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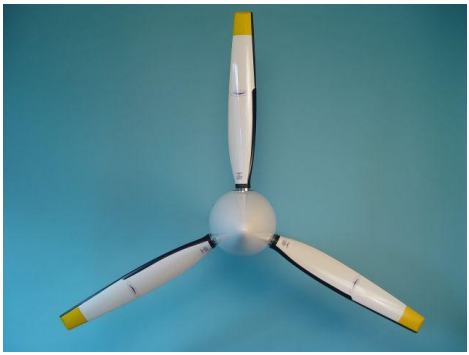
# USER MANUAL
# UM – 05 EN

## AIRCRAFT PROPELLER

## Type: KW-31

## Serial No:



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## 2. List of Revised Pages

Changes or revisions to this manual may only be made by the manufacturer.
Any change should be recorded in the table below.
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## 3. Introduction

Read this manual carefully before putting the product into service to get basic information on operational safety.

If you do not understand the contents or if in doubt, always contact propeller manufacturer – Woodcomp Propellers s.r.o.

We wish you many a pleasant flight with Aleš KŘEMEN – WOODCOMP propellers.

## 4. Manufacturer

**Woodcomp Propellers s.r.o.**
Vodolská 4, Dolínek
250 70 Odolena Voda
Czech Republic

Legal form: Limited Liability Company, registered in the Trade Register maintained by City Court in Prague, section C, file 80616
Company ID: 018 93 351
VAT No: CZ01893351
Phone: +420 283 971 309
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e-mail: info@woodcomp.cz
http://www.woodcomp.cz

## 5. Type Certificate Holder

**Aleš KŘEMEN Company**
Vodolská 4, Dolínek
250 70 Odolena Voda
Czech Republic

Legal form: natural person authorized to perform business according to Law on Entrepreneurship, registered in the Trade Register maintained by City Court in Prague, section A, file 58514
Company ID: 279 52 428
VAT No: CZ6006101046
Phone: +420 283 971 309
Fax: +420 283 970 286
e-mail: info@woodcomp.cz
http://www.woodcomp.cz

## 6. Serial Number

Please state the correct type designation and serial number of the propeller each time you contact the manufacturer.
These data are specified on the first page of this User Manual, on Warranty Certificate and on Product plate fixed on propeller blade No. 1

## 7. General Information

KW-31 propellers are reliable and field tested in long lasting operation, however problems might occur as with any product.

Although it is impossible to eliminate all the risks involved just by reading the manual, they can be minimized by applying the information presented and using the propeller properly.

Information and descriptions in the manual are valid at the time of publication. Users of Aleš Křemen propellers may be informed of changes or mandatory measures by publication in the form of service bulletins at Woodcomp Propellers website (http://www.woodcomp.cz).

Illustrations in this manual are for information only and do not replace drawings in technical documentation.

Technical data are specified in SI metric system.

The manual may be translated from Czech to any other language, but the original Czech text will held decisive validity.

## 8. Operating Safety

***This propeller is subject to approval by aviation authorities, and is always operated on users own risk!***
***Aerobatics and intentional spins with this propeller are prohibited***!
***Operation in icing conditions is not permitted!***

- Only use propeller on engine and aircraft combination recorded in the Propeller Log Book.
- Do not over speed the propeller to higher than maximum permitted rpm, with the exception of emergency procedures detailed in Sect. 14.9.
- Do not start the engine manually by the propeller.

- Pulling/pushing the aircraft using the propeller is only possible when holding the propeller root part closest to the hub.
- Before starting the engine, always check the condition of propeller and its mounting.
- Before starting the engine, always ensure that the propeller and its surroundings are clear.
- Record all data concerning propeller operation and repairs in the Propeller Log Book.
- Do not transport nor store the propeller standing on blade tips, even for short time!
- Do not store the propeller in extremely damp environment, and do not leave it outside in rain for extended periods.

## 9. Propeller's Properties

Electro mechanical propellers, KW-31 range, may be fitted with automatic rpm control (Constant Speed Propeller). This concept offers the best possible utilization of engine power while providing highly comfortable user control.

The pilot selects optimum engine rpm and controls engine power, and/or boost pressure, by throttle lever in the cabin. Automatic control maintains set rpm without any pilot intervention, keeping engine power constant regardless of changing flight speed, climbing, descent, flight in turbulence, or aircraft maneuvering. If proper piloting rules are adhered to, maximum permitted engine rpm will not be exceeded.

Aircraft equipped with this propeller achieves short take-off run, fast climb to level flight altitude, the lowest possible fuel consumption and noise level for given operating range (distance travelled) or endurance, while still allowing fast change to maximum flight speed. Use of this propeller is a prerequisite for achieving high service ceiling of aircraft. Compared with other propeller concepts, aircraft thus equipped has better glider towing characteristics.

Propeller with automatic rpm control protects engine package from damage caused by improper handling during flight.

Propellers of KW-31 range offer stable control and fast reaction, thus meeting the requirements for standard aircraft categories.

# 10. Technical Description

## 10.1. Intended Use

Propellers of KW-31 range are intended for piston engine aircraft with engines up to 85kW (115HP), with reduction gear reaching up to 2550rpm (maximum permitted operating value).

KW-31 is double acting in-flight adjustable propeller, offering two modes: directly controlled blade angle of attack control (so called beta–control mode), or as constant speed propeller (so called constant–speed mode).

Blade angle of attack is adjusted using servomotor controlled from the cabin; range of adjustment is from the minimum angle for take-off up to maximum pre-set angle.

KW-31 propeller may be used as pushing or pulling propeller.

The propeller is attached to engine flange using a spacer and six screws with nuts. The spacer defines the distance between the plane of blade rotation vs. fixed parts of engine cowling. Therefore it supports adaptation to various built-in dimensions in various aircraft.

Electric motor driving the change of blade pitch angle is supplied by multisegment contact ring. The propeller is double acting, which means that movement in both directions, to increase and also to reduce the pitch, is motorized. Adjustment mechanism is self-locking, which means that if motor is not energized, the blades remain at the most recent angle setting.

Electric motor power is transferred to motion screw through multiple planet gears. Motion screw thread moves an arm, which turns propeller blades carried in two roller axial bearings and one radial sliding bearing. Movement of arm is linked to microswitches located at low and high pitch end stops.

Propeller blades are carried by two axial needle bearings in the propeller head flanges. Blade position is locked by a nut–cover. Cover is fixed by two locking screws after preloading the bearings.

The arm mechanism converts axial movement to rotating movement. Bronze stone is used to transfer forces between motion screw and blade pin jutting out of its hub. To prevent direct contact between the arm and individual blade hub bottoms, additional stones are fixed in the opposite end of each edge of arms.

Sliding ring maintains radial position of the blade.

