wren
TURBINES

Wren 75

New High Performance
Miniature Gas Turbine Engine
7.5kg – 16.5lbs thrust

Perfect small size, high performance gas turbine engine for beginners and expert alike.
Integral FOD screen and high quality components throughout for long life.

Specifications:

Thrust 75N – 16.5Lbs
Weight – 1030g – 2lb 2oz
Size – 90mm dia x 240mm long (inc starter)
3-1/2" x 9-1/2" long.

A real quart in a pint pot!!

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Introduction to the new Wren 75.

History.
This engine is the latest development in the evolution of gas turbines utilising the same case size as Wren Turbines' original Wren54, a 5.4kg (12lbs) thrust engine that broke the mould of ever larger engines requiring ever larger fuel tanks and ever larger planes.

The Wren 75 "Club" offers the flier a small compact engine with outstanding performance to suit a wide range of airframes that can be transported in a family car, and at a price to suit the average fliers budget.

The Wren 75 is built along the lines of the highly successful Wren SuperSport which was the first ultra high performance turbine commercially produced and has now been in successful continuous production for six years.

Wren 75 Philosophy
The Wren 75 departs radically from the Wren 54 design in the area of compressor, diffuser and combustion technology enabling high pressure ratio and high performance to be squeezed into the same case – just! The latest version of this best selling engine also has a new bearing system enabling very low rotor resistance for fast pickup and low bearing wear.

Most of the components in the Wren 75 are specially produced for this engine and are not interchangeable with any of the family of Wren54 derivatives. The ancillaries are however common to the Wren54 and SuperSport engine and readily available from Wren so you can be sure of regular and reliable spares backup and Wren Turbines' legendary service support – you will always get a real person on the phone at Wren!

With the advantage of extremely low installed weight and small fuel payload requirement the engine will prove ideal for the club or sports flier looking for reduced wing loadings to fly the typical club circuit with tight runway space but with agility and response to satisfy the most demanding competition flier. An exhaust velocity of greater than 800mph gives a breathtaking vertical performance in most slippery sports airframes and renders the need for the larger engines redundant. Users need to take extra care in the installation and operation of this engine to ensure their airframe, servos etc are of quality appropriate to high speed jet flight.

Full Autostart package contents:

Wren 75 gas turbine including integral FOD screen
Fadec Autostart ECU
Hand data terminal for programming and display
Fuel pump
Propane solenoid with flow control valve
Fuel solenoid
3-piece engine mounting strap
2-cell LiPo
Fuel and gas piping
Gas cannister valve and quick coupling

Safety notes

A code of practice for operating gas turbines may be accessed from the Gas Turbine Builders Association (GTBA) website on GTBA.com. The GTBA is the British Model Flying Association (BMFA) advisory body for model gas turbines.

It is advised always to have a CO^2 or similar gas-type fire extinguisher with you when running the engine – you never know when an emergency will strike and it is best to be prepared. If you need to extinguish an onboard fire you should point the extinguisher into the front of the engine and not in through the turbine end.

Always ensure, when running a gas turbine that you keep people 10m (30ft) clear of the area to the side and rear of the engine as you would a propeller engine, as although a broken turbine is extremely rare it is still technically possible and it is better to be safe.

When running the engine you should stand slightly in front and to one side of the engine, and not to the side for the reason above.

Always wear ear defenders when running the engine as gas turbines have a high intensity noise level (around 112db) close to the engine that can impair your hearing in time.

Never try to improve/speed up the starting of the engine by spraying ignition agents into the engine – a dangerous flashback fire may result and you will in any case never improve the starting this way.

This engine is not a toy and can cause bodily harm to you or others if misused.

It is your responsibility as owner, to ensure safe, careful and considerate operation of your engine at all times, and in accordance with the manufacturers instructions.

If you sell or give away this engine, please pass these instructions to the new owner.

This engine ***must*** only be run firmly attached to a secure and sturdy engine test stand or model installation. The thrust is considerable for such a small size and mountings must be sufficient to withstand such forces. Use appropriate screws and lock-nuts. The engine must not be run held in the hand or clamped in a vice.

