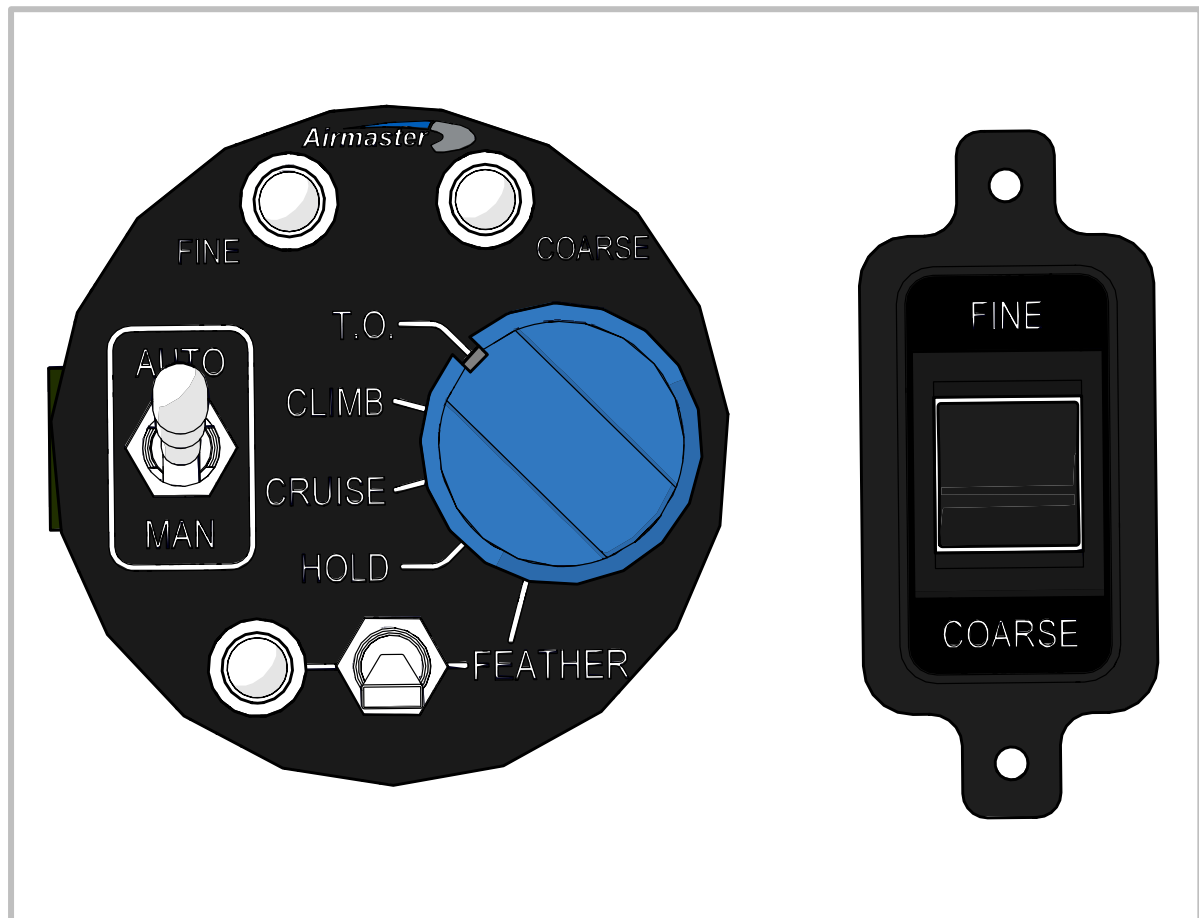


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ASI-7-3-1

PROPELLER FAILURE MODES

GUIDE



SUBJECT:

Troubleshooting

ASSEMBLY NO:

AP-xxx

APPLICABILITY:

All propeller models

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1. TOPIC

1.1 Introduction

This document outlines possible failure modes that may occur for an Airmaster propeller system. For each failure mode, the following information is listed:

- Symptoms and indications on the controller that may be observed.
- Possible cause(s) of the failure.
- Modes of propeller operation that remain possible.
- Recommended action for the pilot to maintain safe flight and minimise the risk of further damage if the fault occurs in flight.

Note

*For detailed fault-finding checks, refer to **ASI-7-3-2**. If a fault cannot be rectified using the guidance provided, contact Airmaster support for further advice.*

Note

*For immediate actions that should be followed in the event of any propeller control failure, refer to emergency operations covered in **ASI-6-2-2**.*

1.2 Loss of Power

1.2.1 Symptoms

- No indications displayed on the controller (dark).
- No automatic (AUTO) or manual (MAN) operation of the propeller is possible.

1.2.2 Possible Causes

- Failure of the aircraft electrical system.
- Tripped circuit breaker (propeller supply or propeller controller).
- Incorrectly inserted power cable connector.

1.2.3 Handling

- Propeller pitch will remain at its last setting.
- Control of the propeller will not return until power is restored.

