

## **Following are the set up and running instructions for the engine:-**

To run the engine you will need some ancillary equipment, this is as follows:-

This engine is designed to start on **Propane**, and **Propane only**, do not use camping gas or a propane/butane mix.

You will need a small propane cylinder and a regulator valve, set the flow to about 10 psi. **Note this will vary due to altitude and temperature.**

All our engines are fitted with an air start facility, to start the engine on air, you will need a regulated air supply set at 60 to 70 psi.

**We recommend your initial starts be done using air, and remember air will always save the engine.**

Optionally the engine can be electric started, to activate our electric starter, you will need a 7 cell 1400 sub c pack ( RC car 7 cell pack) and a push button switch, wired to switch the starter on and off.

The fuel mix for this engine is either Jet A1 with 5% jet oil or household kerosene with 5 % jet oil. **Do not under any circumstance use any form of 2 stroke oil or any oil other than those recommended by us.**

**We recommend the following oils for use with the TJT engine:- MOBIL JET 2, EXXON 2380 or AEROSHELL 500. No other. Please note that we have extensively tested these oils in our engines, we know these oils are compatible with our engines and compliment the bearing and lubrication systems on our engines, All warranties will be void if any other oils than those recommended by us are used. We repeat: Do not use 2 stroke oil in this engine.**

**Warning do not increase the fuel pump battery voltage, we supply with the engine a four cell 2000mahr battery pack, the maximum voltage of this pack will not allow the engine to overspeed in the event of a FADEC failure.**

Some engine manufacturers do not recommend bench running the engine. We at TJT do recommend you bench run your engine, setting the engine up and running it on the bench will give you invaluable information and experience that you will be able to draw on later if you should encounter a problem with your engine.

Running the engine on a test bench will enable you to see how all the aspects of the FADEC control system and the mechanical parts of the system operate and where they fit in the control and operation of the engine.

A Gas turbine engine is no different in operation to any other combustion engine in that there are four stages to the cycle. These being:- induction, compression, ignition and exhaust, how the turbine engine achieves this is a little different from a piston type engine and from a safety point of view, you must ensure the safe operation requirements for this engine are met.

Always ensure that the front intake of the engine and the area in front of the engine is clear of all loose objects, wires and tubing, ensure nothing can be sucked into the engine.

Always ensure that the exhaust end of the engine is kept clear and at least 10 yards behind the engine is clear and free of combustibles.

## **Safety Safety Safety Safety Safety Safety Safety Safety**

We at TJT know that you are going to want to know things about your engine like how much suction it has at the front when running and how much blow it has at the back when running.

Please for your own well being and safety do not attempt to see how much suction the engine has at its front end, **Trust Us**. It is enough to suck in a finger or some other object, and in doing so will reduce the finger or other object to an unrecognisable piece of mush, further to this it will destroy your engine, **remember warranty we cover, stupidity we don't**. The same applies for the exhaust end of the engine, yes it is very fast, yes it is very hot and yes it will most certainly burn you or any other object placed in the exhaust path. Please be sensible and apply a goodly amount of common sense to the operation of your engine, as the safe operation of your engine is your responsibility. At TJT we like happy customers who get a great deal of pleasure using our products. Please be safe and sensible! Please aware of your operating environment and those around you! You are also responsible for their safety!

**Rule 1, Never run your engine in doors, always ensure you are in the open air.** Ensure non associated persons are at least 10 yards away from the engine when running. Always have a fully operational CO2 fire extinguisher available and ready for use when starting and running your engine.

**Rule 2,** When bench running or engine starting in an airframe, never allow yourself or another person to stand behind or in the rear quadrant of the engine. Always ensure the exhaust of the engine is directed away from persons and property as the heat and velocity of the engine exhaust can cause damage and injury.

**Rule 3,** Air will save the engine, in the event of a hot or failed start always isolate the fuel to the engine, but always keep the start air running to the engine, this will clear the engine of residue fuel and will keep the core of the engine cool.