Propeller blades consist of core made of resonance spruce, which is wedged and glued into blade root made of hardened wood. Blade core is enclosed in glass or carbon

laminate with gelcoat surface. This combination brings superb mechanical qualities, low weight, great resilience and perfect look.

Blade end is fitted into duraluminum hub and secured using steel screws with special thread. Outer part of blade leading edge is protected from damage by poured polyurethane (RAKU TOOL) or by stainless steel stamping. Inner part of blade leading edge (close to propeller centre) is protected by applied self-adhesive polyurethane tape.

Color of surface is made to customer order. Blade tips may be highlighted using paint, to improve visibility during rotation.

Composite propeller spinner is attached onto propeller head in two planes, on baffles, which guarantee proper alignment and suppress negative effects of vibrations onto relative movement of the spinner vs. propeller head; this reduces propeller imbalance during operation. Connection of spinner to rear carrier (baffle) is using 9 plated screws with self-locking nuts.

Use of quality aluminum alloys for the propeller head guarantees high strength and rigidity with low weight. Wooden blade cores eliminate possible fatigue problems when used on piston engines. Composite shell of all blades improves resistance to mechanical damage and ingress of moisture and dirt into wooden structure.

## 10.2. Propeller Control Modes

Propeller may operate in manual pitch angle control mode, or constant speed mode.

### 10.2.1. Manual Control Mode

Manual control installation may be in two versions:

- Propeller control on instrument panel–standard
- Propeller control on stick–custom order

Propeller control on instrument panel

Propeller control on instrument panel consists of a panel incorporating both signaling of the direction of blade pitch change and also fine and coarse pitch limit indicating LEDs along with the control switch.

Propeller control on stick

Propeller control is installed on control stick, it consists of a handle which is threaded onto the stick.

In this case, signaling of the direction of blade pitch change as well as fine and coarse pitch limit indicating LEDs are located in the instrument panel without the control switch.

### 10.2.2. Automatic Control Mode – Constant speed

On customer's request, propeller control in the cabin can be expanded with CS 3-5 (CS 4-6) electronic controller, allowing the setting of propeller rpm, which is then

automatically maintained regardless of flight mode. In this case, the propeller acts as so called Constant speed propeller.

Auto–Manual switch is added to the instrument panel, which allows selection of:

AUTO - automatic control mode–Constant speed
MANUAL - manual control mode

## 10.3. Propeller Blade Pitch Stops

Both end positions of blade pitch are preset by propeller manufacturer. Position of limit blocks may be changed according to the engine installed. If it is discovered that particular aircraft-engine configuration would benefit from other preset of end positions, such change may only be performed by the manufacturer or authorized service centre. The movement which changes blade pitch is limited by two systems.

### 10.3.1. Main System

Main limiting system consists of limit switches operated by end stops installed on links connected to the adjustment mechanism; activation of a switch stops the blade in current position. To increase reliability, redundant (double) switches are installed at both positions.

### 10.3.2. Backup System

Mechanical stop–rings are threaded onto moving screw, which limit the range of adjustment mechanism movement. Mechanical stops are set approx. 2° lower/higher than electrical stops. If propeller blade pitch adjustment mechanism reaches a mechanical stop, current consumption of electric motor increases; this increase is detected by the control unit, which disconnects the electric motor.

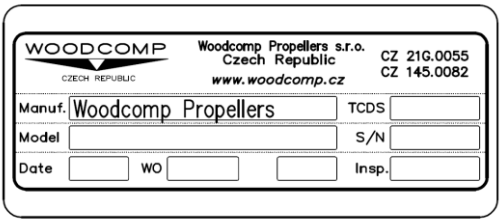
**CAUTION**

If main end stop mechanism fails, the propeller must be removed and sent for repair to the manufacturer or authorized service centre.

## 10.4. Product Label

Propeller blade No. 1 bears a label, containing the following information:

- Manufacturer's name
- Propeller type designation
- Propeller serial number




Where:
TCDS - Type authorization number (EASA.P.177)
Model - KW-31 propeller model
S/N - Propeller serial number
Date - Date of manufacture
WO - Work Order number
- Abbrev. NEW – New product; OH – Overhauled; REP – Repaired;
INSP – Inspected/Tested; MOD – Modified
Insp. - Inspecting technician's number

Each installed propeller blade bears manufacturing label, containing the following information:

**BLADE ……**
**WO ……**
**Pos. … S/N …….**
**HUB ……..**

Where:
BLADE -Type of blade
WO - Work Order number
Pos. - Position within propeller head
S/N - Serial number
HUB - Date of manufacture

## 10.5. Propeller Designation System

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | HUB | | | | / | BLADES | | |
| **KW** | **–** | **xx** | **–** | **( )** | **–** | **( )** | **–** | **( )** | **–** | **( )** | **–** | **( )** | **–** | **( )** | **/** | **( )** | **–** | **( )** | **–** | **( )** |
| *1* | | *2* | | *3* | | *4* | | *5* | | *6* | | *7* | | *8* | */* | *9* | | *10* | | *11* |

## 10.6. The Hub

***1*** KW Type certificate holder - Aleš KŘEMEN

***2*** No. of propeller model

***3*** Code letter for propeller category:
A - Automatic Propeller
F - Fixed Pitch Propeller
G - Ground Adjustable Propeller
V - Variable Pitch Propeller

***4*** Code letter for blade pitch change system:
H – Hydraulic
E – Electric
M – Mechanical

***5*** Number of blades installed

***6*** Code letter for feathering system:
F – Feather position installed
0 – No feather position possible

***7*** Code letter for reverse provision:
R – Reverse position installed
0 – No reverse position possible

***8*** Code letter for flange type listed in Aleš KŘEMEN Service Bulletin No. 4

## 10.7. Blades

***9*** Code letter for blade design and installation:
R - Right-hand tractor
RP - Right-hand pusher
L - Left-hand tractor
LP - Left-hand pusher

***10*** Propeller diameter in v cm

***11*** Blade type identification (contains design configuration and aerodynamic data) according to the certified hub/blade-combinations.