This engine is an internal combustion gas turbine engine which generates large quantities of heat – ensure the mountings and installation are appropriate for operation at these elevated temperatures.

During operation and for a time afterwards there are parts of the engine which are hot enough to cause serious burns – do not touch any part of the engine until it has cooled to room temperature.

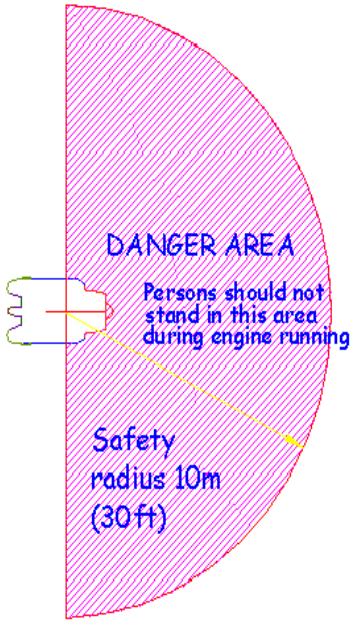
Always operate your engine in open air away from confined spaces as the engine exhaust contains gases which can cause asphyxiation and nuisance from smells.

The exhaust gases are very hot (over 450'C) on leaving the engine and can cause burns to skin or damage to objects close to it – keep exhausts clear of anything which is affected by such heat.

This engine must not be used near flammable gases, liquid or materials.

Turbine fuel is poisonous to living beings. Keep it away from the mouth and eyes and from contact with skin. Always store it in a marked container out of reach to children.

Turbine fuel has a relatively high flash-point but in certain circumstances can be highly flammable. Keep it away from heat and sources of combustion.



The starting gas is highly flammable and must be used with extreme care. Maintain canister and fittings in good leak-proof condition. Protect from sunlight and prevent exposure to temperatures exceeding 50'C. Keep out of reach of children. Discard used canisters in a safe place and do not puncture or incinerate, even when empty. Avoid deliberate inhalation.

Ensure gas only is supplied the engine, liquid gas must not be allowed to pass into the system. Gas supply must be disconnected until ready for immediate use. Gas is heavier than air and can fill a model if allowed to leak unchecked, and become a potential explosion hazard.

Turbine oil can be are hazardous to health and must not be allowed to come into contact with skin, mouth, eyes or through ingestion, accidental or otherwise. Take care when decanting and ensure any spillage is wiped away immediately and clean any affected area with warm soapy water.. Wash hands and any affected part immediately after any contact.

Turbine oil can discolour or affect certain paint finishes as may be used. Take precautions to prevent spillage .

Do not discard or allow any spillage to run into drains.

If removing the glow-plug to test it, keep fingers or bare skin away from possible burn from the glowing element – use a metal tool or appropriate insulation.

As operator, it is *your* responsibility to ensure any spectators (especially small children) or helpers are kept well away from the engine whilst it is operating. The safest position to operate the engine is directly in front. The area inline and to the rear of the turbine is the most dangerous area and you must keep well clear of this.

Keep all spectators away from the side and rear of the engine to a distance of at least 10mtrs (30ft) radius, as shown. If operating from a pit area take special care as safety distances are often difficult to maintain.

Keep all helpers close by and brief them fully on their duties before starting the engine. One helper can carry out the role of fireman. Ensure they are aware of what to do in event of emergency and where to position the extinguisher if required.

Do not attempt to alter the starting characteristics of the engine by spraying ignition agents into the intake, as might be used for gasoline and diesel engines. A dangerous fire and flashback may result.

Specifications:

Max thrust	7.5kg (16.5lbs) nominal @ 160,000rpm.
Idle speed	45,000rpm
Pressure Ratio	3:1
Fuel consumption	260ml/min @ full power @ 15'C.
Weight engine only	1030gms
Weight ancillaries ex. ECU battery	260gms.

Setting Up.

A 2-cell LiPo battery pack is supplied with the engine. Charge the pack prior to use. A larger capacity pack can be substituted if required. Before connecting up, ensure the charger is one specified for use with LiPo batteries and is set to the correct charge rate.

Fuel.

