



# Ivoprop Corp.



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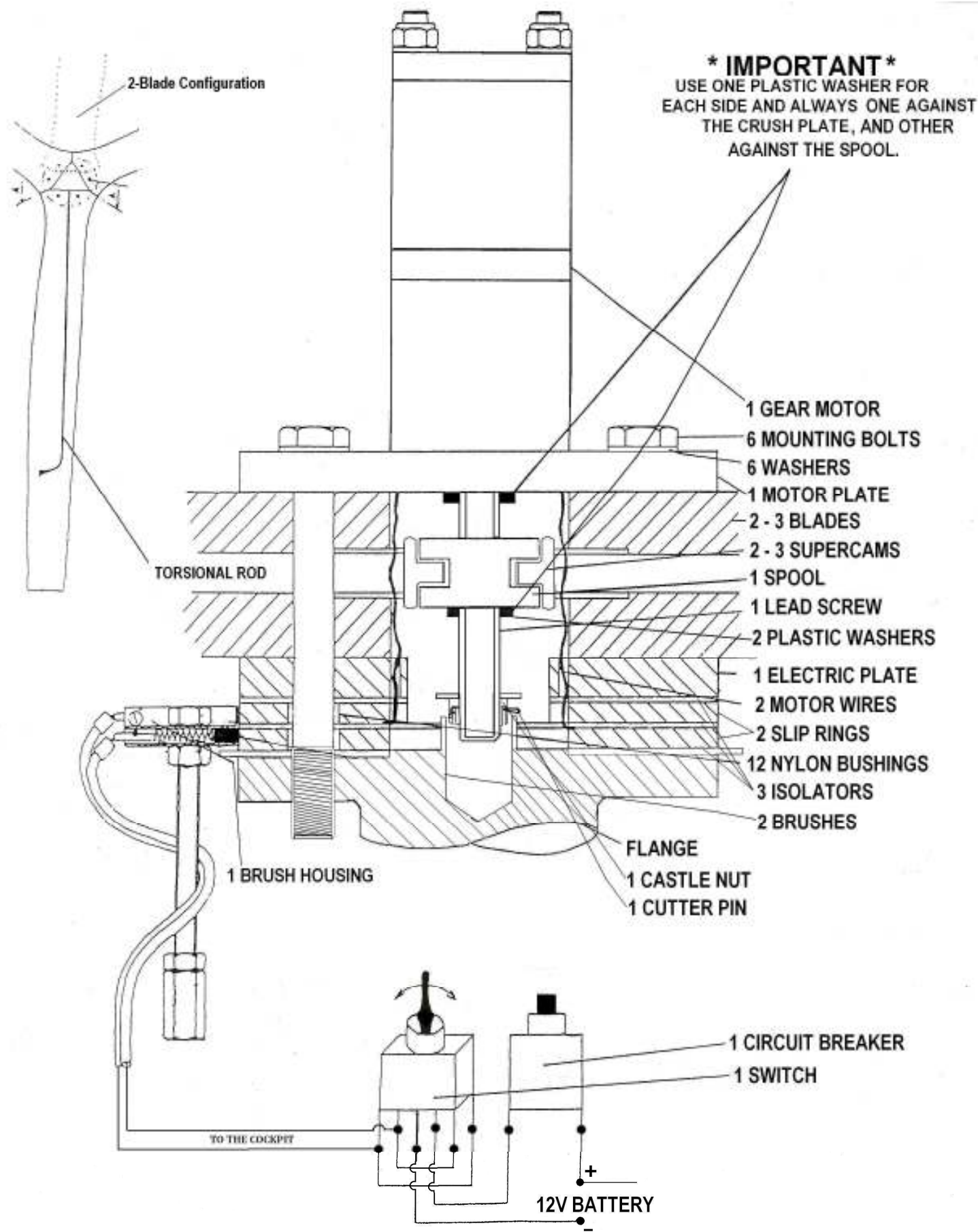
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## Ivoprop Pitch-Change Design And How It Works

The IVOPROP operates on a COMPLETELY UNIQUE adjustable pitch system that allows for substantially less hardware and rotating mass than any other ground pitch adjustable prop. The unique pitch adjustment design operates on the principle of twisting the blades through the chrom-moly alloy steel torsional rod cast inside the blade. The outer end of the torsional rod is firmly anchored inside the outer blade section. The round torsional rod is capable of rotating inside the blade, except for the outer end. Both models utilize the same carbon / graphite fiber blades with stainless steel leading edges. The blades are capable of pitch change 3 to 17 degrees on the tips or inches of helix advancement from 18" to 52".