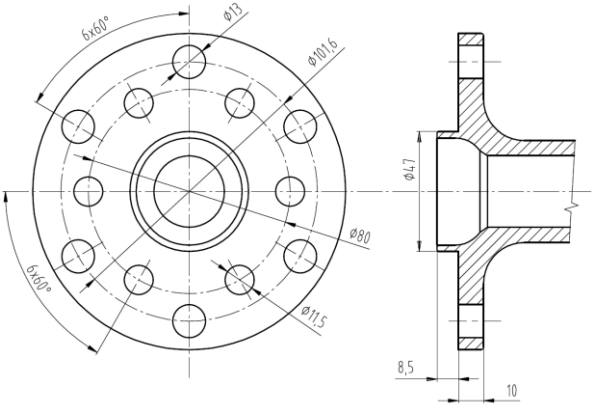
## 11. Basic Performance Data

| | | | |
|---|---|---|---|
| **Propeller model** | KW-31 | | |
| **Number of blades installed** | 3 | | |
| **Blade type** | - 031 („W“) | - 033 („C“) | - 034 („B“) |
| **Diameter** | Right: 1738 ± 4mm<br>Left: 1714 ± 4mm | 1726 ± 4mm | 1642 ± 4mm |
| **Min. angle setting** | 5° | | |
| **Max. angle setting** | 50° | | |
| **Max. engine power output-$N_{max}$** | 115HP | | |
| **Max. propeller RPM - $n_{max}$** | 2550rpm | | |
| **Temperature Service Rate** | -25°C / +45°C | | |
| **Mass moment of inertia** | 0.51kgm$^2$ | | |
| **Mass of complete propeller** | ca. 11.5kg acc. to type of blades and spinner | | |
| **Mass of CS 3-5 governor** | 0.23kg | | |
| **Time between end positions** | ca. 6sec. | | |
| **Max. continuous current of servomotor** | 4A | | |

KW-31 has been tested in operation of aircraft equipped with ROTAX 912/914 engines.

## 12. Connection of KW-31 Propeller to Engine

### 12.1. Dimensions of Engine Flange




Dimensions correspond to ROTAX 912 engine flange–part number 837 282.

Dia. 11.5mm holes on dia. 80mm circle are used to attach KW-31 propeller.

## 12.2. Connecting Flange - Spacer

A spacer is used for installation of the propeller and it is placed (see **Chyba! Nenalezen zdroj odkazů.**) between the propeller and the propeller flange of the engine, to which it is secured by propeller attachment bolts.


The thickness of the spacer and arrangement of attachment bolts depend on the type of engine, to which the propeller is fitted.
Different spacer thicknesses are needed for different engine installations, since the propellers flange may project from the front of the cowling by different amounts.
Unless the aircraft design advises differently we advise that the thickness of the space is chosen to give a gap between the rear edge of the spinner and the front of the cowling about 7-10 mm.
When ordering a propeller, customer should specify both the distance of engine flange from engine cowlings according to our drawing, and the diameter of circle through the centres of attachment bolts.

# 13. Propeller Unit Adjustment

Propeller unit consists of a propeller and a controller. Connection between the controller and pilot forms a part of aircraft fuselage, can differ in each particular case, and as such, is not detailed in this text.

**CAUTION!**
**Adjustment of propeller unit by persons not authorized by the manufacturer are strictly prohibited.**

Although the adjustment of propeller unit on aircraft is simple, improper modification of settings may be dangerous to propulsion unit and operating safety.

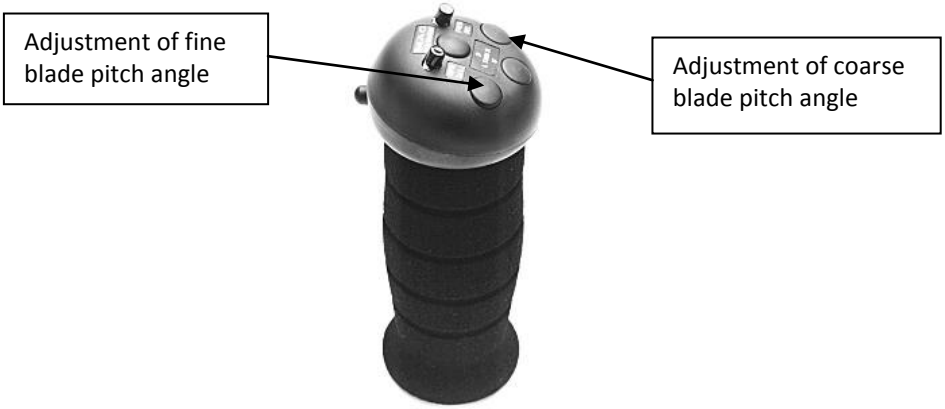
## 13.1. Control Mode

### 13.1.1. Manual Control Mode

The manual control can be situated either on the control stick or on the instrument panel.

*Control on the control stick*

On the top of control stick there is a grip with a rocker switch to control the servomotor mechanism for blade adjustment.
On the instrument panel there is an indicator of blade position
For the sense of controllers and their functions – see the pictures below.



*Control on the instruments panel*

A rectangular signal device of blade position is situated on the instrument panel. Sense of controller and functions are seen in the following picture:


Yellow lamp for adjustment of fine pitch. Blinks when adjusting to fine pitch. Is lit when the end position (stop) of minimum pitch is reached.

Blue lamp for adjusting the coarse angle. Blinks when adjusting to coarse angle. Is lit when the end position (stop) of maximum pitch is reached.

Buttons for blade pitch adjustment

**FINE**–adjustment to a finer pitch **COARSE**–adjustment to a coarser pitch

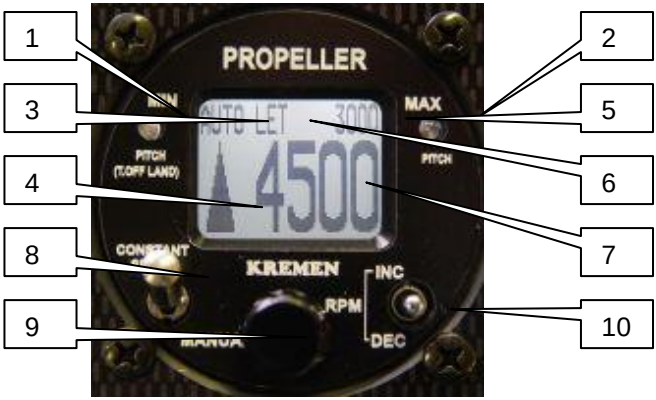
## 13.2. Control Unit for Automatic Control

### 13.2.1. Instruction Manual

CS 3-5 governor is used to control KW-31 propellers. It operates in two modes:
**AUTOMAT**IC – the instrument evaluated propeller speed, compares the value with preset value, and controls the propeller to achieve constant speed with pre-set tolerance. The propeller is operated in Constant speed mode.
**MANUAL** – the pilot controls propeller blade pitch according to specific flight mode.

**Agreement on CS 3-5 installation**
Before installing CS 3-5 into an aircraft, study the manual.
The pilot must understand the controls; without such knowledge, he/she must NOT use the controls!
Carry the manual with you in the cabin.
After installation of CS 3-5, perform ground engine test, and only afterwards perform a test flight, first of all, switching on current consumers one after another, to discover possible interference to CS 3-5 from any of current consumers already installed on the aircraft.
CS 3-5 connects directly to propeller pitch adjustment mechanism. If the conditions listed above are not complied with or in case of fault, inadvertent adjustment of propeller pitch may occur.