If you are using the Electric stater then once again isolate the fuel supply to the engine and keep the starter running. Do not be afraid to use your fire extinguisher, a Co2 extinguisher will not harm the engine in any way.

**Rule 4,** Never attempt to start a flooded or wet engine, this will result in a hot or wet start and you will have flames. To dry out or clear the engine, stand it tail pipe down and either run the starter motor or blow air through the engine until all residual fuel has been blown out of it.

**Rule 5** Be gentle on the start gas, once you hear the ignition (pop) of the gas inside the engine increase the gas gently in relation to the air or the RPM of the electric starter. To much gas will result in flames out of the exhaust of the engine, and a hot start.

**Rule 6** In the event of a hot start, or sever engine fire, Keep the air on or the starter running, close the throttle and the trim lever to the fully back position and turn off the fuel isolation valve, this will allow the engine to clear its self, be ready to use your fire extinguisher. A Co2 type extinguisher will not harm the engine in any way, if a dry powder extinguisher is used and the powder is ingested into the engine then you must return the engine to our service department.

### **Things to note:-**

You will see that there are three FESTO connectors fitted to the three coloured tubes that exit through the front of the engine.

The colours are Black for air start in, yellow for start gas in and blue for fuel in.

The black and the yellow have FESTO non return valves (check valves) fitted to them, the blue has a FESTO joiner.

**Please ensure that the non return valves (check valves) are fitted at all times to the black and yellow tubes, this is important as these non return valves prevent hot gas from the combustion process damaging the yellow and black tubes.**

Always ensure that the tubes are correctly fitted into the FESTO joiners and non return valves, do this by first ensuring that the tube ends are cut square. Now push the tube into the FESTO fitting and try, with firm pressure to pull the tube from the fitting, the tube should not release without the blue collar on the fitting being pushed in.

Follow the hook up diagram and connect all the tubing as per this diagram, also note and connect the thermo couple and the RPM sensing plug into the FADEC.

Please ensure that the filter is fitted in the correct place and that the flow direction of the pump is correct, this is shown on the pump outlet face and is indicated by an arrow in the direction of flow.

Do ensure that the FESTO ball valve is fitted between the fuel pump outlet and the engine fuel inlet, this valve can be made to be servo driven. Operation of this valve into its closed position will stop the engine immediately by cutting off the fuel supply to the engine.

Before proceeding, check your set up against the diagram once again, and confirm all is correct.

### **Setting up the radio and programming the FADEC**

Ensure that the pump and radio batteries are fully charged and connected correctly, you will not be able to program the radio or FADEC if the batteries are flat or not connected.

Plug in the Hand Data Terminal into the FADEC and place it in a position where you can see it

Switch on your transmitter and ensure that the throttle ATV or throttle travel is set to the maximum in both low and high throttle positions, most transmitters will allow you to go over 100%, go to the maximum you can achieve.

Turn off the transmitter and switch it back on, set the throttle trim and the throttle stick positions to be fully down.

Switch on the receiver, if all is connected correctly then you will see the screen on the hand data terminal will activate, allow two or three seconds for the FADEC to initiate.

Once the FADEC has initiated, the front screen will show a two line display.

The top line from the left shows, case pressure, and engine temperature.

The bottom line shows, RPM and pump power %.

Either side of the screen on the hand data terminal, are two black buttons, the two on the left allow you to scroll through the data entry points, the two on the right are data entry, the upper button increases the data entry, the lower decreases the data entry.

Using the upper left hand button press once, you will see that the screen has changed to show a two line read out, the upper line shows the pulse width being transmitted by the radio, and also the transmitter throttle stick position in %.

The lower line shows the fuel pump battery voltage, a fully charged battery should read 5.2v.

