

Instruction manual

JetCAT Air Speed Sensor



Airspeed Sensor

The optional *Airspeed Sensor* consists of a pitot tube and a precision, differential pressure sensor. By sampling the ambient air temperature, the current flight speed of the model is calculated by the ECU, from the measured difference in static versus dynamic pressure.

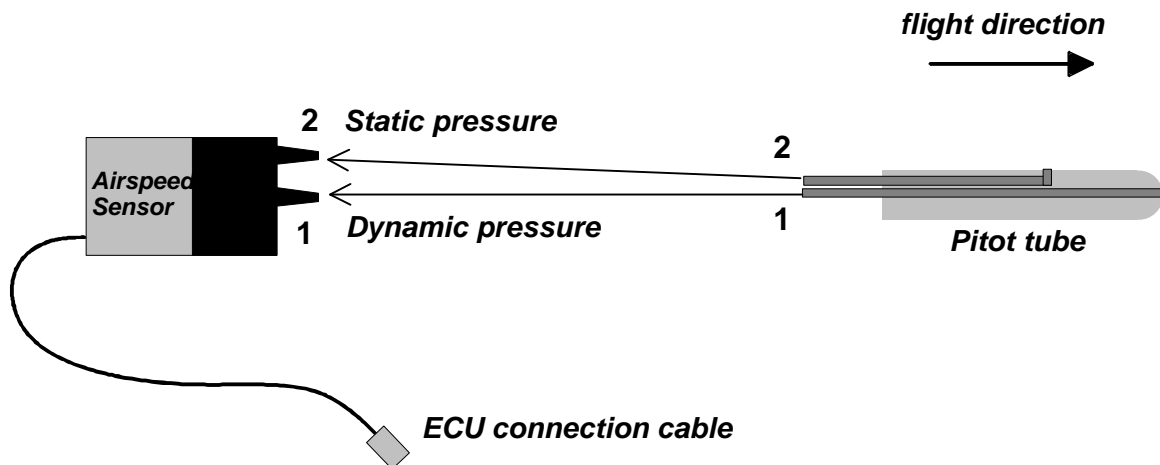
When the ECU is used without the *Airspeed Sensor*, it is set in **thrust control** (normal) mode. In this mode, the throttle stick directly alters turbine thrust.

When the *Airspeed Sensor* is plugged into the ECU, it automatically establishes **speed control** mode. In **speed control** mode, the turbine thrust is automatically controlled – to keep the model at a predetermined speed and/or to limit the model's maximum speed.

Speed control mode features several functions:

- measurement and storage of maximum and average flight speeds
- automatic restriction of maximum flight speed
- maintenance of current flight speed (fixed "**Cruise Control**")
- regulation of flight speed, analogous to throttle stick position (adjustable "**Cruise Control**")

Connection diagram for the Airspeed Sensor:



Connect the air lines from the pitot tube to the airspeed sensor, using the 1/16th inch ID vinyl tubing provided.

1 = Dynamic pressure input

2 = Static pressure input

Note: Tubing length and/or cross sectional area has no influence on measurement precision

Connect the *Airspeed Sensor* cable to the appropriate socket, where indicated on the ECU (see: engine diagram in the Operation Manual). The orange wire is aligned to the pulse symbol. Once the *Airspeed Sensor* is connected, the ECU controls additional functions:

- under the **Run** menu, measurement of current air speed (“**Airspeed**”) and desired flight speed (“**SetSpeed**”), can be displayed
- under the **Min/Max** menu, the measured maximum speed (“**MaxAirSpd**”) and the average flight speed (“**AvgAirSpd**”), can be displayed
- under the **Limits** menu, speed limits and the parameters of speed regulation can be predetermined

Limits menu parameters assigned to the *Airspeed Sensor*:

Parameter	Explanation
MAX LIMITAIRSPD	Maximum allowed flight speed of the model, in km/h. If this speed is achieved, turbine thrust is automatically reduced – to keep the model from exceeding the maximum limit. This safety option is always active, despite the position of the AUX switch.
Max.AirSpeed	Maximum flight speed value, in km/h, for the Cruise Control mode. This value corresponds to the speed at the maximum throttle stick position.
Min.AirSpeed	Minimum flight speed value, in km/h, for the Cruise Control mode. This value corresponds to the speed at the minimum throttle stick position.
SpeedRegVal-I	Regulator speed, which sets the reaction time of the PID servo loop – much like a sensitivity control in a gyroscope system. Default value = 18 Increase this value, to increase reaction sensitivity.
SpeedRegVal-P	Regulator coefficient (proportional) Default > 500 Under normal circumstances, does not require alteration.
SpeedRegVal-D	Regulator coefficient (differential) Default = 50 Under normal circumstances, does not require alteration.
SPDCTRL SW0 ACT	With the <i>Airspeed Sensor</i> connected to the ECU – by moving the AUX switch to the Off (SW0) position, while maintaining a model air speed > 40km/h, the following options are available: Hold-Speed = momentarily sustains the current flight speed DISABLED/NONE = no function, thrust control remains active Turbine OFF = turbine will immediately shut off LrnSpeed Lo/Hi = learn minimum or maximum flight speeds Lrn Speed Lo = learn minimum flight speed Lrn Speed Hi = learn maximum flight speed
SPDCTRL SW2 ACT	With the <i>Airspeed Sensor</i> connected to the ECU – by moving the AUX switch to the AutoOff (SW2) position, while maintaining a model air speed > 40km/h, the following options are available: Hold-Speed = momentarily sustains the current flight speed DISABLED/NONE = no function, thrust control remains active LIN-Speed Ctrl = linear Cruise Control 3-StepSpdCtrl = three speed Cruise Control

Explanation of the speed regulator options:

If the *Airspeed Sensor* is NOT connected – the standard functions of the **AUX** switch are assigned as follows:

Standard assignments of the **AUX** switch:

- **Position SW0** = **Off**, turns the turbine off, immediately
- **Position SW1** = **Start/Standby**, normal **thrust control**
- **Position SW2** = **AutoOff**, normal shutdown method

With the *Airspeed Sensor* connected to the ECU, the **AUX** switch positions **SW0** and **SW2** include the expanded functions that are covered in the above parameters table. These expanded assignments are only valid when the model is airborne (with a flight speed > 40 km/h), otherwise the standard functions remain active. As long as the **AUX** switch is maintained in the center position, the ECU continues functioning in **thrust control** mode and turbine thrust can only be determined by the throttle stick position.

Available options:

Option	Description
Hold-Speed	Maintains the current flight speed. Flight speed is measured at the time the AUX switch is placed in the SW0 position. This action establishes the ECU in speed control mode (i.e.: the model maintains the flight speed measured at the time the mode is activated, despite the throttle stick position). This mode remains active until the AUX switch is returned to the SW1 position. WARNING: When the AUX switch is set in the SW0 position, the model must be flying faster than 40 km/h, otherwise the turbine will shut off.
DISABLED/NONE	No function. Thrust control mode remains active.
Turbine OFF	Immediately shuts down turbine. Normal thrust control mode remains active.
LrnSpeed Lo/Hi	Learns the current flight speed. If the throttle stick is set at less than half throttle and the AUX switch is momentarily placed in the SW0 position, the current flight speed is assigned and recorded as the Min.AirSpeed parameter. If the throttle stick is set at greater than half throttle and the AUX switch is momentarily placed in the SW0 position, the current flight speed is assigned and recorded as the Max.AirSpeed parameter. By momentarily activating the AUX switch, this option makes it possible to store a particular slow or fast model speed, while in flight. These values then become the parameters for the Cruise Control mode, plus the operator can also display the values in the limits menu, after landing. WARNING: When the AUX switch is set in the SW0 position, the model must be flying faster than 40 km/h, otherwise the turbine will shut off.