**If you do not accept these conditions, do not install CS 3-5 into an aircraft!**




**Driver functions and symbols:**
1 - in manual and automatic mode signals at the minimum angle of the propeller blade

2 - in manual and automatic mode signals at the maximum angle of the blades
3 - AUTO inscription notes that are in automatic mode
4 - arrow symbol shows the command to change the propeller
Δ propeller stops at a smaller angle, engine speed will increase
∇ propeller stops at a greater angle, engine speed will be reduced
5 - actual motor speed
6 - CRUISE description or TAKE-OFF - signaling speed dial mode (if this feature is enabled)
7 - set (desired) the engine speed; propeller will represent so motor to reach these speeds
8 - Switch automatic and manual mode with lock
9 - knob setting values
10 - Propeller Control switch:
In manual mode: position INC - speed will increase, population DEC - speed will decrease.
In automatic mode, quick choices between modes CRUISE and TAKE-OFF (if this feature is enabled).

### 13.2.2. Control–AUTOMATIC mode

After switching on-board network is CS 3-5 activated.
To set the device before the flight, it is necessary to switch the switch with lock 8 to MANUAL position, the display shows MANUAL mode, press the button 9 for 2 sec, highlight Done is displayed, set the switch to the lock position 8 CONSTANT SPEED - remains the highlighted Done, wait 2 seconds and turn the knob to the right and then left to browse through the device settings menu and set the following values:

- Take-off rpm: Preset speed for fast change to TAKE-OFF mode. (Upper limit pre-set by the manufacturer is 5700rpm.) User may reduce the value by pressing the knob (9), which highlights the pre-set rpm value; turning the knob (9) allows setting of required value. Then press the knob (9) to confirm your selection and store it to the memory. Continue turning the knob (9) to highlight another menu item:
- Flight rpm: Preset speed for fast change to CRUISE mode. (Upper limit pre-set by the manufacturer is 5700rpm; lower limit pre-set by the manufacturer is 4000rpm.) User may reduce the value by pressing the knob (9), which highlights the pre-set rpm value; turning the knob (9) allows setting of required value. Then press the knob (9) to confirm your selection and store it to the memory. Continue turning the knob (9) to highlight another menu item:
- Display: User may select normal or inverted display; press the knob (9) to highlight current setting, turn the knob (9) to the left or to the right to switch between normal or inverted display; press the knob (9) to confirm. Continue turning the knob (9) to highlight another menu item.
- Disp.con: Setting of display contrast; press the knob (9) to highlight current setting, turn the knob (9) to the left or to the right to change the value. Continue turning the knob (9) to highlight another menu item:
- Disp.bri: Setting of display brightness; press the knob (9) to highlight current setting, turn the knob (9) to the left or to the right to change the value. Continue turning the knob (9) to highlight another menu item:
- LED bri.: User may select brightness of LEDs 1 and 2; press the knob (9) to highlight current setting, turn the knob (9) to the left or to the right to change the value. Continue turning the knob (9) to highlight another menu item:
- Language: User may select display language; press the knob (9) to highlight current setting, turn the knob (9) to the left or to the right to change to desired language – CZE (Czech), ENG (English), and press the knob (9) to confirm.

  Other menu items are pre-set by the manufacturer, i.e. user cannot change them!

- Password: Used to protect manufacturer's settings.
- RPMdisp.: Current engine rpm (5) rounded to nearest 50rpm– pre-set by manufacturer
- RPMstep: Setting of engine rpm (7) with 100rpm step–pre-set by manufacturer
- RPM: Pre-set value of minimum rpm for all modes (CONSTANT SPEED, TAKE-OFF and CRUISE)
- RPMmax: Pre-set value of maximum rpm for all modes (CONSTANT SPEED, TAKE-OFF and CRUISE)
- RPMratio: Multiplier for prop speed measurement
- Insens.: Defines the insensivity band–HYSTERESIS (in case of engine speed change smaller than this value, the governor and prop do not react)

- Ext.Pot: Control by external potentiometer
- Rv.ramp: Propeller electric motor ramp speed
- Mot.prot: Current limiting of propeller electric motor
- Control: TAKE-OFF and CRUISE
- Eng.hrs: The instrument adds up actual engine hours

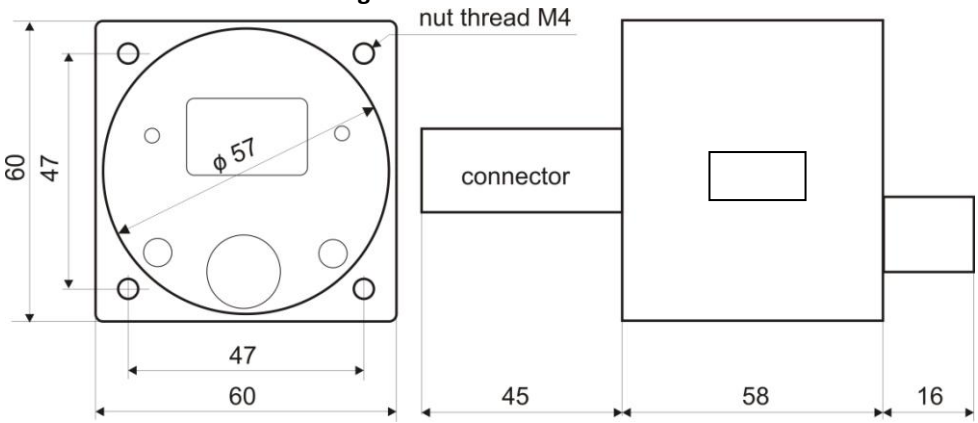
When finished making settings in the menu, turn the knob (9) to the left to Done, press knob (9) and you will be in CONSTANT SPEED mode.
Before taking-off, set TAKE-OFF rpm using knob (9)
(If Fast option TAKE-OFF and CRUISE is enabled in the menu, switch (10) may be pushed to RPM INC position to activate TAKE-OFF rpm (this is indicated on the display as well, along with display of pre-set rpm value).
During take-off, propeller is controlled automatically to prevent engine overrevving.
After take-off, user may turn knob (9) to set desired cruise rpm (coordinate this control with control of fuel supply to the engine – MANIFOLD PRESSURE!)
(If Fast option TAKE-OFF and CRUISE is enabled in manufacturer's menu, switch (10) may be pushed to RPM DEC position to set cruise rpm (this is indicated on the display as well, along with display of pre-set rpm value).
Any change of set speed by turning the knob (9) changes the pre-set, the indication CRUISE disappears, and newly set value becomes valid.
If current engine speed (5) differs from set value (7) by more than 100rpm, the instrument controls the propeller; example: if pre-set is 5000rpm and current value is 5150rpm, the instrument commands increase of propeller pitch and subsequent drop in engine rpm will establish a new equilibrium; the insensitive band is 100rpm, and therefore engine rpm will drop below 5100rpm, but never below 4900rpm.
During active change of blade pitch, an arrow is displayed; its orientation indicates the direction of blade pitch change; up arrow means decreasing pitch (and increasing engine speed), while down arrow means decreasing pitch (and increasing engine speed).
On reaching end position, LED1 (minimum pitch) or LED2 (maximum pitch) is lit. At the same time, simple arrow (6) on the display changes to an arrow with stop line.

