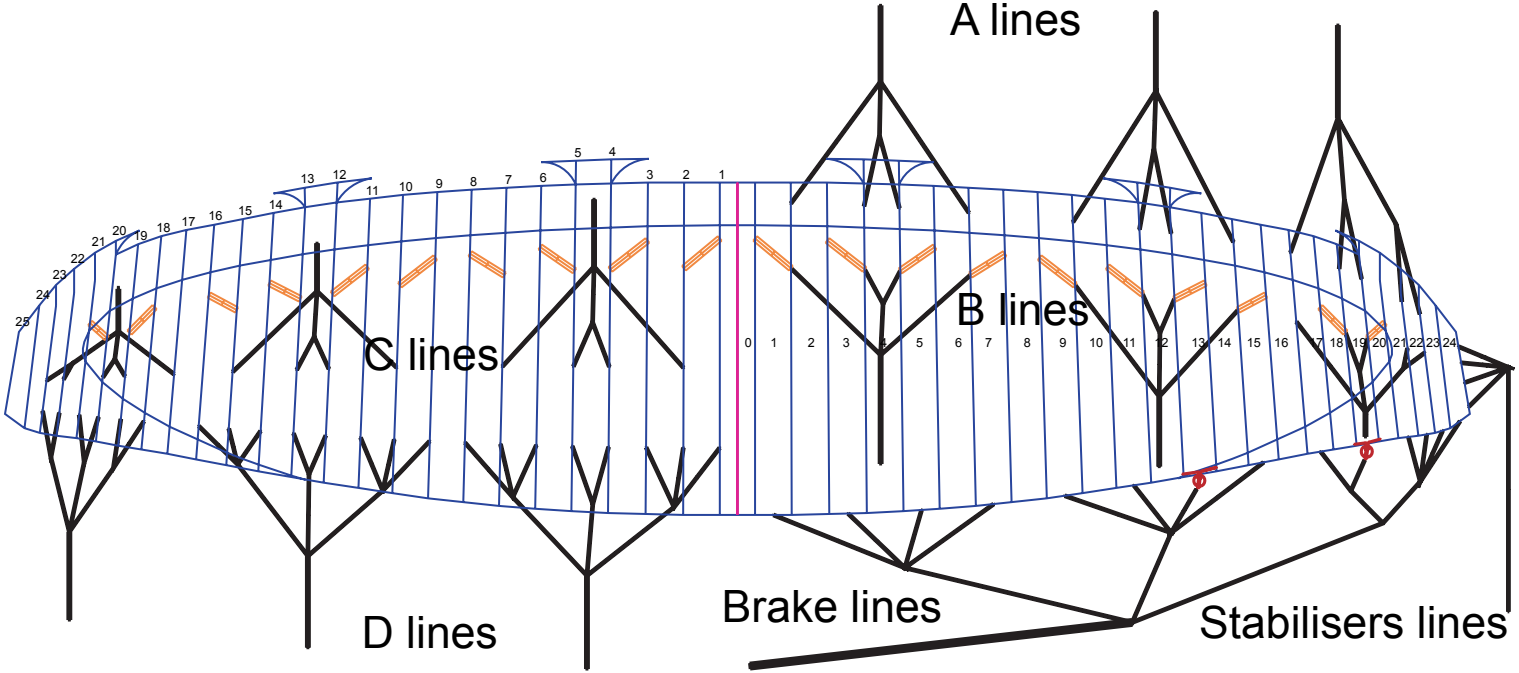
This was after DHV 5000 cyclic line calc depicting old lines
(When new lines are tested they are +/- 50% stronger)



5.5 Lining Tables

Below are lining diagrams & tables. The lines are configured so that most profile changes take place in the tertiary lines, meaning that they are all different lengths enabling the secondary and primary lines to be a more standard length. Lines are numbered from the middle. These are the lines most often damaged or in need of changing, when a full service is carried out. a spare primary line comes with your repair kit, just in case you catch one in a propellor.