### The In Flight Adjustable Pitch Ivoprop

- The ability to change the pitch in flight is as significant for the airplane pilot as for the driver of a car to shift gears in the transmission.  
This results in substantial savings in fuel, engine wear and noise.
- Pilot controls the pitch through the toggle switch mounted in the cockpit. Pressing the toggle switch one way sends electric current through the graphite brushes to the slip rings and finally to the electric motor.
- Depressing the toggle switch the other way reverses the polarity of current and the rotation of electric motor. The pitch changes operation is similar to the power windows in an automobile. As long as you hold the switch in one direction- the pitch changes in that direction and you observe the result on your RPM meter.
- Torque from the electric motor is multiplied in a two-stage planetary gear drive, which turns the lead screw.
- Lead screw is supported by a thrust bearing and converts its rotary motion into axial movement of the spool.
- The spool is linked to the supercams, which turn the torsional rods. Torsional rods transmit the movement from the center of the prop to the outside section of the blade. This causes the blade to twist therefore changing the pitch in the same manner as the ground adjustable pitch system.
- Total time required for full range of adjustment is about 5 seconds.
- Movement of the spool can be restricted each way by inserting washers on the lead screw. This limits maximum and minimum pitch and prevents engine over-revving.
- Mounts directly to any rotax gearbox, Can be adapted to other engines.
- Older models Ivoprop ground adjustable props can be converted to In-Flight Adjustable System by means of retrofit kit.
- In-Flight adjustable hub comes assembled with instructions on how to use it.
- Total weight of 3-blades 72" diameter In-Flight Adjustable IVOPROP including wire harness, spinner, control switch, mounting hardware, and the circuit breaker is 10lbs.



**In-Flight Adjustable Pitch Ivoprop Ultralight Model**

# Ivoprop In-Flight Adjustable Assembly

- Insert the mounting bolt with the washer through the motor plate in one of the bolt holes **closest to the two motor wires**.
- Insert one blade on the mounting bolt. **Flat airfoil side towards the electric motor for pusher. Curved airfoil side toward electric motor for tractor.**
- Rotate the blade so that the super cam goes into the groove in the spool.
- Insert second bolt through the motor plate and blade.
- Insert electrical plate (**the one without nylon bushings**) on the bolts.
- Insert small isolator.
- Insert slip ring on the bolts. **Do not push out the nylon bushings.**
- Bend one motor wire in right angle radially outward on the slip ring.
- Insert second small isolator.
- Bend second motor wire the same way like the first one on the isolator.
- Insert second slip ring.
- Insert large isolator.
- Bolt prop loosely on the flange.
- Insert remaining blade (s) between plates and **torque mounting bolts to 200 inch X Lbs.**
- Rotax reduction "B": replace one of the 8mm nuts on the gearbox closest to the prop axis with a coupling nut (torque 150inch X Lbs.)
- Screw the stud into the coupling nut deep enough to clear the blades, and lock it with jam nut.
- Rotax reduction "C": replace 6mm bolt on the gearbox with stud and countertorque one of the jam nuts against the gearbox 100inch. X Lbs.
- Other than Rotax : Mount the stud "somehow" next to the flange so that brushes will contact slip rings
- Screw the jam nut on the stud, insert the brush housing and screw the last jam nut on the stud.
- Position and torque the jam nuts against brush housing so that brush on the blade side is in contact with brush plate right next to the isolator. That way there is a maximum clearance between brush housing and the blades.
- Install switch and circuit breaker in the cockpit in a place where you can easy reach but not accidentally activate.
- Attach 3/16" connectors to the brush housing running the wire under the stud.
- Attach battery connectors to the battery. Circuit breaker wire belongs to the positive pole.
- Write next to the switch direction of the pitch change. By interchanging brush connectors you can change the direction of the pitch change.

Example:

<b>Pitch up</b>	<b>Pitch down</b>
<b>RPM down</b>	<b>RPM up</b>
<b>Cruise</b>	<b>Climb</b>

\* **Caution** : Brushes are brittle. Do not brake them.

# Ivoprop In-Flight Adjustable

## Setting Your Own Pitch Limits

- The pitch change operation in flight can be greatly simplified by restricting movement of the spool therefore limiting the pitch change from your best climb pitch to your best cruise pitch.
- Land with the prop in your best climb pitch.
- Take prop off the flange. Do not take the mounting bolts out of the prop.
- Measure (with a caliper) the distance from the spool and the end of the lead screw and write it down.
- Mount the prop back on the flange.
- Go flying and find your almost best cruise pitch. Remember “almost” stands for the pitch which will still give you a little bit of climb.
- Land the prop in your “almost” best cruise pitch.
- Take the prop off the flange and measure the distance between the spool and the end of the lead screw and write down.
- Mount the prop back on the flange and bring it to neutral (you can hear it –no load on the electric motor.)
- Take prop apart.
- Insert limit washers on the lead screw so that spool can not travel beyond your measurements.
- Do not forget to insert plastic washers on each side of the spool. Failure to do so will immediately lead to the destruction of the gears in the planetary drive.
- Note: the thickness of the plastic washer under load is about ½ of its original thickness.
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### How To Fly With It.