### 13.2.3. Control–MANUAL mode

Switching from CONSTANT SPEED mode (NOT from the menu) is possible by pulling and then moving switch (8) to MANUAL position.
Switch (10) allows manual control of prop speed: RPM INC–decreases propeller pitch, thus increasing the rpm–LED 1 blinks during the change; on reaching the end position, it is lit permanently. RPM DEC position–increases propeller pitch, thus decreasing the rpm–LED 2 blinks during the change; on reaching the end position, it is lit permanently.


When switch (8) is in Constant speed position, turning knob (9) allows setting of TAKE-OFF speed.
Pre-set TAKE-OFF speed may also be activated quickly by pushing switch (10) to up position (RPM INC). (Keep pushed for 2sec.)

### 13.2.4. Dimensions of CS 3-5 governor



**CAUTION!**

1. **Always set TAKE-OFF mode before landing–propeller must be able to achieve max. permitted speed!**
2. **In case of fault in AUTOMATIC mode, switch to MANUAL mode and utilize manual control**.

**NOTE**

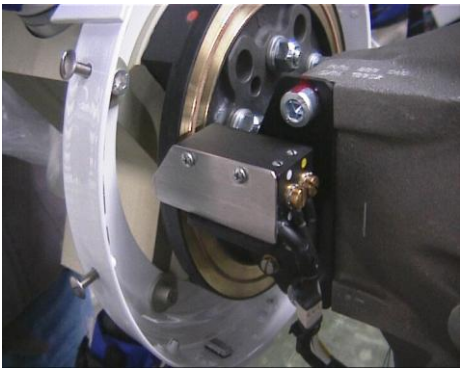
**Due to system lag, use throttle level gradually.**

**NOTE**

**Propeller manufacturer recommends installation of boost meter, allowing the pilot to set proper engine operation mode.**
**Without this instrument, fuel efficiency may drop and engine may be damaged by overloading during operation (e.g. due to low engine rpm with improper position of throttle lever.)**

## 13.3. Installation and assembly of cabling and instruments

Use drilling template (included with propeller) to make holes for installation of instruments in the instrument panel. Instruments must be located in a way that makes them visible and accessible from both piloting seats.
Installation of instruments and cabling continues by threading the cables (bundle inside Achru–flame retardant–tube) from the cabin using the shortest possible route to the propeller. Pay extra attention when passing the bundle through baffles (sharp edges must be avoided at all costs), and also around movable parts (keep safe distance from movable parts and when the bundle is at/near a movable part–e.g. when installing onto the throttle lever–always maintain the biggest possible bending radius).
When installing the cables, avoid hot areas and contact with engine parts which heat up during operation.
Fitting the flange (which carries the brushes) onto ROTAX engines is shown in the figure below. The flange attaches by two screws to existing holes on ROTAX engine. It is therefore not necessary to drill into the engine.



Note:
When installing the flange onto other engines, brass ring cannot be installed onto the propeller, due to the fact that later connection to brushes is impossible due to upper reduction gear wheel. Solution: brass ring and brush holder are installed onto rear side of upper reduction gear wheel and only two cables are threaded through hollow reduction gear shaft up to the propeller.
Installation onto other engine type must always be consulted with the propeller manufacturer.

## 13.4. Propeller Installation

Into six mounting holes in the engine flange is inserted 6 pieces centering bushings of 13mm diameter. The centering bushings are inserted from the engine side. The propeller is mounted on the engine flange using six M8 bolts, which protrude from the rear of the propeller. The bolts must be threaded to the bushings. Be careful when fitting the propeller do not damage the carbon brushes, which supply the propeller with electric power. Carbon brush housing flange must move freely and must be shifted into rear position. The propeller is then gently pushed onto the propeller flange by hand and open end spanner is used to tighten M8 self-locking nuts from behind the propeller progressively. During screwing nuts, check touchdown of mounted faceplates of inserted bushings on the engine flange. Bushings must face planted area of land on the motor flange - transmits torque from the engine shaft to the propeller hub. If all bushings are leaned by its shoulders holster on the motor flange, perform successively tighten the nuts.
Final tightening is done with a torque spanner set to 22Nm. After checking this final tightening, adjust carbon brush housing according to the given scheme. While turning the propeller by hand, check that the carbon brushes seat properly in the centres of the brass slipways, and make contact with their entire surfaces.

## 13.5. Checking the Installation

Switch on the electric power source and check propeller functions:

1. Switch on the electrical master switch.
2. Check function of the cradle switch on control stick, or the switch on the CS 3-5 instrument panel.
3. Check movement between propeller pitch end positions and related signaling
   - when adjusting towards fine pitch: yellow LED should blink;
   - when reaching end position (minimum–fine–blade angle): yellow LED must be lit;
   - when adjusting towards coarse pitch: blue LED should blink;
   - when reaching end position (maximum–coarse–blade angle): blue LED must be lit.
4. During pre-flight inspection, checks main end stop system. With the engine off, cycle the propeller from one end position to the other. The main system is functioning normally if the propeller reaches its end positions and adjustment is stopped there.

**WARNING!**

**In case of failure of the main stop system, the propeller must be removed and sent for repair to the producer or to the authorized service centre.**

5. Adjust the propeller approximately for the middle angle of incidence of the blades and carry out the engine test on the ground. During the engine ground test, excessive vibration or unusual noise must not occur.

**WARNING NOTICE**

**At maximum engine power output with fine angle of blades (at end stop), engine overspeeding can occur. RPM display must be carefully monitored.**

**!!When making the engine ground test with the aircraft stationary, never adjust the maximum coarse angle on the propeller when the engine runs at maximum power (full throttle). This may produce stall flutter on the propeller with subsequent damage!!**

# 14. Operation Instructions

## 14.1. Starting the Engine/Engine Test

Starting the engine and engine test must be performed according to the following procedure:

1. Inspect the power unit according to its manufacturer's instructions.

2. Check that the propeller is undamaged.

3. Set pitch control to take-off mode, i.e. minimum blade pitch. This position allows reaching of maximum engine speed.

4. Start the engine.

On starting the engine, the propeller reaches engine idle speed. Observe the instruction for warming up the engine and gradually increase engine rpm. During this operation, blades rest on minimum pitch end stop; propeller governor usually does not intervene, with the exception of atmospheric conditions far from standard ones, and even in this case, it may only start to interfere near engine peak power spot. ROTAX 912 engine will reach up to 5400 or 5500rpm under standard conditions, while the governor limits the speed only on reaching 5730–5750rpm.

