

FADEC/ECU

The Auto start ECU/FADEC is made by Regal Electronics. It is a reliable unit and is supplied programmed for your JM66. The engine has already been set up and tested using the FADEC/ECU so there is very little to adjust in order to get the engine running.

Confirm you have connected the ECU input to the throttle channel of your receiver and the Data Terminal is plugged into the ECU.

Ensure no rates or curves are used with your transmitters throttle channel. If you are using digital trims ensure you program an alternate transmitter switch to an immediate throttle cut for sake of safety.

Connecting glow plug and starter

Connect the green 6 pin connector from the ECU to the one on the engine. Depending on the type of glow plug used, it could be necessary to modify the power that the ECU provides to the plug through the appropriate menu in the data terminal.

The ECU has been factory set and tested for the glow plug supplied with your engine. Do not to push down too hard on the glow plug driver rubber boot.

Aligning transmitter with ecu

This must be accomplished for proper turbine control!

Make sure that your pump battery is disconnected prior to this procedure.

Below in bold are what you will see while aligning the transmitter to the FADEC/ECU. Turn on the transmitter and receiver. The opening screen should show as below:

(If the temp” probe is not connected it will show as 0’C). “T” = ambient temp’.

Trim Low T=030°C
RPM 00000 PW 000

The buttons are down, up, plus and minus.

Use the arrow up button and scroll through the menus until you find the one showing:

Transmitter yes adjust

It is imperative that each change be stored by pressing (+) button on the data display which will advance the next screen.

Follow the directions again storing the data with the (+) button and so on until complete.

Press the right hand button (+) and the screen will change to:

Stick Up Trim
Up (Full power).

On your transmitter, raise the throttle stick and trim to full. Ensure stick is firmly against the stop.

Now holding the stick against the stop, press the right button (+) to set the value into the ECU.

The screen will now change to:

Stick Down
Trim Down (Stop)

Move the trim and throttle stick back to zero and again press the right hand button (+).

The display will now change to:

Stick Down
Trim Up (Idle)

Leaving the throttle stick in the minimum position, raise the throttle trim to the full up position, and again press the (+) button.
FADEC/ECU setup is now complete.

This setup can be validated in screen 2.

With the stick lowered and trim raised a value of 10-30% should be displayed in screen 2 on your LCD.

With stick/trim full up 100% should be displayed.

These settings should remain the same unless the receiver is changed out or settings in the transmitter regarding the throttle function are changed.

There are times when using a Futaba transmitter the servo reversing of the throttle maybe required.

Preparing the engine for operation

Select a clear area for running –

keep clear of areas with loose debris that could be picked up or drawn towards the intake.

Confirm your test stand is securely fixed to a bench or heavy table.

Keep your hearing protection within easy reach and a fire extinguisher available.

Ensure the fuel tank is position well clear of the exhaust area and secured.

The same applies to the starting gas canister.

First engine runs.

Fill the start gas tank or use separated start gas fuel source and fuel tanks with filtered clean fuel.

Important! Confirm all batteries are freshly charged and connected up. Fresh batteries are imperative to the correct operation of the electronic components. Check that there is a temperature reading on the data terminal. It should read ambient air temperature.

Ensure the running area is clear of onlookers – especially the zone of about 25' feet radius around the engine.

Verify that the fuel tubes are full of fuel and purged of all air, if not; carry out the fuel prime sequence as described below.

Priming the fuel system:

Purging the fuel line of air prior to turbine operation will make the turbine start easily. Take extra care when priming fuel line, ensure fuel line is primed only up to engine; too much fuel inside engine will cause excessive flaming during start sequence or worse the turbine may overheat shutting itself down trying to start.

Priming is achieved by raising the throttle stick to full throttle and pressing the menu up button (.) on the LCD display. The fuel pump will come on at about 25% power. Please observe the fuel line to engine very carefully and pull throttle back as soon as fuel reaches near the engine. Pulling the throttle back will stop the prime sequence.

The second the fuel reaches the vicinity of the engine pull the throttle stick down and the turbine will go into start sequence.

If you are not ready for the turbine to go into start sequence just pull the throttle stick down partially. This process can be repeated if required by moving the throttle stick to the top again. Repeat this as needed by resetting the receiver.