RLD01 Revolution line diagram (all sizes)



RLT 23m - lining table

A - lines

primary	23m	secondary	23m	Thirtery	23m
AP-1	3240	AS-1	2527	AT-1	932
		AS2	1539		
		AS-3	2489	AT-2	929
AP-2	3240	AS-4	2482	AT-3	893
		AS-5	1539		
		AS-6	2409	AT-4	881
AP-3	3645	AS-7	1924	AT-5	474
		AS-8	1336		
				AT-6	427
				AT-7	365
		AS-9	1336		
				AT-8	358

B - lines

primary	23m	secondary	23m	Thirtery	23m
BP-1	3240	BS-1	2438	BT-1	850
		BS2	1539		
		BS-3	2421	BT-2	847
BP-2	3240	BS-4	2413	BT-3	833
		BS-5	1539		
		BS-6	2330	BT-4	825
BP-3	3645	BS-7	1886	BT-5	449
		BS-8	1337		
				BT-6	408
				BT-7	356
		BS-9	1337		
				BT-8	350

C - lines

primary	23m	secondary	23m	Thirtery	23m
CP-1	3240	CS-1	2550	CT-1	962
		CS2	1539		
		CS-3	2530	CT-2	960
CP-2	3240	CS-4	2517	CT-3	933
		CS-5	1539		
		CS-6	2454	CT-4	923
CP-3	3645	CS-7	1971	CT-5	530
		CS-8	1337		
				CT-6	485
				CT-7	415
		CS-9	1337		
				CT-8	395

	23m		23m		23m		23m
						DT-2	467
				DS-1	1458	DT-3	467
						DT-4	399
DP-1	4050	DS2	1458				
						DT-5	395
				DS-3	1458	DT-6	453
						DT-7	439
						DT-8	541
						DT-9	526
						DT-10	413
				DS-4	1458	DT-11	415
						DT-12	345
DP-2	4050	DS-5	1458				
						DT-13	331
				DS-6	1458	DT-14	371
						DT-15	325
						DT-16	390
						DT-18	401
				DS-7	891	DT-19	326
						DT-20	264
DP-3	4455	DS-8	891				
						DT-21	215
				DS-9	891	DT-22	147
						DT-23	135

Brake lines (E)'s

primary	23m	secondary	23m	thirtary	23m	Quadary	23m		stitching	excess loop
				ET-1	2033					
		ES-1	1968	ET-2	1774					
				ET-3	1580					
				ET-4	1531					
EP-1	3000	ES-2	1588	ET-5	1758					
EXCESS	250	mm		ET-6	1612			TE RING	230	60	10
				ET-7	1507					
		ES-3	1377	ET-9	982	EQ-1	672			
						EQ-2	543	TE RING	158	60	10
						EQ-3	543			
						EQ-4	486			
				ET-10	923	EQ-5	445			
						EQ-6	421			

Stablizer lines

Primary	23m	secondary	23m
SP-1	4293	SS-A	911
		SS-B	919
		SS-C	964
		SS-D	1037

Gin Kevlar line

- Gin kevlar 381 dn 2.3mm (181 dn after dhv cycle test)
- Gin kevlar 208 dn1.6mm (112dn after dhv cycle test)
- Gin Kevlar 114 dn 1.3mm (60dn after dhv cycle test)
- Gin Kevlar 90 dn 1.1mm (47dn after dhv cycle test)

RLT 26m Revolution line table

A - lines

primary	26m	secondary	26m	Thirtery	26m
		AS-1	2964	AT-1	1093
AP-1	3800	AS2	1805		
		AS-3	2930	AT-2	1090
		AS-4	2911	AT-3	1048
AP-2	3800	AS-5	1805		
		AS-6	2825	AT-4	1034
		AS-7	2256	AT-5	556
AP-3	4275	AS-8	1568		
				AT-6	501
				AT-7	428
		AS-9	1568		
				AT-8	420

B - lines

primary	26m	secondary	26m	Thirtery	26m
		BS-1	2860	BT-1	997
BP-1	3800	BS2	1805		
		BS-3	2840	BT-2	994
		BS-4	2830	BT-3	977
BP-2	3800	BS-5	1805		
		BS-6	2732	BT-4	968
		BS-7	2212	BT-5	526
BP-3	4275	BS-8	1568		
				BT-6	479
				BT-7	418
		BS-9	1568		
				BT-8	410