## 14.2. Taxiing

Keep propeller control in Take-off position, i.e. minimum pitch and maximum speed, throughout taxiing. Use throttle lever to control engine speed; when necessary, use brakes to slow down the aircraft. Throttle lever normally controls engine speed, and propeller governor usually does not intervene.

When taxiing, propeller thus equipped usually allows finer control of aircraft speed than fixed or manually adjustable propeller. Due to lower propeller blade pitch, expect the need to use higher propeller speed for the same taxiing speed, but keep in mind that required engine power is actually lower.

## 14.3. Take-off

Set full throttle, keep propeller control in take-off mode. With aircraft forward speed increasing, during take-off run and initial climb, power plant speed increases on its own up to maximum value pre-set on the governor, which then begins to intervene, and maintains constant speed.

After initial climb, it is advisable to switch from take-off power (only permitted for 5 minutes with ROTAX 912 engine) to maximum continuous power (full throttle and 5500rpm for ROTAX 912). The safest and most appropriate procedure to change to

maximum continuous power is to keep throttle lever at max. setting, and reduce engine speed by governor control. On reaching desired attitude, reduce throttle opening according to desired cruise speed.

An attempt to reduce engine speed during flight by reduction of throttle opening is serious error, resulting from misunderstanding of automatic propeller governor function. With constant speed propeller, throttle lever does not control engine speed, but whole propulsion package pull/thrust. If the pilot reduces throttle opening, the governor reduces blade pitch, until the engine reaches very low power output, where engine and prop speed drops rapidly, and especially inexperienced pilots risk dangerous change into 2nd flight mode with all its consequences.

## 14.4. Horizontal Flight

Automatically controlled propeller allows the best possible operating economy–the lowest possible fuel consumption for maximum range or endurance. It is also possible to reach high cruising speed without undue load on the engine, and/or select propulsion package mode with the best possible (noise) comfort.

The best possible operating economy may be calculated by complicated method from aircraft, engine, and propeller characteristics; almost the same result may be obtained by performing the following test.

Recommended procedure to reach the best possible adjustment:

1. When at desired flight level, set desired flight speed by appropriate setting of throttle lever and propeller speed control, e.g. set to 4800–5500rpm, and stabilize the flight mode.

2. Do not touch the throttle lever, and use governor control to achieve engine rpm recommended by the manufacturer, e.g. 4300rpm.

3. Maintain newly found position of propeller governor control and use throttle lever to restore original (desired) flight speed.

If propeller and/or engine are overloaded (check oil pressure and temperature, engine temperature), allow higher engine/propeller speed by using governor control (e.g. to 4800, 5200rpm, etc.), and use throttle lever to adjust flight speed. Recommended settings included in aircraft flight manual have priority over this instruction. For most regimes, you usually obtain lower fuel consumption and higher propulsion effectiveness of propeller.

## 14.5. Aircraft Maneuvering and Turbulence

Propulsion package maintains set rpm without pilot intervention, with high precision.

## 14.6. Maximum Flight Speed

Some aircraft reach maximum horizontal flight speed not at maximum propulsion package rpm, but at full throttle with slightly lower rpm. Suitable setting must be reached by trial and error, using the procedure recommended in Sect.15.5.

The governor protects the engine from overrevving within the whole flight envelope, up to a speed slightly higher than the never exceed speed ($v_{NE}$).

## 14.7. Landing

When landing, set governor control to Take-off mode not later than after 3rd turn. If necessary (incorrect approach, obstacle on runway…), this setting will support faster increase of flight speed and altitude. When commanding full throttle, use gentle and gradual movement, so that the governor manages to control the propulsion unit, protecting the engine from overrevving. The change from idle to maximum power takes approx. 5sec.

## 14.8. Switching the Engine Off

Before switching the engine off, set governor control to Take-off mode; leave it in this position when aircraft is parked.

## 14.9. Emergency Procedures

KW-31 range propellers are very reliable, but there is always a theoretical risk of failure; therefore the pilot must be familiar with procedures allowing safe completion of flight.

Failure of propeller governor usually manifests itself by blocking of pitch setting to a particular value between the end stops, or at an end stop. Propulsion unit may then be used in the same way as with fixed pitch propeller. In this case, it is possible to use throttle lever to control the speed. Sometimes, governor may become unstable, e.g. because of improper function of automatic control unit. Depending on the position in which blade pitch locks, and also on current flight mode, proceed according to instructions below:

**A) Propeller blades locked at small (fine) pitch setting**

This fault manifests itself by overrevving during flight speeds higher than the optimum climbing speed.

Should the fault occur during take-off and/or initial climb, it will not manifest itself in any way; take-off will be completely normal. The pilot will only discover the fault when aircraft speeds up, and the engine begins to overrev.

Proper reaction: reduce speed to optimum climbing speed. At lower flight speeds, it is possible to utilize complete range of engine speeds.

Should the fault occur during high flight speed, engine speed will increase. Pilot must react quickly, by reducing the throttle, if possible completely, to idle speed, and wait until flight speed drops to optimum climb speed; afterwards, gradually open the throttle and continue flying at lower speed.

In both cases mentioned above, slight overrevving of engine is always possible, even for longer time period.

***Continue flying only to the nearest area suitable for landing*.**

**B) Propeller blades locked at high (coarse) pitch setting**

This fault manifests itself by reduced propeller speed, which can only be increased by opening the throttle. The pilot must increase engine power and if flight altitude permits, increase flight speed by slight diving. The goal is to reach and maintain sufficient flight speed. Propulsion unit is still able to maintain level flight, and in certain flight speed range, also allows slight climbing. Landing approach must be carefully calculated, because in landing configuration (wing devices, landing gear), go around may not be possible.

***Continue flying only to the nearest area suitable for landing*.**

**C) Loss of Governor Stability**

This fault manifests itself by unstable propulsion unit speed. It is necessary to switch the governor's control unit to MANUAL mode. If control unit operates normally in Manual mode, it is possible to continue flying.

# 15. Transport, Handling, Storage

## 15.1. Propeller Delivery

Propeller is delivered complete, with cabling, controls, signaling, electric power brushes, propeller attachment hardware, and necessary documentation.

## 15.2. Handling

Propeller must be handled very carefully, to prevent damage, including e.g. damage by impact.

When transporting disassembled propeller, blades must be protected by cloth pockets. For safer transport, we recommend to place propeller into solid box (cardboard, plywood). Compete propeller must be transported in horizontal position with the hub supported.

## 15.3. Storage

During storage, blades must be protected by cloth pockets. Before long-term storage, we recommend to clean propeller body and blades with lukewarm water and detergent.

Compete propeller must be stored in horizontal position with the hub supported, or hanged by attachment holes.

