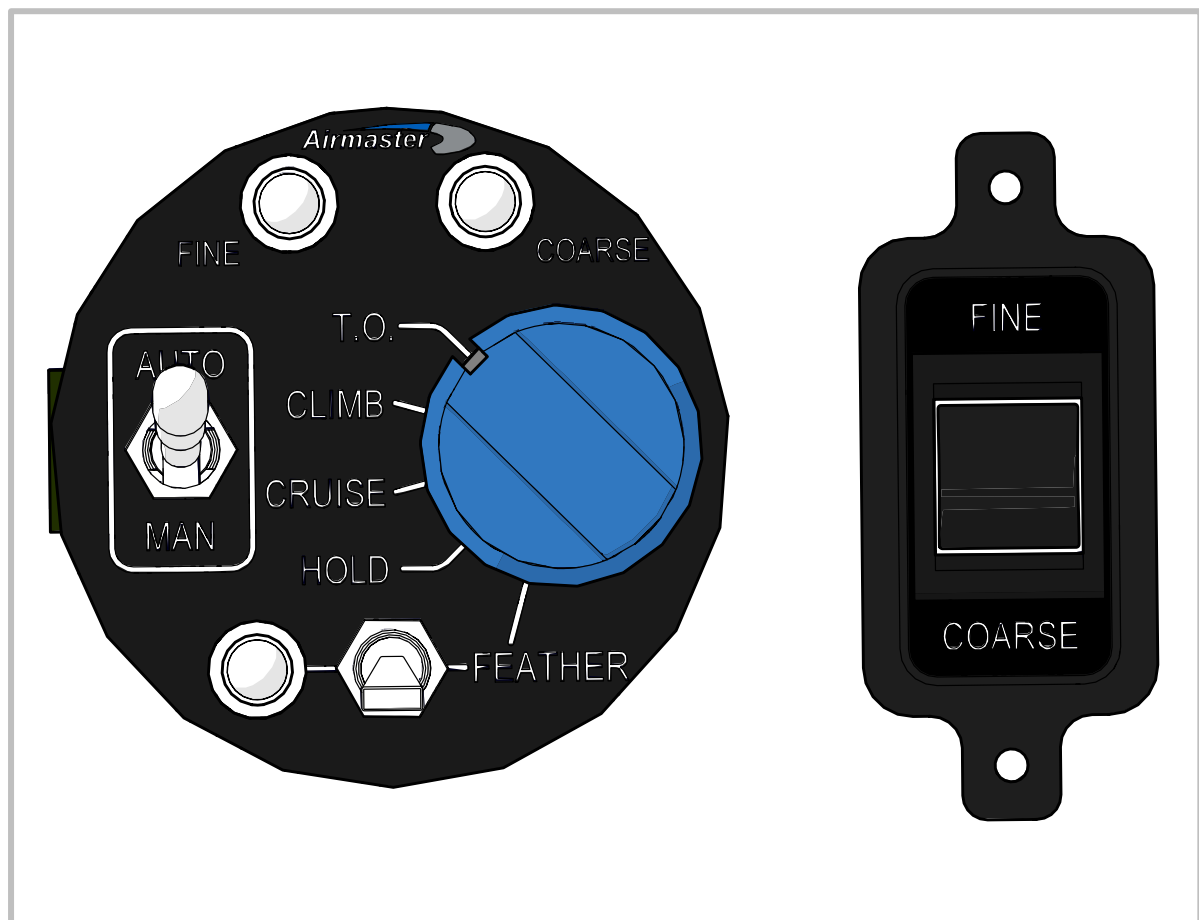


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PROPELLER OPERATING INSTRUCTIONS

GUIDE



SUBJECT:

Operation of Propeller

ASSEMBLY NO:

AP-xxx

APPLICABILITY:

All propeller models

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1. TOPIC

1.1 Introduction

This document provides operating instructions for the Airmaster propeller system.

This information supplements flight manuals and operating instructions for the aircraft and engine. It covers operational aspects of the propeller only, and should not override any instructions, cautions or warnings applicable to any other equipment.

1.2 General Handling

The Airmaster propeller is a variable pitch propeller and must be handled differently to a conventional fixed pitch propeller. Improper handling can cause the engine to exceed limits for manifold air pressure (MAP) or engine speed during flight.