IMPORTANT: The prime procedure should be done only to fill the fuel tubes and filters in the case of a first installation or in case of disassembly of the fuel tubes.

Also, prime if the aircraft has been stored and the fuel lines purged.

Do not flood the turbine with fuel during priming, this will cause excessive flames on start up and a hot start that may damage the turbine or worse, dumping raw fuel into the fuselage of your aircraft.

If you think you have a wet start condition it may be

indicated by repeated hot starts it will be noticeable on the temperature display $>900^{\circ}\text{C}$ “overheat” during start up and the start will be exceptionally fiery.

If this occurs, pack paper towels into the front of the turbine and raise the tail of the aircraft vertically so that the excess fuel goes into the paper towels. You may have to remove the starter and dry the starter if it gets wet with fuel.

Be careful not to get fuel all over the inside of the aircraft as this will be a fire hazard and is likely to start fire when the engine is started.

Lower the “start ramp” value one or two points then try to restart turbine to burn out excess fuel. The turbine may not arrive at idle until “start ramp” is adjusted back to +1 or +2. If turbine consistently wont reach idle, or is taking too long and is not overheating raise the “start ramp” value up one or 2 points.

Starting the Turbine

Set the throttle stick down and the trim up. “Idle” - Confirm that the green LED in the ecu is illuminated and the screen will show "Ready".

Ensure that the trim is moved well into the “Ready” zone. If the trim is set on the edge of “Ready” the ecu will teeter back and between “Stop” and “Ready” interfering with proper operation of the turbine.

Move the stick to 100% and then back to idle again. Then the FADEC/ECU will automatically check the glow plug circuit and if the plug is good and connected it will energize the plug, and say “glow test” wait 1 second then apply power to the starter and open the gas solenoid. In the screen of the Ecu it will show the word "Ignition"

The gas will ignite. You will hear a "POP" confirming this, the temperature

indicated will rise.

When the FADEC/ECU detects an increase in temperature of 50°C from the temperature read at the moment the start is initiated or when temp goes above 100°C, the screen will change to "preheating". The fuel pump will begin to operate and power to the glow plug power will be turned off.

Next the screen will change to "Fuel ramp". In this phase the FADEC/ECU will be gradually increasing the starter power and the pump will begin to pump kerosene. When the preset RPM is reached the FADEC/ECU will automatically disconnect power to both the starter and gas solenoid valve. When the rotor speed reaches idle, the screen will change to "running" and the engine speed will stabilize.

The Turbine is Running!

Control of engine power/rpm is now handed back to the transmitter and controlled by the position of the throttle stick. Raise the throttle to full power very slowly making the throttle stroke from idle to full power take at least 10 seconds.

Let the turbine stabilize at full power. Pull the throttle back down to idle taking 10 seconds. Perform this procedure twice.

This procedure will calibrate the FADEC/ECU for the current conditions. After that you should be able to move the throttle stick as fast as desired and the FADEC/ECU will manage the turbine as required and as fast as possible for the turbine. This setting will be stored in the FADEC/ECU after the correct shut down procedures are followed.

Engine shut down procedure

To shut down the engine lower the trim and the stick.

It is recommendable that before shutting down raise the throttle stick to approximately 50%, allowing temperatures to stabilize for about 6 seconds, this can be witnessed on the FADEC/ECU display temperature display.

Pull the trim down all the way then bring the throttle stick down and the engine will shut down and proceed into its cooling cycle.

The starter motor will come on periodically. The cooling cycle will continue until the engine temperature is below 100°C. After that it is permissible to shut the aircraft power off.

What to do in case of an emergency

If there is a problem lower throttle trim immediately. If the starter motor is free raise the throttle stick to full throttle and this will spin the starter motor to cool the turbine.

If the turbine is unable to spin it is a good idea to use an external air source such as a battery operated leaf blower or even compressed air.

If the fire remains inside the turbine use a fire extinguisher on the intake side of the engine (preferable a CO₂ type extinguisher. If a regular dry powder type extinguisher is used the turbine will have to be sent for service and cleaning. If your turbine is mounted internally go with the CO₂ extinguisher immediately.