Storage condition: temperature 5° to 25°C, relative humidity up to 80%.

**It is prohibited to store and/or transport the propeller standing on blade tips–even for short time!**

## 15.4. Transport

Propeller is always delivered in special carton package, which may be used to return the propeller to manufacturer or authorized service centre for service inspections.

Note:

When sending propeller for overhaul, it may only be sent disassembled provided that disassembly was performed by authorized service centre.

## 15.5. Responsibility for Transport

When standard packing recommended by the manufacturer is used to transport the propeller, the manufacturer bears responsibility for proper packing at manufacturing

plant, up to acceptance of the package by the transport company, which takes over the responsibility afterwards.

Customer must always check that propeller packing is undamaged on receipt of the package from the transport company.

If packing is damaged on receipt, unpack the product in presence of the transport company representative, observe, record, and/or claim the damage.

## 16. Inspections

Mandatory inspections must be performed by the manufacturer or authorized service centre in the intervals specified below:

| Sec. | Operating hours | Type of inspection | Performed by |
|---|---|---|---|
| **16.1** | **Pre-flight inspection** | | Pilot or designated mechanic/technician |
| **16.2** | **25hrs** | After first 25 operation hours or after each new installation | Aircraft mechanic (AML ICAO, AML Part 66, etc.) |
| **16.3** | **Every 100hrs / 1 year*** | Periodic inspection on airplane | Manufacturer or authorized service centre |
| **16.4** | **700hrs/2 years*** | Medium repair | Manufacturer or authorized service centre |
| **16.5** | **1400hrs/4 years*** | Overhaul | Manufacturer or authorized service centre |
| **18** | | Special inspections | Manufacturer or authorized service centre |

* Whichever occurs first.

**CAUTION**
**Periodic inspections must be recorded in Propeller Log Book**.

### 16.1. Pre-flight Inspection

Perform visual check before each flight:

- Tightening of all screws;
- Attachment of propeller to engine flange;
- Condition of blades, leading and trailing edges. Condition of blade roots at connection to propeller head;
- Condition of propeller cone, attachment to propeller.

Defects, if discovered, must not exceed the scope detailed in Chapter 19.
On discovering unacceptable defects, stop using the propeller immediately and send the propeller for repair to manufacturer or authorized service centre!

### 16.2. After first 25 operation hours or after each new installation

Check tightening torque of flange nuts (22Nm). Use torque wrench with valid calibration.

### 16.3. After 100 operating hours

Perform according to technology instruction TN-31.

### 16.4. Medium Repair

Medium Repair is performed after 700 operating hours or 24 months after Overhaul– whichever occurs first.

Medium Repair may only be performed by manufacturer or authorized service centre.

### 16.5. Overhaul

Overhaul is performed after 1400 operating hours or 48 months after Overhaul – whichever occurs first.

Overhaul may only be performed by manufacturer or authorized service centre.

**CAUTION**
**Without mandatory inspections being regularly performed,**
**the propeller is not airworthy and must not be used.**

## 17. Airworthiness Limitations Sections

No Airworthiness Limitations!

This Airworthiness Limitations Section (ALS) is EASA approved in accordance with Part 21A.31(a)(3) and CS-P40(b). Any change to mandatory replacement times, inspection intervals and related procedures contained in this ALS must also be approved.

## 18. Special Inspections

Special inspections are necessary when:

- When major damage to blade by impact of foreign object (stone, bird, hail, etc.) is detected
- In case of careless or prohibited handling;
- In case of overrevving the propeller by more than 200rpm;
- In case of lighting strike;
- In all cases of operating the propeller outside the conditions/ranges stated in this manual.

Special inspections may also be required when installing propeller on other engines than ROTAX 912/914.

**WARNING!**

**Damage to the propeller is more dangerous than damage to the engine!**

## 19. Repairs

This chapter describes repairs of small damages which may be performed by the user. Description of damage and method of repair must be recorded in Propeller Log Book.

**WARNING!**
**More serious damage can only be repaired by the manufacturer or authorized service organization.**

### 19.1. Blade Repairs

Only small dents and cuts on the blade surface or leading may be repaired. In case of any doubt about blade condition the manufacturer or authorized service station.

***Blade surface:***

Maximum permitted depth of damage to suction or pressure side of blade is 0.7mm. Surface area of single repaired spot must not exceed 0,5cm$^2$

Maximum permitted depth of damage to trailing edge is 2mm, repaired locations must be farther than 80mm away from each other, and must not be longer than 15mm.

**Repair procedure:**

1. Clean and dry the location.
2. Use fine file or sandpaper to prepare the location.
3. Fill the location with epoxide.
4. Let cure and grind to blend with the surroundings.
5. Apply polyurethane paint to repaired location.

Hair-cracks on the blade surface are permitted if they are only in outer gelcoat layer. If they start growing quickly and penetrating into the fiberglass (or carbon) layers, stop using the propeller immediately and contact the manufacturer or authorized service station

Pay special attention on leading edge or trailing edge damage. Such damage may cause penetrating of moisture to wooden core and must be repaired as soon as possible.

***Polyurethane leading edge:***

Maximum permitted depth of damage to PU leading edge is 2mm, repaired locations must be farther than 80mm away from each other, and must not be longer than 15mm. No cracks on the leading edge are permitted. The leading edge must always fully adhere to blade along the entire length.

The repair may be done only by filling and sanding, to achieve smooth shape. Don't try to add any material to damaged areas.

***Stainless steel leading edge:***

Maximum permitted depth of damage to stainless leading edge is 1mm, damaged locations must be farther than 80mm away from each other and must not be longer than 5mm. No puncture or crack on is permitted, nowhere on the length of leading edge. The leading edge must fully adhere to blade, and no gap between stainless strip edge and blade surface is permitted.

No repairs of the stainless leading edge are permitted.

## 19.2. Repairs of Propeller Head and Metal Parts

Repairs of propeller head and metal parts are strictly prohibited!!

## 19.3. Repairs of Propeller Spinner

Only small surface cuts on outside surface not deeper than 0.5mm may be repaired.

**Repair procedure:**

1. Clean and dry the location.
2. Use fine file or sandpaper to prepare the location.
3. Apply polyurethane paint to the dent/cut.

## 19.4. Replacement of Polyurethane Protective Tape

**Replacement procedure:**

1. Carefully remove old tape (slightly heat the tape using hairdryer).
2. Clean the surface from dust and oil. Carefully remove remnants of old glue using acetone or MEK.
3. Carefully remove backing tape from new foil, taking care not to touch/soil the glue surface.
4. Apply tape to prepared blade surface.
5. Use plastic spatula to force out air bubbles, or puncture the tape by a pin, and press out air using a roller or finger pressure. Do not use a blade or razor to cut the tape!!
6. Place the propeller into operation no sooner than after 24 hours from applying the tape, when the glue fully cures.