- Do the first flight in still air.
- Run the prop W.O.T. on the ground and adjust pitch of few hundred R.P.M. below your maximum HP R.P.M. (W.O.P. means wide open throttle.)
- Climb W.O.T. and adjust the pitch to maximum climb rate. (Do not exceed maximum allowable R.P.M. for your power plant.)
- Remember your R.P.M. at **your best climb pitch.**
- After reaching cruising altitude hold W.O.T. and start increasing pitch by short impulses until your climb rate is about 200ft/min.
- Remember your W.O.T. R.P.M. at this **your almost best cruise pitch.**
- Throttle back until your R.P.M. start dropping or until your climb is zero.
- Before landing go for a moment into W.O.T. and start decreasing the pitch by short pulses until you reach your best climb R.P.M. which you remember from the take-off.
- Do not change the pitch after landing. Run the prop W.O.T. on the ground and remember your best climb R.P.M. which you remember from the take off.
- Before next take-off run prop W.O.T. and read your best climb ground R.P.M. to make sure that your pitch is in climb setting.
- Next time you want to cruise even in a turbulent air just use your almost best cruise R.P.M. which you remember from your last flight in order to put prop in your almost best cruise pitch.

## Ivoprop In-Flight Adjustable Important:

- Assume that in-flight pitch adjustment can quit on you any time in which case the pitch stays where it is. Therefore do not pitch prop up for cruise more than you need to slightly climb. So you can bring your plane back where you came from.
- Do not use pitch adjustment more than you need and always allow some time for electrical components to cool down between cycles.
- Do not run the prop without the circuit breaker, which is supplied with it.
- If you hold the switch for few seconds after reaching the pitch limit therefore stalling the motor the circuit breaker pops out and you have to wait several seconds to reset it.
- The system will not run safely on regulated DC current from regular therefore you need a battery.
- Before disassembling the prop always bring the pitch to the neutral.
- Never engage pitch adjustment only on one blade or on two blades spaced 120 degrees.
- Do not remove carbon deposit from brushes on slip rings.
- Do not rely on spring, which returns the switch lever to the neutral position.
- If you can't change the pitch in-flight try it in idle R.P.M. or try to move the switch lever back and forth.
- Even if you fly without setting your pitch limits you still need one limit washer the castle nut and the plastic washer.
- Do not shorten the 12' wires or circuit breaker will pop out sooner.
- Keep the grease away from plastic and limit washers.
- Brushes wear much faster when wet. Therefore if you really have to fly in a rain pitch the prop for climb, loosen the jam nut, which is against coupling nut, turn brush housing away from brush plates and re-torque the jam nut.
- Make sure that there is no electric continuity between brush and plates and the engine frame- otherwise you could destroy your regulator-rectifier when changing the pitch while engine is running.
- After you are done with setting the limits and the final installation seal the gaps between the blades with silicon and install the spinner to keep the water and dust from getting into the mechanism.
- Tie down or put the tape over the brush connectors so they will not come loose in flight.
- Apply blue loctite on the spinner bolt and bolt and torque to 35 inch X Lbs. otherwise your spinner will fall off.
- If you wish to secure mounting bolts- use 8mm nylon lock nuts (not supplied) on the other side of the flange.
- **Use only the hardware supplied with the prop, never drill or modify the bolt holes in the blade (s).**
- **Maintain the 200-inch X Lbs. torque on the bolts.**
- **Make sure that there is at least 5" of clearance between the blade tips and trailing edge of the wing, radiator rudder, or whatever, because the blades are design to flex back and forth more than wooden blades.**
- **Do not slide your fingers along the trailing or leading edge of the blade, fibers may pierce your skin.**
- **If you wish to increase top speed or decrease cruise R.P.M., switch to a 2-blade prop or cut the 3-blade prop to a smaller diameter using a hack saw, as long as you cut the same length piece from each blade, the prop will remain in balance. Do not cut the prop to less than 48" diameter.**
- **When switching from 3-blade to a 2-blade configuration, increase the pitch about 4 degrees.**
- **Rotax engines develop maximum horsepower around 6500 RPM so pitch the prop accordingly.**
- **If you are going to use other than skull cap type spinner make sure that there is at least ¼" clearance between blades and cut-outs in the spinner.**
- **If your aircraft holds u.s. experimental airworthiness certificate you are supposed to contact the F.A.A. FSDO before flying the aircraft. When notified, the F.A.A. inspector can determine if procedure was major change (as defined per far 21.93 and listed in appendix a to part 43) and if any additional inspections or operating limitations are needed prior the flight.**