Because the propeller can move to significantly coarser pitch settings than a typical fixed pitch propeller, this may impose a higher load on the engine. This can result in MAP limits being exceeded. On aircraft equipped with MAP gauges, pilots must ensure that throttle is set so that MAP remains within prescribed limits at the selected engine speed.

The Airmaster propeller is designed such that normal operation of the propeller is in automatic mode where constant speed governing functions occur.

1.3 Automatic Operation

To set the propeller to automatic mode, select AUTO on the controller's mode selector switch. In automatic mode, the propeller functions as a constant speed system, where blade pitch automatically adjusts ('governs') to maintain a set target value for engine/propeller speed. This function greatly reduces pilot workload. The pilot sets the desired power setting using the throttle, allowing them to focus on flying the aircraft while engine/propeller speed, and therefore power output, remains constant.

Engine power is typically set by adjusting the throttle to achieve a desired performance. On aircraft equipped with a MAP gauge, MAP indication may be used to help set the desired power setting.

The pilot must remain aware of the propeller's governing capabilities. The controller and pitch change mechanism have finite response times and a finite rate and range of pitch change. The system can respond effectively to normal changes in air speed or throttle to keep engine speed within governing limits. However, rapid change in air speed or throttle can cause engine speed to temporarily deviate from these limits until the propeller has sufficient time to adjust. For this reason, throttle changes should always be made in a smooth and gradual manner.

Pilots must always monitor engine speed, to ensure that limits are not exceeded. If an overspeed occurs, reduce the throttle immediately to return within limits. An overspeed may occur due to:

- Controller failure.
- Sudden increases in air speed (e.g. during a dive).
- Rapid increases in throttle.

1.4 Manual Operation

The propeller may be operated in manual override mode during any phase of flight. This is normally used in the event of a failure of the automatic control system. To set the propeller to manual mode, select MAN on the controller's mode selector switch.

In manual mode the pilot has direct control of blade pitch by using the manual control switch. The pilot must control both propeller pitch and engine throttle to achieve the desired combination of power, engine speed, and performance.

Caution

Avoid engine overspeed. A pitch setting that is too fine at high power settings may cause the engine to exceed its speed limits.

Caution

Avoid low engine speed. A pitch setting that is too coarse may prevent the propeller from reaching or maintaining the desired speed, even at full throttle.

1.5 Flight Operations

1.5.1 Using a Constant Speed Propeller

A constant speed propeller allows the pilot to set the desired power setting and fly the aircraft. However, for different phases of flight, the most appropriate governing speed must also be set, to ensure the desired power setting and performance can be achieved.

The following guidelines are provided for use of the Airmaster propeller during different flight operations. These are recommendations only on the effective use of the constant speed capabilities of the propeller and may be varied to suit desired operations.

Note

Consider adding these instructions to the aircraft flight manual.

1.5.2 Taxi

Taxiing may be carried out with the propeller at any setting, however if cooling on the ground is limited, and engine temperature becomes too high, propeller pitch (blade angle) may be increased to enhance cooling flow from the propeller:

- Select MAN.
- Toggle COARSE on the manual control switch.

1.5.3 Take-Off

- Select AUTO / T.O.
- Smoothly increase throttle to full power.
- Take off and climb to normal point after take-off checks (500ft AGL or higher is recommended).

Caution

Take-off speed may be higher than the maximum continuous speed of the engine. The time limit for operating above the maximum continuous speed should be monitored if applicable.

1.5.4 Climb

- Select AUTO / CRUISE.
- Adjust throttle to desired climb power setting.

 **Note** Often (e.g. after take-off) this will be full power (WOT).

1.5.5 Cruise

- Select AUTO / CRUISE.
- Adjust throttle to desired cruise power setting.

1.5.6 Hold

Sometimes the pilot may wish to operate the propeller at a speed that is different to the pre-set governing speeds. In such cases, hold mode may be used to set an alternative governing speed during flight. This is commonly used during cruise, to achieve improved fuel efficiency or a higher-than-normal cruise speed.

- Select AUTO / HOLD.
- Use manual control switch to adjust target speed.
- Adjust throttle to desired cruise power setting.

In hold mode, the propeller governs to the current speed setting, which is adjusted using the manual control switch. While the switch is actuated, propeller pitch adjusts in the direction indicated, causing a corresponding change in engine/propeller speed. When the desired speed is indicated on the engine tachometer, release the switch. The propeller will then govern to that new speed. Finally, adjust the throttle to set the desired power setting.