1.2.4 Action

- If the pitch limit stops are correctly set and propeller pitch is within normal flight range, continued safe flight is possible by adjusting engine throttle (operate as a fixed pitch propeller).
- If loss of power is caused by a tripped circuit breaker, wait briefly to allow the (thermal) circuit breaker to cool, then attempt one reset.

⚠ Caution

Do not attempt multiple resets due to risk of further damage or fire unless required to maintain safe flight (e.g. when propeller is in feather pitch range).

- Identify and rectify the cause of the fault before next flight.

1.3 Open Circuit

1.3.1 Symptoms

- All lamps flashing red on the controller (1Hz).
- No automatic (AUTO) or manual (MAN) operation of the propeller is possible.

1.3.2 Possible Causes

- Broken or worn slipping brush.
- Broken or worn PC motor brush.
- Damaged electrical wiring to the propeller.
- Damaged electrical wiring within the propeller.
- Incorrectly inserted sensor-brush assembly cable or extension loom connector(s).

1.3.3 Handling

- Propeller pitch will remain at its last setting.
- Control of the propeller will not return until the fault is rectified.

1.3.4 Action

- If the pitch limit stops are correctly set and propeller pitch is within normal flight range, continued safe flight is possible by adjusting engine throttle (operate as a fixed pitch propeller).
- Refer to troubleshooting procedure in **ASI-7-3-3** to rectify fault before next flight.

1.4 Over-Current

1.4.1 Symptoms

- If over-current occurs in automatic mode (AUTO):
 - The controller lamp illuminates red in the affected pitch change direction.
- If over-current occurs in manual mode (MAN):
 - The controller's resettable thermal circuit breaker fuse (FS1) may trip.
- No automatic (AUTO) operation of the propeller is possible (this is disabled due to the internal current-monitoring function of the controller).

1.4.2 Possible Causes

- Mechanical resistance (constriction) attributed to the pitch change mechanism or blades.
- Propeller is attaining fixed hard stops due to incorrect setting of adjustable pitch limit stops.
- Electrical short (due to exposed or damaged electrical connection).

1.4.3 Handling

- Propeller pitch will remain at its last setting.
- Manual control of the propeller remains possible but should be limited to prevent further damage.
- Automatic control of the propeller will not return until the fault is rectified.

1.4.4 Action

- If over-current occurs in automatic (AUTO) mode:
 - Attempt to reset automatic operation by briefly selecting MAN, then return to AUTO. If automatic operation is not restored, use manual mode (MAN) for limited manual control.

Caution

Minimise manual operation to prevent the possibility of damaging the PC motor or PC mechanism. In this mode, current is only limited by the aircraft electrical system circuit breaker. Continuous over-currents may cause this to trip, resulting in a loss of power and control over the propeller.

- If over-current occurs in manual mode (MAN) and circuit breaker trips:
 - Briefly wait to allow the (thermal) circuit breaker to cool, then attempt one reset.

Caution

Do not attempt multiple resets due to risk of further damage or fire unless required to maintain safe flight (e.g. when propeller is in feather pitch range).

- If the pitch limit stops are correctly set and propeller pitch is within normal flight range, continued safe flight is possible by adjusting engine throttle (operate as a fixed pitch propeller).
- Refer to troubleshooting procedure in **ASI-7-3-4** to rectify fault before next flight.

1.5 Failure of Controller

1.5.1 Symptoms

- Automatic (AUTO) operation of the propeller may not be possible.
- Unexpected change in propeller pitch (and engine/propeller speed).
- Random or no indications may be displayed on the controller.

1.5.2 Possible Causes

- Hardware failure.

1.5.3 Handling

- Manual control of the propeller remains possible.
- Automatic (AUTO) control of the propeller will not return until the fault is rectified.

1.5.4 Action

- Select manual mode (MAN) to regain manual control of the propeller. Continued flight in manual mode is acceptable.

Caution

If a sudden, unexpected change in propeller pitch occurs, monitor engine speed closely and adjust throttle immediately to avoid engine overspeed (if applicable).

- Some controller failures may trip the controller's internal fuse (FS1). Operation may be regained on the ground by resetting the controller, either by temporarily removing power from the controller using the circuit breaker, pushing the internal fuse button (FS1) or briefly switching off the aircraft power. Do not carry out this action in flight.
- Identify and rectify the cause of the fault before next flight. The mode selector (AUTO/MAN) switch can be tested in accordance with procedure **ASI-7-4-4**.

1.6 Controller Software Fault

1.6.1 Symptoms

- All lamps rapidly flashing red (5Hz) on the controller.
- No automatic (AUTO) operation of the propeller is possible.

1.6.2 Possible Causes

- Issue with controller firmware version.
- Issue with controller parameter settings.

1.6.3 Handling

- Manual control of the propeller remains possible.

1.6.4 Action

- Select manual mode (MAN) to regain manual control over the propeller. Continued flight in manual mode is acceptable.
- Operation of the controller may be regained on the ground by resetting the controller, either by temporarily removing power from the controller using the circuit breaker, pushing the internal fuse button (FS1), or briefly switching off the aircraft power. Do not carry out this action in flight.
- Identify and rectify the cause of the fault before next flight.