## 20. Troubleshooting

If you cannot solve a problem according to the following instructions, contact the manufacturer or authorized maintenance organization.

| Problem | Possible cause | Elimination |
|---|---|---|
| Vibration in flight or on the ground | Static imbalance of the propeller | Check on the ground that the balance weights inside the spinner are not missing and that there are no missing or broken parts of the blades, which could cause the imbalance. |
| | Aerodynamic imbalance of the propeller | Check on the ground, with engine out of operation, if all three blades are adjusting simultaneously and smoothly. These defects can only be repaired by the manufacturer or authorized service centre. |
| Propeller blades do not change pitch, while the LED blinks. | Broken, worn or wrong contact of carbon brushes. | Replace or adjust the brushes. Check according to the diagram whether there is proper electrical connection of propeller and all electrical connections.<br>All other faults can only be repaired by the manufacturer or authorized service centre. |
| Lubricant leak | Within the first 25 hours of operation there may be slight leak of lubricant from the propeller, which has been used for its conservation. | Clean the propeller using a cloth dipped in lukewarm water with added detergent. |
| | Any other leak signals damage to the rubber sealing rings. | Replacement can only be performed by the manufacturer or authorized service centre. |

# 21. Warranty Conditions

## 21.1. Warranty Period

The manufacturer accepts responsibility for faults of new and unused product for the period of 24 consecutive months from sale to original purchaser recorded in the Warranty Certificate, or for 100 operating hours, whichever occurs sooner.

After 25 operating hours, propeller must be presented to the manufacturer or to an authorized service centre for inspection, otherwise the warranty becomes void.

Actual operating hours must be recorded to Propeller Log Book and Aircraft Log Book.

No unauthorized or unprofessional modifications may be performed, otherwise the warranty becomes void.

The propeller must be operated according to manufacturer's instructions and provision of this User Manual.

## 21.2. Warranty Conditions

The user must present the manufacturer with completed Propeller Log Book and stamped/signed Warranty Certificate, along with proper records of propeller installation and operation.

## 21.3. Responsibility

The warranty does not cover possible secondary damages.

All legal relationships resulting from purchase of the propeller by the user, from services provided by the manufacturer during maintenance, and also all legal relationships resulting from propeller operation, especially those resulting from responsibility for propeller faults, responsibility for damages, and remuneration of property and other damages related to propeller operation, propeller accident, and related events, will be assessed according to Czech law, and will be decided according to it by applicable court in the Czech Republic.

## 21.4. Honoring the Claim

Faulty product will be assessed by the manufacturer within the warranty period, and if claim is accepted, faulty parts will be replaced with new ones, with parts and work free of charge. Original replaced parts become property of the manufacturer.

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# WARRANTY CERTIFICATE

**Manufacturer:**

**Woodcomp Propellers s.r.o.**
Vodolská 4
250 70 Odolena Voda
Czech Republic

**Propeller type:** **KW-31**
**Model:**

**Type Certificate:** **EASA.P.177**

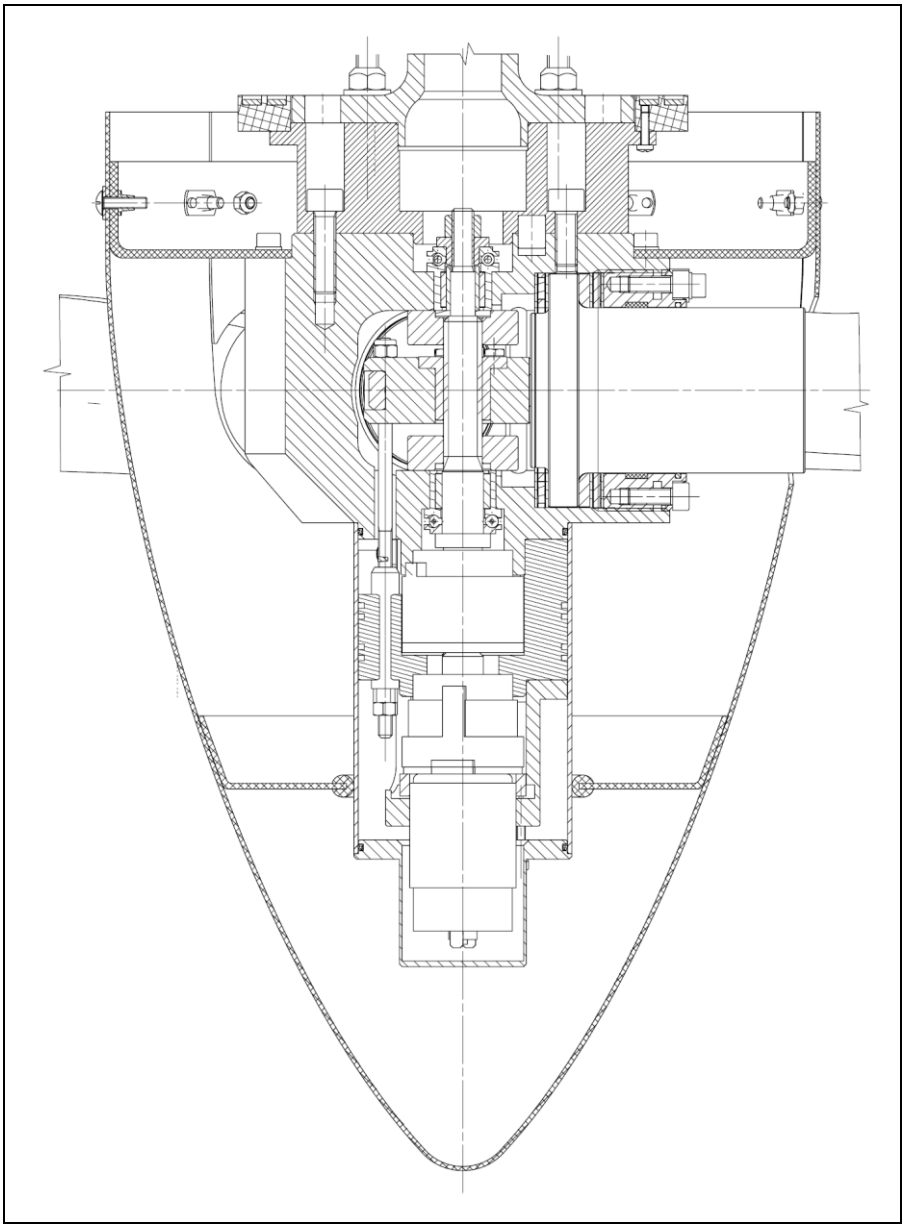
**Serial Number:**

**Date of Sale:**

**Supplier's Stamp and Signature:**

Product warranty is subject to warranty conditions listed in Chapter 21 of this User Manual.

# KW-31 PROPELLER



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