Note: the purpose of the cooling cycle is to prevent the heat from the turbine conducting down into the bearings and coking the fuel/oil into the ceramic bearings thus shortening the life of the bearings.

It is important that when you are finished flying that you are sure to turn off

your aircraft receiver power shut the start gas valve off and unplug the pump battery. There are cases that the plane was left on another turbine operator on the same frequency has started their own plane and inadvertently starting the stored aircraft's turbine in the process. Thus, burning down the trailer of the stored aircraft.

Note

If the turbine is mishandled and the starter gets misaligned the FADEC/ECU can be easily damaged. Always listen for a smooth starter engagement and disengagement during start sequence. Do not try to start a turbine with a misaligned starter. With that being said "do not pick up turbine by the starter as this can cause misalignment."

Fuel System

Always use appropriate containers to store fuel.

It is a good idea to use some type of air trap or as a minimum a header tank that the main tank cascades into. Be sure to use a felt wrapped clunk as this prevents bubbles from entering the fuel system. If bubbles are introduced into the fuel system during operation they may cause a flame-out condition.

At the same time it is important to have a relatively clean fuel plumbing system a strained fuel pump makes for unstable turbine control.

The best orientation for the fuel pump is vertical. It is important to ensure any fuel seepage does not reach the motor brushes.

The fuel feed from the pump to the engine should have sufficient length of the clear tubing fitted to allow placement of the electronic fuel shut-off valve and the valve should always go on the pressure side.

Be sure to make square cuts when cutting the fuel in as it will be easier to release the push-fit connections. To release a push-fit connector; push in on the tubing and blue flange then while continuing to keep the blue flange depressed pull the tubing out of the push-fit connector. This process may take practice.

Fuel and Oil

Use clean filtered fuel that is available from farm stores, hardware stores, etc. Jet A-1 and turbine oil can be found at airports. Beware when purchasing in small quantities of fuel from bulk type storage.

Kerosene purchased in 5 gallon containers from the hardware store can be more expensive but very clean.

Ensure the fuel is clean and filtered at each stage of mixing and transfer to the model fuel tank. Not using clean good quality fuel will result in blocked fuel needles (fuel needles are hypodermic needles that inject fuel into the turbine combustion chamber). Even if one or two needles get clogged the turbine may fail to operate properly.

Use quality aircraft grade turbine oil. Do not use two-stroke lubricant of any kind.

A fuel ratio of 4-5% is safe. Use one quart of oil per 5 gallons of kerosene/Jet fuel.

Fuel Lines

For the fuel lines use polyurethane or nylon fuel line. Do not use silicon anywhere in the fuel system because it is quickly broken down by the kerosene / Jet A-1. Tygon tubing for gasoline engines is acceptable but only to be used before the fuel pump. If you think you have suitable tubing soak it in kerosene for a couple of days and then check its properties for swelling, etc.

Start Gas

A start gas is required to preheat the combustion chamber during start up. There are various mixes of propane/butane mixes available and will work fine. Most

common and the cheapest is propane from the camping/soldering bottles. However, straight propane will need to be regulated to prevent jamming of the solenoids especially in warmer weather when gas pressure is higher.

A regulator needs to reduce gas pressure below 25 psi to avoid jamming the solenoid. Should jamming occur unhook the gas bottle to relieve the pressure in the line and the solenoid should become free again. Fresh batteries will help keep solenoids operating properly. A simple regulator from a standard torch would work.

Maintenance

1. Your turbine will be due in for bearing change at the 25 hour mark. This is user responsibility to ensure that his/her turbine is sent off for servicing. In the event of catastrophic bearing failure your aircraft maybe damaged and certainly your turbine could receive severe mechanical damage.
2. Keep a close eye on all wiring, look for chaffing and fraying correct as necessary.
3. Always check for fuel leaks, because there is potential for a fire hazard.
4. Ensure the temperature probe it correctly sticking into the exhaust tailpipe.
5. Inspect entire aircraft for loose bolts/nuts and especially the turbine mounting.
6. Use clean filtered fuel
7. GloGlow plugs from time to time will wear out. When a plug is replaced be sure to tease out about 2 or 3 coils to expose the element to the start gas. recommended glow plug is the cool type and a good one is the McCoy MC-9 or O.S. #8.

