

## Safety Warning.

- ?? When using the Throttle Jockey for the first time or making changes to the throttle servo throw always perform the calibration operation.
- ?? Always perform a range check after installing the Jockey.
- ?? When starting the model, always keep the throttle below 25% to ensure that the jockey does not regulate the throttle.
- ?? Set the failsafe of the throttle channel to the stop position of the engine.

## Model Avionics "Throttle Jockey" Instructions.

### Introduction.

The Throttle Jockey is a digital speed regulator for Model Helicopters. It uses an adaptive feed-forward control algorithm to regulate rotor speed. The Jockey monitors and regulates engine speed. There are two types of rotor speed regulators, ones that measure rotor speed from the main gear and ones that measure rotor speed from the fan. The main gear measuring regulators suffer from over speed any time the rotor system is unloaded. Engine shaft regulators in an unloaded rotor system will keep the engine speed constant. The Jockey continuously adapts to the response of the engine and the demands of the pilot. Aggressive throttle commands cause the Jockey to underdamp the control loop yielding a fast response to changing loads and slowly changing throttle command cause the Jockey to overdamp the control loop yielding a smooth response to changing loads.

The Jockey employs a pulse filtering system that cleans up any hits or glitches on the auxiliary and throttle channels if used on an FM system, but for best results use a PCM system.

The jockey is designed to regulate the engine speed between 9500 and 20500rpm. The actual head speed can be calculated by dividing the engine speed by the main gear ratio.

$$\text{Rotor rpm} = \text{engine rpm} / \text{gear ratio}$$

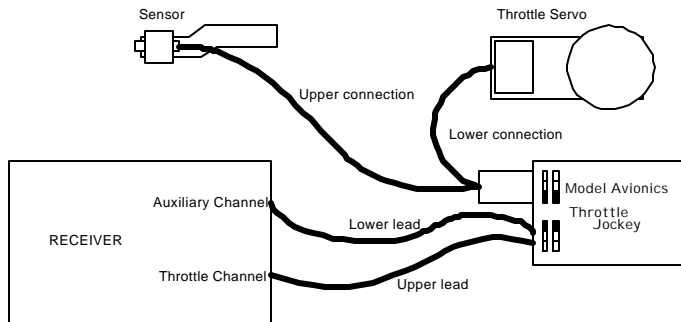
For example, a 9:1 gear ratio would yield a regulated head speed range of 1055 to 2253 rpm.

The modelavionics website (<http://www.modelavionics.com>) includes the latest information, setup tips and an on-line ATV calculator.

### Connections.

The jockey has 2 input channels, one for the throttle and for an auxiliary channel. The auxiliary channel is used to disable regulation and set the target regulation speed. The lead nearest the label is the Throttle connection to the receiver and the lead furthest from the label in the Auxiliary channel connection to the receiver. These connectors are compatible with both JR and Futaba receivers. On Futaba receivers, the brown wire should be oriented in the same polarity as the black wire.

The jockey has a sensor input and a throttle servo output. The header nearest to the label is the sensor input and the header furthest from the label is the throttle servo output. Note the polarity of the headers. On JR servos, the brown side of the lead should be oriented with the black square on the label.



## Calibration

During calibration, the Jockey measures the limits of the auxiliary and throttle channels. Once calibrated, the Jockey stores the measurements in non-volatile memory.

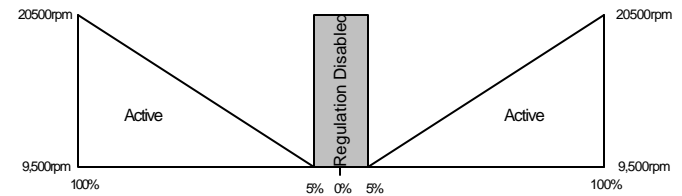
Calibration only needs to be performed when first installing the Jockey, changing throttle servo throws or after transferring the Jockey to a new machine.

- ?? Setup the throttle servo operation so the travel (ATV) is as close to +/-100% as possible. Set the throttle curve to be linear.
- ?? Set the Aux travel (ATV) to +/-100%, make sure that any mixing to the Aux channel is turned off.
- ?? Set the throttle and trim to the low (stopped) position <- Important!
- ?? Turn on the transmitter and then turn on the receiver.
- ?? During the first few seconds of operation toggle the aux switch a couple of times.
- ?? The green LED will flash indicating that the jockey has entered its calibration phase.
- ?? With the throttle trim all the way down raise and lower the throttle then cycle the aux switch a couple of times.
- ?? The jockey will extinguish the green led indicating that it has measured and stored these parameters.

To verify operation the throttle servo should operate normally. Verify the regulation enable threshold by raising the throttle stick above 25% of its travel and observe the green LED. It will illuminate indicating that regulation is enabled.

### Aux channel operation

The aux channel is usually assigned to a slider, pot or two or three position switch. The ATV of this channel controls the active state of the Jockey as well as the target speed. If the ATV in either direction is set to less than 5%, regulation is disabled. An ATV setting between 5% and 100% sets the target speed. 100% ATV is the highest target rpm (20500) and 5% ATV is the lowest rpm (9500). To verify operation, raise the throttle above the 25% threshold and lower the active ATV of the auxiliary channel below 5% and verify the Green LED is off. Alternatively, the ATV at each state of the aux switch can be used to set a different speed target. ATVs greater than 5% set the target rpm. 6% corresponds to 9500 rpm and 100% corresponds to 20500 rpm. On some radio systems, the auxiliary channel can be mixed with the flight mode switch. Different ATVs (or speeds) can be assigned to each flight mode setting using this method. Set the PCM failsafe to 0% for this channel.