C - lines

primary	26m	secondan	26m	Thirtery	26m
		CS-1	2991	CT-1	1129
CP-1	3800	CS2	1805		
		CS-3	2968	CT-2	1126
		CS-4	2953	CT-3	1094
CP-2	3800	CS-5	1805		
		CS-6	2879	CT-4	1083
		CS-7	2311	CT-5	621
CP-3	4275	CS-8	1568		
				CT-6	569
				CT-7	486
		CS-9	1568		
				CT-8	464

D - lines

primary	26m	secondary	26m
		DS-1	1710
DP-1	4750	DS2	1710
		DS-3	1710
		DS-4	1710
DP-2	4750	DS-5	1710
		DS-6	1710
		DS-7	1045
DP-3	5225	DS-8	1045
		DS-9	1045

Brake lines (E)'s

primary	26m	secondary	26m	thirtary	26m	Quadary	26m			
				ET-1	2385					
				ET-2	2080					
		ES-1	2310	ET-3	1995					
				ET-4	1796					
				ET-5	2060					
EP-1	3515	ES-2	1860	ET-6	1890					
EXCES	250	mm		ET-7	1765	TE RIN	270	stitching	60	excess loop 10
				1795		EQ-1	790			
		ES-3	1615	ET-9						
				1150		EQ-2	635	TE RIN	185	stitching 60 excess loop 10
						EQ-3	635			
						EQ-4	570			
				ET-10	1080	EQ-5	520			
						EQ-6	495			

Stablizer lines

Primary	26m	secondary	26m
		SS-A	1070
SP-1	5035	SS-B	1075
		SS-C	1130
		SS-D	1215

Gin Kevlar line

- Gin kevlar 381 dn 2.3mm (181 dn after dhv cycle test)
- Gin kevlar 208 dn1.6mm (112dn after dhv cycle test)
- Gin Kevlar 114 dn 1.3mm (60dn after dhv cycle test)
- Gin Kevlar 90 dn 1.1mm (47dn after dhv cycle test)

RLT 28m Revolution Line table

A - lines

primary		secondary	28m	Thirtery	28m
	28m	AS-1	3120	AT-1	1151
AP-1	4000	AS2	1900		
		AS-3	3084	AT-2	1147
		AS-4	3064	AT-3	1103
AP-2	4000	AS-5	1900		
		AS-6	2974	AT-4	1088
		AS-7	2375	AT-5	585
AP-3	4500	AS-8	1650		
				AT-6	527
				AT-7	451
		AS-9	1650		
				AT-8	442

B - lines

primary	28m	secondary	28m	Thirtery	28m
		BS-1	3010	BT-1	1049
BP-1	4000	BS2	1900		
		BS-3	2989	BT-2	1046
		BS-4	2979	BT-3	1028
BP-2	4000	BS-5	1900		
		BS-6	2876	BT-4	1019
		BS-7	2328	BT-5	554
BP-3	4500	BS-8	1650		
				BT-6	504
				BT-7	440
		BS-9	1650		
				BT-8	432

C - lines

primary	28m	secondary	28m	Thirtery	28m
		CS-1	3148	CT-1	1188
CP-1	4000	CS2	1900		
		CS-3	3124	CT-2	1185
		CS-4	3108	CT-3	1152
CP-2	4000	CS-5	1900		
		CS-6	3030	CT-4	1140
		CS-7	2433	CT-5	654
CP-3	4500	CS-8	1650		
				CT-6	599
				CT-7	512
		CS-9	1650		
				CT-8	488

D - lines

primary		secondary	28m
		DS-1	1800
	28m		
DP-1	5000	DS2	1800
		DS-3	1800
		DS-4	1800
DP-2	5000	DS-5	1800
		DS-6	1800
		DS-7	1100
DP-3	5500	DS-8	1100
		DS-9	1100

Brake lines (E)'s

primary		secondary		thirtary	28m	Quadary				
				ET-1	2500					
			28m	ET-2	2190					
		ES-1	2430	ET-3	2100					
				ET-4	1890					
	26m			ET-5	2170					
EP-1	3515	ES-2	1960	ET-6	1990		26m	stitching	excess	loop
EXCESS	250	mm		ET-7	1860	TE RING	284	60	10	
				ET-8	1890		28m			
						EQ-1	830			
		ES-3	1700	ET-9	1200			stitching	excess	loop
						EQ-2	670	TE RING	195	60	10
						EQ-3	680			
						EQ-4	600			
				ET-10	1140	EQ-5	550			
						EQ-6	520			