Depending on the glow plug a different glow plug power setting may be needed depending on the type and brand used. To be safe, when plugs are changed out lower the plug power about 10 points and then raise the power 5 points during a trial and error process to get back the correct plug power to provide consistent reliable starts.

Be gentle when tightening the glow plug. It is very easy to break the glow plug embossment inside the engine. Just snug the plug down.

Pump Battery

With your FADEC/ECU you will want to use a 7.4v sub 1800 mah sub C NiCad rechargeable battery. It is important to use a quality peak detection charger to ensure the battery can provide correct power to run your turbine. Approximately 300-500 mah will be consumed during each 10 minute run time. After two flights or so it is a good idea to recharge your battery.

For Semi-Auto FADEC/ECU configurations only a 4 Sub 4.8v Sub C battery may be required to the run the fuel pump. The amount of cells needed depends on the fuel pump efficiency and plumbing.

It may be possible to use a 2 cell 7.4v Li Po battery. As of current time we have not tested this method. Other manufactures have done this and this seems to be a viable method. However, there is no voltage cutoff with the current FADEC/ECU as there should not be. It is better to ruin a \$50 Li Po battery than crash a model jet.

Mnemonic Codes During Normal Operation

TrimLow: Indicates that the signal received from the transmitter corresponds to the lowered trim, that is to say, engine OFF.

Ready: Indicates that the engine is ready for starting, and that the transmitter signal corresponds to IDLE, (green LED lit)

Stick Lo!: This indicates that the throttle stick is in a position above IDLE, the engine will not start with the stick in this position.

Glow Test: Looking for circuit continuity

Start On: Starter lightly spins the turbine

Ignition: Glow plug is attempting to light the start gas

Preheat: Pre heat of the combustion chamber

Fuel Ramp: Stepping the turbine RPM incrementally.

Running: Engine working correctly you have full control of engine power.

Stop: Engine off.

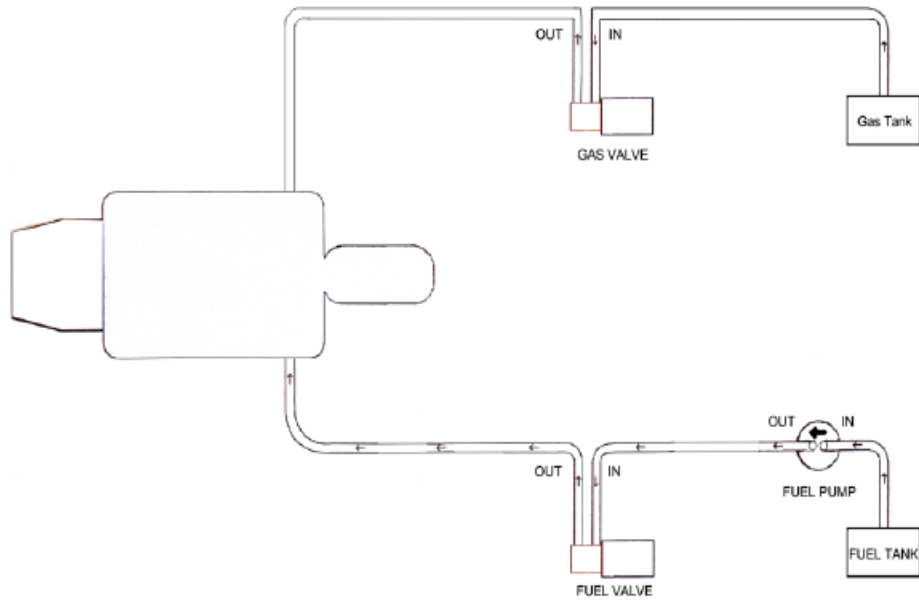
Cooling: Starter operating to cool the engine and will continue until temperature is less than 100°C

Diagrams

- The fuel pump diagram indicates direction flow of fuel as viewed from the front.
- Notice the solenoid has ports that are offset from one another. The input is

closer to the coil than the out-put. There is no difference between the fuel valve or the gas valve.

GAS SYSTEM INSTALLATION



FUEL SYSTEM INSTALLATION