**Following is the factory recommended settings for the first runs on your engine, please note there is one set of settings for the Pressure type FADEC and one for the RPM version.**

### Setting the Pressure type FADEC.

**When using the Pressure type FADEC, under no circumstance must you exceed a full power pressure of 2.1 barg. If you intend to use this engine at above 2000ft above sea level then do not exceed a full power pressure of 1.85 barg.**

Press the upper left hand button once:-

The screen will show: **FULL POWER PRESSURE**

Set this to **2.09 bar** using the right hand buttons, by pressing and holding the buttons the input will scroll.

Press the upper left hand button once:

The screen will show: **IDLE PRESSURE.**

Set this to **0.12** using the right hand buttons.

Press the upper left hand button once:

The screen will show: **STOP PRESSURE.**

Set this to **0.042** using the right hand buttons.

Press the upper left hand button once:

The screen will show: **START MINIMUM TEMPERATURE.**

Set this to **100c** using the right hand buttons.

Press the upper left hand button once:

The screen will show: **MAX TEMPERATURE.**

Set this to **800c** using the right hand buttons.

Press the upper left hand button once:

The screen will show: **Transmitter adjust yes.**

Press the upper right button, adjacent to the caption yes.

The screen will change to say **stick up trim up (full power).**

Move the transmitter stick and trim fully up, **Press the upper right button once.**

The screen will change to **Stick down trim down (stop).**

Move the transmitter stick and trim fully down, **Press the upper right button once.**

The screen will change to **Stick down Trim up (Idle).**

Move the trim fully up with the throttle stick fully back, **Press the upper right button once.**

The screen will change to **Acceleration Delay:** using the right hand buttons set this to **50 then** press the upper right button once:

The screen will change to **Deceleration Delay :** using the right hand buttons set this to **50 then** press the upper left button once:

The screen will change to **Stability Delay:** using the right hand buttons set this to **10** then press the upper left button once:

The screen will change to **Pump Start Point:** using the right hand buttons set this to **18** then press the upper left hand button once:

The screen will change to **Pump Start Ramp:** using the right hand buttons set this to **3 for electric start or 6 for air start.** Press the upper left hand button once:

The screen will change and show the timers, these can not be altered but show Total time of engine run, total time of last run and how many engine start cycles completed.

Press the upper left button once: This will bring you back to the first screen.

### **Setting the RPM FADEC.**

**When using the RPM FADEC do not exceed a Maximum RPM of 126000.**

Press the upper left hand button once:-

The screen will show: **Max RPM**

Set this to **126000** using the right hand buttons, by pressing and holding the buttons the input will scroll.

Press the upper left hand button once:

The screen will show: **IDLE RPM**

Set this to **33000** using the right hand buttons.

Press the upper left hand button once:

The screen will show: **Min RPM**

Set this to **20000** using the right hand buttons.

Press the upper left hand button once:

The screen will show: **START MINIMUM TEMPERATURE.**

Set this to **100c** using the right hand buttons.

Press the upper left hand button once:

The screen will show: **MAX TEMPERATURE.**

Set this to **800c** using the right hand buttons.

Press the upper left hand button once:

The screen will show: **Transmitter adjust yes.**

Press the upper right button, adjacent to the caption yes.

The screen will change to say **stick up trim up (full power).**

Move the transmitter stick and trim fully up, **Press the upper right button once.**

The screen will change to **Stick down trim down (stop).**

Move the transmitter stick and trim fully down, **Press the upper right button once.**

The screen will change to **Stick down Trim up (Idle)**.

Move the trim fully up with the throttle stick fully back, **Press the upper right button once.**

The screen will change to **Acceleration Delay:** using the right hand buttons set this to **50 then** press the upper right button once:

The screen will change to **Deceleration Delay :** using the right hand buttons set this to **50 then** press the upper left button once:

The screen will change to **Stability Delay:** using the right hand buttons set this to **10 then** press the upper left button once:

The screen will change to **Pump Start Point:** using the right hand buttons set this to **18** then press the upper left hand button once:

The screen will change to **Pump Start Ramp:** using the right hand buttons set this to **3 for electric start or 6 for air start.** Press the upper left hand button once:

The screen will change and show the timers, these can not be altered but show Total time of engine run, total time of last run and how many engine start cycles completed.