Auxiliary Channel Speed Settings

### Throttle channel operation.

Make the servo operating range as close to +/-100% ATV as possible.

Use backup throttle curves.

Set the flight mode/stunt/idle up minimum throttle settings greater than the 25% so that regulation is enabled at all stunt throttle stick positions. (note that regulation can still be disabled using the aux channel).

Make sure that the engine can idle reliably when the throttle stick is below 25%.

Set the throttle hold below the enabled threshold so that regulation is automatically disabled during autorotations.

Set the PCM failsafe to the stop position of the engine.

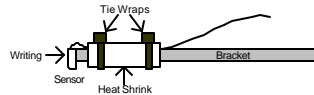
Regulation is enabled only after all the following conditions are met:

1. The jockey has been calibrated.
2. The throttle is raised above 25%
3. The active auxiliary state ATV is above 5%
4. The engine has reached the target speed for more than 1 second.

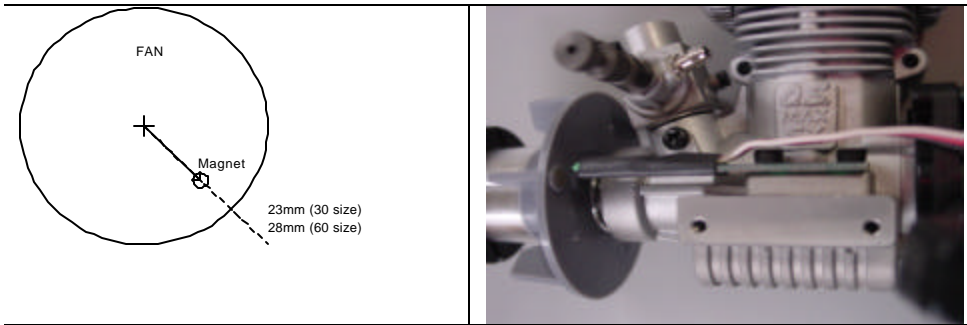
#### Sensor installation.

The jockey uses a magnetic hall-effect sensor. The magnet is installed on the cooling fan of the engine and the sensor is attached to a bracket which attaches to one side of the engine mount.

Use the supplied Heat Shrink tubing and tie wraps to mount the sensor to the bracket. A dab of Cyno can be used to secure the sensor and tie wraps once the position has been set. The sensor is carefully bent over the top of the bracket with the writing on the sensor facing the fan (Note: The most sensitive side of the sensor is the side with the writing, however, if you have a magnet installed from a previous Futaba GV1 setup, the Jockey sensor needs to be oriented with the side without the writing facing the magnet).



The magnet should be mounted on the underside of the fan at a radius of 28mm (60 size) or 23mm (30 size) from the center of the fan. Drill a 4mm hole 1.5mm deep and epoxy the magnet to the fan. Do **not** use metallic epoxy such as JB-Weld, it will lower the performance of the magnet. Use a good epoxy with a 20min or greater curing time.



The sensor must be mounted as close to the magnet as possible. The sensor must be less than 2mm away from the surface of the magnet.

The sensor is only sensitive to one pole of the magnet. To check the correct orientation of the magnet, connect the Jockey to the receiver and turn on the transmitter, connect the sensor and pass it in front of the magnet. The Red LED will toggle as the sensor detects the magnet. After installation, this method can be used to periodically check that the sensor and magnet are in range.

#### Operation.

After power-up, the Jockey enters a 2 second boot sequence waiting for a toggle on the auxiliary channel. A toggle on the aux channel will cause the Jockey to enter the calibration sequence. Normally the Jockey will enter an idle state monitoring the sensor, throttle and auxiliary channels waiting to be enabled. Once enabled the jockey waits for the engine to reach the target speed set by the auxiliary channel state ATV. After 1 second, the Jockey will slowly and smoothly take over the throttle channel, regulating the engine directly. If the target speed is changed (by changing the aux state setting), the Jockey will acquire the new speed target setting. During regulation if the sensor malfunctions or the throttle falls below 25% or the aux setting is

changed to less than 5%, the Jockey immediately and abruptly disables regulation, passing control back to the receiver.

Rules of regulation engagement.

The Jockey will only enable regulation after ALL of the following conditions have been met:

1. The Sensor, Throttle and Aux channel are operating correctly AND
2. The Jockey has been calibrated AND
3. The Throttle stick is above 25% AND
4. The AUX ATV is greater than 5% AND
5. The target speed has been reached.

After regulation has been enabled, the Jockey will pass control back to the throttle channel if ANY of the following conditions occur:

1. The Throttle stick is below 25 % (Throttle stick priority) OR
2. The sensor fails OR
3. The AUX ATV is less than (Auxiliary disable) 5%

#### Four-stroke engine setup.

Four-stroke engines run about half the speed of a two-stroke engine. Two magnets can be installed 180 degrees apart on the fan. This will cause the Jockey to regulate at half the setpoint rpm (4750 to 9250 rpm).

#### Specifications:

Regulation range:	9500 to 20500 rpm engine shaft speed. 4-stroke: 4750 to 10250 rpm
Control System:	Adaptive, digital Feed-Forward
Resolution:	0.04Hz (2.26rpm engine speed)
Response:	20ms
Operating Voltage range:	3.56 – 8V
Operating Temp range:	-40 to +85 degrees C
Weight:	20g
Current Drain:	17mA @ 4.8V
Command oversampling:	8X
Nominal command:	1510us
Absolute range:	900us to 2200us

#### Disclaimer and Limitation of Liability

Specifications subject to change without notice.

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