1.7 Loss of Speed Signal

1.7.1 Symptoms

- FINE lamp flashes orange on the controller (1Hz).
- No automatic (AUTO) operation of the propeller is possible.

1.7.2 Possible Causes

- Failure of the speed sensor (inside sensor-brush block).
- Loss of the speed sense magnet (inside slipring).
- Failure of the speed sense wiring loom (sensor-brush assembly cable or extension loom).
- Incorrectly inserted sensor-brush assembly cable or extension loom connector(s).

1.7.3 Handling

- Limited manual control of the propeller may remain possible.
- The controller will restore automatic operation if a stable speed signal is restored. Other automatic functions such as feathering will remain possible.

1.7.4 Action

- Select manual mode (MAN) to regain manual control over the propeller. Continued flight in manual mode is acceptable.
- Identify and rectify the cause of the fault before next flight.

1.8 Failure of Manual Control Switch

1.8.1 Symptoms

- No specific indications will be displayed on the controller.
- No manual operation, or automatic operation in hold speed mode is possible.

1.8.2 Possible Causes

- Broken actuator.
- Damage to the manual control switch loom.
- Incorrectly inserted manual control switch cable connector.

1.8.3 Handling

- Automatic control of the propeller (besides hold speed mode) remains possible.
- Manual control of the propeller will not return until the fault is rectified.

1.8.4 Action

- Continued flight in automatic (AUTO) mode is acceptable.
- Refer to functional tests covered in **ASI-7-4-3** and rectify the fault before next flight.

1.9 Failure of Pitch Limit Microswitch

1.9.1 Symptoms

- If microswitch fails open circuit:
 - Symptoms for open circuit (previous) will apply.
- If microswitch fails closed circuit:
 - The adjustable pitch limit stops are rendered inoperative, and the propeller will be able to be operated beyond the setting of the applicable adjustable pitch stop (i.e. outside the normal flight range) due to normal operation by the controller or the pilot. If the propeller pitch is left outside the flight range, safe flight may not be possible in all situations.
 - No indications other than normal will be observed on the controller, however if the propeller pitch is driven to one of the fixed pitch stops, then an over-current alarm may be observed.

1.9.2 Possible Causes

- Hardware failure.

1.9.3 Handling

- Limited (and unrestrained) manual and automatic control of the propeller remains possible.
- Propeller pitch is limited by the fixed pitch stops ('hard stops') at all times.

1.9.4 Action

- If the operator observes symptoms that indicate that propeller pitch has adjusted outside the normal range, such as an unusual combination of power, airspeed, and engine/propeller speed, then the propeller should be operated in manual mode.
- Maintain propeller pitch in a normal range with reference to power, airspeed and engine/propeller speed.
- Refer to functional tests covered in **ASI-7-4-2** and rectify the fault before next flight.

1.10 Failure Modes Specific to Beta (or Pre-Rotate) Operation

Beta-enabled propellers can attain blade pitch angles (under specific conditions) below those that can sustain safe flight; this facility poses additional risk.

Beta propellers incorporate five independent layers of protection that are designed to mitigate these risks under a variety of potential failure scenarios as follows:

1.10.1 Pilot Error

The pilot may inadvertently attempt to initiate beta operation in flight.

- To prevent this mistake, a deliberate 3-stage process is required to initiate beta operation:
 - Select AUTO / BETA
 - Lift BETA engage switch.
 - Select MAN.
- The controller incorporates a software safeguard which disables beta operation if RPM exceeds a preset maximum which would not normally be encountered in flight.

1.10.2 Controller Malfunction

A controller malfunction may energise the beta circuit. In this event, beta operation cannot occur, as deliberate manual input from the pilot is required (via the manual control switch) to drive the propeller into the beta pitch range. Without this command, the propeller remains in the normal flight pitch range.

1.10.3 Failure of Pitch Limit Microswitch

The primary fine pitch stop microswitch may fail. To mitigate this risk, a secondary microswitch located approximately 2° below the first microswitch offers redundancy.

If the first microswitch fails open, then failure mode corresponds to that described in the open circuit section. If the microswitch fails closed, the pitch change mechanism will briefly continue travelling until the secondary microswitch is activated, which stops pitch travel.

1.10.4 Failure of Secondary Pitch Limit Microswitch

The primary and secondary fine pitch stop microswitches may both fail. In this case, a mechanical hard stop prevents further pitch travel. This hard stop is centrifugally actuated at engine speeds which would normally be encountered in flight and corresponds to the same angle as the fine hard stop in regular hub types.

1.10.5 Centrifugal Hard Stop Malfunction

The centrifugal stop may suffer a malfunction:

- If the stop seizes in the active position, operation in the beta pitch region cannot occur. Attempting to drive the propeller into the beta pitch region will result in an overcurrent. Normal propeller operation remains possible in all other modes.
- If the stop seizes in the inactive position, the propeller relies on the preceding layers of protection to prevent beta operation: pilot actuation, software safeguard, microswitches 1 and 2.