Stablizer lines

Primary		secondary	28m
	26m	SS-A	1124
SP-1	5300	SS-B	1135
		SS-C	1191
		SS-D	1276

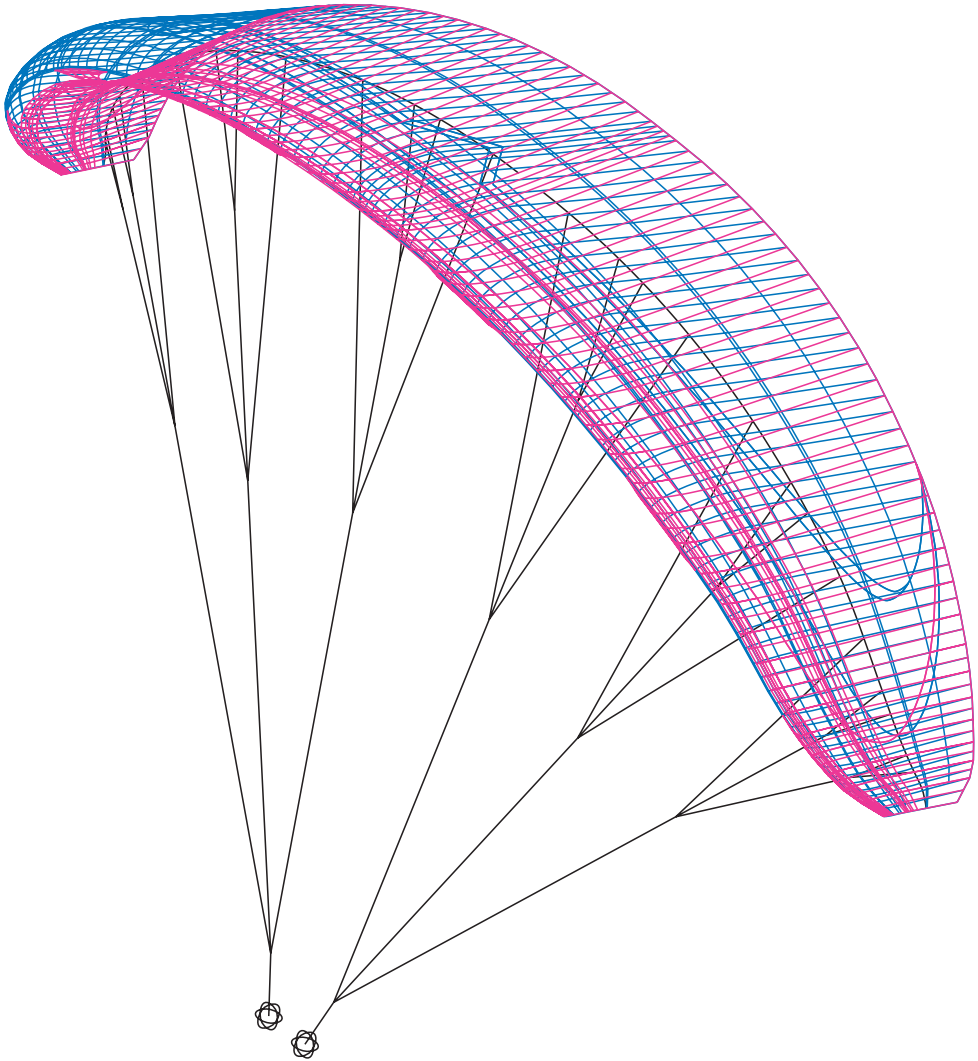
Gin Kevlar line

- Gin kevlar 381 dn 2.3mm (181 dn after dhv cycle test)
- Gin kevlar 208 dn1.6mm (112dn after dhv cycle test)
- Gin Kevlar 114 dn 1.3mm (60dn after dhv cycle test)
- Gin Kevlar 90 dn 1.1mm (47dn after dhv cycle test)

7 SUMMARY

We would like to stress again the points made in Section 1 of this Manual.
The Revolution Powerglider Manual is subject to continuous updating.
To assist us in our quest for perfection, we would appreciate any input that you the customer may contribute towards future versions.
Please don't hesitate to contact us to let us know your views.

Wishing you many hours of fun on your Revolution Powerglider.



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