1.5.7 Before Landing Check

Add the following steps to the before landing check (e.g. CUP check: cowl flaps, undercarriage, propeller):

- Select AUTO / T.O.
- Check propeller is at the fine pitch limit (FINE lamp illuminating green).

1.5.8 Landing

Selecting AUTO / T.O. before landing ensures that maximum power is available in the event of a balked landing (go-around). In this event, smoothly increase throttle to full power as for take-off.

1.5.9 Flight in Special Conditions

When flying at low altitude, low speed, in mountainous terrain or any situation where rapid application of power may be required, the propeller should be operated in AUTO / CLIMB or AUTO / T.O. These settings enable the engine to deliver high power immediately when required.

1.6 Feathering Operation (Option)

1.6.1 Description

Feathering the propeller improves the aircraft's glide performance. This (optional) facility may be used intentionally for gliding flight (e.g. motor-gliders), or in an emergency following an engine failure.

Restoring powered flight after feathering requires time and may not be possible in the event of an engine, propeller or electrical system failure.

Any decision to feather the propeller must be made with flight safety as the primary consideration. The aircraft should remain with gliding distance of a safe landing site at all times.

1.6.2 Feather Procedure (Normal)

Before feathering, ensure that sufficient altitude is available to unfeather the propeller, restart the engine, and achieve a positive rate of climb.

Feather the propeller (automatically) as follows:

- Select AUTO / FEATHER.
- Reduce throttle to a low power setting and allow engine temperatures to stabilise as for a normal shutdown.
- Shut down the engine and initiate the automatic feather cycle by actuating the FEATHER engage switch.

Note

To expedite completion, initiate the automatic feather cycle shortly before engine shutdown.

- The automatic feather cycle completes as follows:
 - FEATHER lamp illuminates orange while propeller adjusts towards feather pitch stop.
 - COARSE lamp flashes red (5Hz), indicating that the coarse pitch stop is inactive.
 - FEATHER lamp illuminates green when the feather pitch stop is reached.

WARNING

Battery management is important during gliding flight. The controller draws less than 0.2A when the propeller is not changing pitch (typically less than lights or radios). It is therefore recommended that the controller always remains powered to allow immediate unfeathering if required. Loss of electrical power may prevent restoration of powered flight.

1.6.3 Un-Feather Procedure

Un-feathering may be performed any time after the automatic feather cycle has been initiated, including before completion.

Unfeather the propeller as follows:

- Select AUTO / CLIMB.
- The automatic unfeather cycle completes as follows:
 - FINE lamp illuminates orange as propeller pitch returns to normal flight range.

- COARSE lamp flashes red (5Hz), indicating that the coarse pitch stop is inactive.
- At completion of the un-feather cycle (or earlier, if safe), start the engine normally.
 - Engine typically starts once propeller pitch has reduced sufficiently to allow normal idle speed (usually after ~20 seconds).
 - After engine start, the propeller continues adjusting automatically to the normal flight pitch range.
- Smoothly increase throttle to climb power setting.

⚠ WARNING

Ensure that sufficient power is available throughout the unfeathering cycle. Loss of electrical power will prevent the propeller from returning to the normal flight pitch range.

1.7 Reverse (Beta) or Pre-Rotate Operation (Option)

1.7.1 Description

The (optional) reverse facility enables the propeller to produce reverse thrust (beta pitch) and is primarily designed to aid water maneuvering for amphibious aircraft.

An (optional) pre-rotate facility is also available and is primarily designed to achieve (near) neutral pitch for gyrocopters. The procedure for engaging beta pitch (for reverse-enabled propellers) and neutral pitch (for pre-rotate-enabled) propellers is identical, whereby a two-stage activation process is required.

⚠ WARNING

Beta and pre-rotate functions are strictly for ground or water maneuvering. It is expressly forbidden to attempt to use these functions for short field landings (i.e. air-braking in the case of beta operation), or at any time in-flight.

1.7.2 Beta Procedure

Initiate beta mode as follows:

- Reduce throttle to an idle power setting.
- Select AUTO / BETA.
- Engage beta control by actuating the BETA engage switch.
 - FINE lamp should flash red (1Hz), indicating that the fine pitch stop will become inactive.

📌 Note

If this doesn't occur, verify that engine speed is below RPM limit for this process. For Rotax engines, this is generally 2500rpm. Refer to controller parameter (400): Max Engage RPM.