Press the upper left button once: This will bring you back to the first screen.

Now turn off the receiver and transmitter. Turn on the transmitter ensuring that the throttle stick and trim are fully back, turn on the receiver, the hand data terminal should show the first screen.

On the front face of the FADEC there are two LEDS, watch the right hand one (Green) push the throttle trim fully forward the green LED should glow steady.

**At this point either disconnect the fuel line to the engine or close the in line ball valve between the pump and engine.**

Move the throttle stick to fully open and then fully closed, this will activate the fuel pump prime system. The pump will run for 1 second at 25% of full power to prime the fuel pump. **Make sure that engine is isolated from the fuel system so that the engine is not flooded on the prime, it is not necessary to utilise the fuel pump prime facility on every start up, normally just once at the start of the flying session.**

With the throttle stick fully back and the throttle trim fully forward, the Green LED should be steady on.

If all is as described above then the engine is ready to start.

**Please note on the more recent FADECS, there are two LEDS one green, one red, the red led will flash to indicate when full power has been achieved from the engine. This is dependant on either the max RPM set or the full power pressure that has been set.**

## **Starting the engine.**

We recommend that at least two people are present for any engine operations, one of these people will have been briefed on the use of the fire extinguisher and any other duties deemed necessary for the engine start.

Ensure you have your CO2 fire extinguisher and it is ready for operation.

Ensure the intake and exhaust of the engine and surrounding area's are clear of loose objects and combustibles to a distance of 10 yards.

Ensure the pump battery and radio battery are fully charged.

Ensure you have a clean and filtered supply of correctly mixed fuel ie 5% oil in the fuel.

Ensure you have a charged Propane bottle set to give approx 10 psi pressure to the engine.

Ensure you have either a fully charged battery for the E starter or a fully charged air tank for the air start, a constant 70 psi min.

- 1) Transmitter throttle stick and trim fully back, switch on the transmitter.
- 2) Plug in the hand data terminal and switch on the receiver.
- 3) Allow the screen 3 seconds to set the FADEC up.
- 4) Throttle trim fully forward, the green LED should show steady on the FADEC.
- 5) Isolate fuel from engine, close ball valve.
- 6) Throttle stick to full forward then back to full back, the fuel pump should run for 1 sec to prime the fuel system.
- 7) Open the ball valve.
- 8) Light the glow plug.
- 9) Spin the engine over to about 500 rpm using air or the E starter, turn off the air or E start and as the RPM decreases turn on the start gas gently, listen for the POP of ignition.
- 10) As soon as you have heard the ignition POP, increase the gas slightly and turn on the starter motor or increase the air to the engine.
- 11) The green LED will start to flash and the sound of the engine will change from a whoosh to a deeper roar, at this point you can turn off the gas, shortly after this you can turn off the starter or the air supply, the green LED will go out and the FADEC will bring the engine to idle, from this point on the engine is controlled by the throttle stick.
- 12) To shut the engine down, bring the engine to ½ throttle and move the trim fully to the rear then close the throttle, the engine will shut down. We normally close the ball valve at this point also.

Things to note.

On your first runs you might not get the fully programmed case pressures or RPM levels, this is because the FADEC has to learn the engines characteristics.

To enable the FADEC to learn the engine, do the following at least three times on each of the first five engine runs.

Start the engine, then taking 10 to 15 seconds bring the engine up to full power and back to idle 10 to 15 up 10 to 15 down, you will see that each time you do this the engine will get smoother and more responsive.

Always shut the engine down as described in para 12 above, this ensures the FADEC has learned and memorised the latest set of operating parameters.

**Warning,**

**If the engine temp is above the Min start Temp, and you try to do an engine start, the fuel pump will start to run and deposit fuel into the engine, this can result in a hot or wet start. Closing the ball valve on shut down will prevent this.**

**Remember, before attempting to start the engine ensure the engine is not flooded with fuel, if there is fuel in the engine then clear the engine as described earlier.**