Lrn Speed Lo	<p>Learns the slow flight speed. If the AUX switch is momentarily placed in the SW0 position, the current flight speed is assigned and recorded as the Min.AirSpeed parameter.</p> <p>WARNING: When the AUX switch is set in the SW0 position, the model must be flying faster than 40 km/h, otherwise the turbine will shut off.</p>
Lrn Speed Hi	<p>Learn the fast flight speed. If the AUX switch is momentarily placed in the SW0 position, the current flight speed is assigned and recorded as the Max.AirSpeed parameter.</p> <p>WARNING: When the AUX switch is set in the SW0 position, the model must be flying faster than 40 km/h, otherwise the turbine will shut off.</p>
LIN-Speed Ctrl	<p>Cruise Control mode, with linear speed regulation to the throttle stick position. Flight speed is controlled between the values of the “Min AirSpeed” (throttle stick in the minimum position) and “Max AirSpeed” (throttle stick in the maximum position).</p>
3-StepSpdCtrl	<p>Cruise Control mode, featuring three different speeds. Flight speed can be set to three predetermined speeds, between the values of “Min AirSpeed” (throttle stick in the minimum position) and “Max AirSpeed” (throttle stick in the maximum position).</p> <p>Speed 1: “Min AirSpeed” → throttle stick in the minimum to 1/3rd position Speed 2: (“Min AirSpeed” + “Max AirSpeed”) / 2 → throttle stick in the 1/3rd to 2/3rd position Speed 3: “Max AirSpeed” → throttle stick in the 2/3rd to maximum position</p>

Reminder:

The turbine can be immediately switched off, any time the throttle stick and the throttle trim are brought to their minimum positions.

If **Hold-Speed** or **Cruise Control** modes are activated, while the model is flying over 40 km/h -- and should the model then slow down, to a speed less than 40 km/h -- **Hold-Speed** or **Cruise Control** *will remain active*. The turbine will NOT shut off, unless the **AUX** switch is moved back to the **SW1** position and then returned to **Hold-Speed** or **Cruise Control** position.

WARNING:

Make sure the *Airspeed Sensor* is working, before using features that require a minimum flight speed to operate. If the system is not operating properly, you may inadvertently shut off your engine, in flight. To verify that the *Airspeed Sensor* is functioning, apply a little air pressure and note the change in “**Airspeed**” on the **run** menu display.

Two examples:

Example 1 – Hold-Speed function

SpdCtrl SW0 Act assigned to “**Hold-Speed**” and **AUX** switch set in the **SW0** position:

- Flight speed is measured and stored, when the **AUX** switch is moved to the **SW0** position. Thrust is then regulated automatically, to maintain this memorized speed, despite the throttle stick position. This regulator function is turned off immediately, by returning the **AUX** switch to the **SW1** position (normal **thrust control**).
- If this function is activated while flight speed < 40 km/h, turbine will shut off, immediately (normal **Off** function).

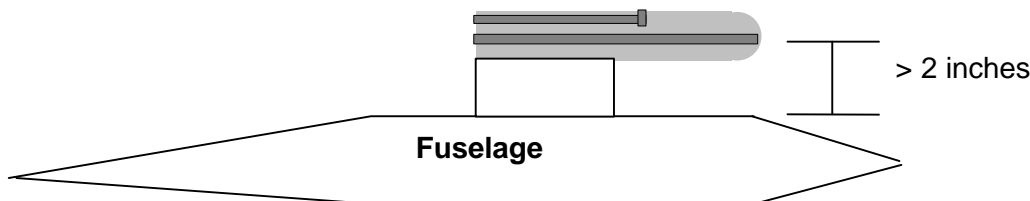
Example 2 – Linear speed regulation

SpdCtrl SW2 Act assigned to “**Lin-SpeedCtrl**” and **AUX** switch set in the **SW2** position: **Cruise Control** mode becomes active, featuring linear speed regulation to the throttle stick position.

- The minimum throttle stick position corresponds to the parameter “Min AirSpeed” and the maximum throttle stick position corresponds to the parameter “Max AirSpeed”.
- If flight speed < 40 km/h when this function is activated, the turbine will shut off (normal **AutoOff** function).

Airspeed Sensor Mounting:

Experiments indicate that the *Airspeed Sensor* is more accurate when the pitot tube is side-mounted on the widest part of the fuselage. In this configuration, the pitot tube should stand off from the fuselage, by at least two (2) inches. Because each model installation is different, Golden West Models and JetCAT will have additional mounting information for review, as auxiliary data becomes available.



Hold Speed and Cruise Control limitations:

Under normal circumstances, the *Airspeed Sensor* is primarily used for limiting the maximum flight speed and/or recording the maximum and average speeds of the model. Nonetheless, **Hold Speed** and **Cruise Control** modes are clever additions. These modes require evaluating and adjusting the PID parameters in the **limits** menu, while flying the model with a different technique. The slower reaction time of the throttle response necessitates executing smoother patterns, with limited pitch changes. Experimenting will identify how the turbine will react and help ascertain how to compensate for its limitations.