- Select MAN.
 - FINE lamp should flash red rapidly (5Hz), indicating that fine pitch stop is inactive.

📌 Note

If this doesn't occur, verify that engine speed is below RPM limit for this process. For Rotax engines, this is generally 3500rpm. Refer to controller parameter (403): Max Run RPM.

- Use manual control switch to adjust propeller anywhere throughout its full pitch range.
 - BETA lamp illuminates orange while driving towards the reverse pitch stop (turns green when the beta pitch stop is reached).
 - COARSE lamp illuminates orange while driving towards the coarse pitch stop (turns green when the coarse pitch stop is reached).
- It is recommended that engine speed is held at approximately 3000rpm, and propeller pitch is adjusted as necessary to allow precise control of the aircraft while docking.

Note

The propeller can only be adjusted in the reverse pitch direction while engine speed is below the prescribed RPM limit (see controller parameter (403): Max Run RPM). If rpm exceeds this limit, reverse movement will be locked out until rpm is lowered below this limit.

WARNING

The aircraft must remain on the ground/water at all times while beta mode is active.

Caution

The controller does not regulate engine speed in beta mode. The pilot must maintain engine speed within manufacturer's limits at all times.

Caution

The pilot must monitor engine temperature carefully during beta operation as there may be reduced airflow through the engine and therefore reduced engine cooling.

1.7.3 Beta-Exit Procedure

Exit beta mode to resume normal operations as follows:

- Select AUTO / CLIMB.
- The automatic beta exit cycle will complete as follows:
 - COARSE lamp illuminates orange as propeller pitch returns to normal flight range.
 - FINE lamp flashes red rapidly (5Hz), indicating that the fine pitch stop is inactive.
 - At completion of the beta exit cycle, normal automatic operation will resume, and the FINE lamp will stop flashing red.

1.8 Emergency Operation

1.8.1 Symptoms

A variety of failures that may lead to incorrect operation of the propeller are possible. These failure modes will typically affect the ability of the controller or the pilot to control the propeller.

Symptoms of propeller failure may include:

- A change in engine/propeller speed during a change in power or air speed, with no associated response from the controller.
- No indications on the controller.
- FINE lamp flashing orange (this is the indication for no speed signal).
- One lamp illuminating red.
- All lamps flashing red (1Hz).
- All lamps flashing red rapidly (5Hz).
- Sudden and unexpected changes in engine/propeller speed.

Note

*For a detailed analysis of possible failure modes, including possible cause, symptoms, indications, specific actions and rectification required, refer to **ASI-7-3-1**.*

1.8.2 Emergency Procedure (Control Failure)

Perform the following actions immediately in the event of any propeller control failure.

- If necessary, reduce throttle immediately to avoid engine overspeed.
- Select MAN.
- If manual control is possible:
 - Use the manual control switch to adjust propeller pitch.
 - Adjust throttle to achieve the desired power and engine speed.

Caution

Avoid engine overspeed. A pitch setting that is too fine at high power settings may cause the engine to exceed its speed limits.

Caution

Avoid low engine speed. A pitch setting that is too coarse may prevent the propeller from reaching or maintaining the desired speed, even at full throttle.

- If manual control is not possible, propeller pitch remains fixed at its last setting.
 - If propeller pitch is within normal flight range, continue flight with caution using throttle to control engine/propeller speed and power (as with a fixed pitch propeller).

⚠ Caution

*If propeller pitch is **not at fine limit**, full power may be unavailable at low airspeeds – plan accordingly for approach and landing.*

- If propeller pitch is **outside flight range** (e.g. stuck while feathering), insufficient power may be available to sustain safe flight; **prepare for immediate landing**.

1.8.3 Emergency Feather Procedure (Engine Failure)

In the event of an engine failure, the propeller may continue to windmill, causing adverse drag. Feathering can stop windmilling and extend glide distance if engine restart attempts fail.

Feather the propeller as follows:

- Select AUTO / FEATHER.
- Initiate the automatic feather cycle by actuating the FEATHER engage switch.

Pilot Considerations:

- A feathered propeller is structurally stronger and less likely to break if it contacts the ground.
- In a forced landing, a feathered propeller may increase the likelihood of the aircraft tipping, if a blade digs into the ground.
- In some situations, leaving the propeller unfeathered may reduce tipping risk despite higher drag.

⚠ Caution

Any decision to emergency feather should balance engine restart attempts, glide range, and landing safety.