The engine is designed to run on Jet A or Jet A1 kerosine. Paraffin such as is available at hardware or DIY stores or at filling stations from the pump is a suitable alternatively where available.

Oil.

To this fuel must be added 5% oil, ie a mixture of around 20:1 fuel to oil. Suitable oils are turbine oils such as Mobil JetOil, Aeroshell 500 or Exxon 2380. Alternatively, good quality 2-stroke motor cycle oil such as Castrol Power 1 TTS (Halfords) may be used.

When decanting fuel, take precautions to ensure no solid particles or water droplets are carried over into your fuel tank – use an effective filter system. Note that jet fuels and oils should not be allowed to come into skin contact so wear suitable gloves and take extra care when handling.

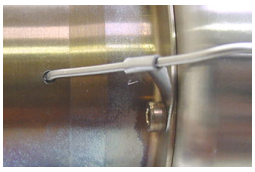
If you are new to turbines it is a good idea to set the engine up on a simple test-stand and to get used to starting and running the engine before installing in a model. A three-piece mounting strap is supplied and this should be attached to a pair of timber battens screwed to a base-board. The two straps must fit securely on the engine to prevent the casing sliding. The various components can be temporarily secured to the baseboard, be especially careful not to allow any cables or pipes to run close to the engine intake where they might be sucked against the fod screen.

The mounting must be properly secured as the thrust from this small engine is considerable and users are asked to use "*belt and braces*" in mounting to avoid any possibility of the stand being pushed over

by the thrust of the engine. The suction on this engine is extremely high and special care must be exercised to prevent anything being sucked against the protective screen whilst test running and afterwards when running in the model.

Connections.

The ECU unit has a label which shows where all the engine accessories are plugged in; gas valve, fuel valve, temp' probe, rpm pickup (the servo-type lead coming out of the cowl of the engine). The green plug and socket connect the starter and glow in one and the fuel pump and ECU battery in the other. The various items are colour coded for ease of recognition. The glow-plug and starter wires should already be well twisted together to minimise radiated electrical noise and routed clear of the front right/hand side of the engine as this contains the magnetic rpm sensor and this can be affected by stray noise from the glow wire.



The temperature sensor is pre-shaped and retained in the exhaust cone by the small bracket which is secured to one of the exhaust cone screws. It should protrude approx 4mm through the small hole at 3 O-clock in the exhaust cone (viewed from the turbine end).

The front end of the probe is secured with an M2.5 screw inserted through a spacer to one of the FOD screen mounting holes. A "P" shaped bracket is supplied to hold it in place by the sleeve on the probe body. Note carefully the orientation of the temp' probe plug – it has a white wire and a green one – check the positioning on the label on the ECU.

Fuel System.

The fuel outlet from the tank should be connected to the fuel pump using "Tygon" yellow fuel pipe provided. A short length (25mm) of 4mm clear tube should be first pushed onto the pump inlet barb and the Tygon pushed over this. This ensures an airtight seal and prevents slices of tygon tube entering the fuel system which can happen if the Tygon is pushed directly onto the barb on its own. A felt clunk is available for use with "Dubro" type tanks. When using specialist jet tanks refer to the manufacturers instructions.

Electrical (solenoid) Valves.

Both solenoid valves have an arrow on the valve base showing the direction of flow. The fuel pressure (output) line of the fuel pump is connected to the fuel solenoid valve with a clear 3mm pipe. The fuel solenoid valve should be installed in the fuel pressure line *after* the pump – never on the suction side.

The output of the fuel solenoid feeds the clear line to the engine. A fuel shut-off tap is not essential as the solenoid valve provides this function but where regulations require one to be fitted it should be fitted on the delivery side of the pump. An in-line fuel filter is already fitted in the fuel feed to the engine, under the green cover.

All connections of the fuel system should be kept spotlessly clean to eliminate the possibility of dirt particles entering the engine system which will cause sticking valves, stalled fuel pumps and blocked injectors in the engine causing hot spots and poor running and requiring major repairs. If the engine needs to be returned for servicing or to transfer between aircraft, keep the fuel and gas lines blanked off to prevent contamination.

Gas (propane) system.

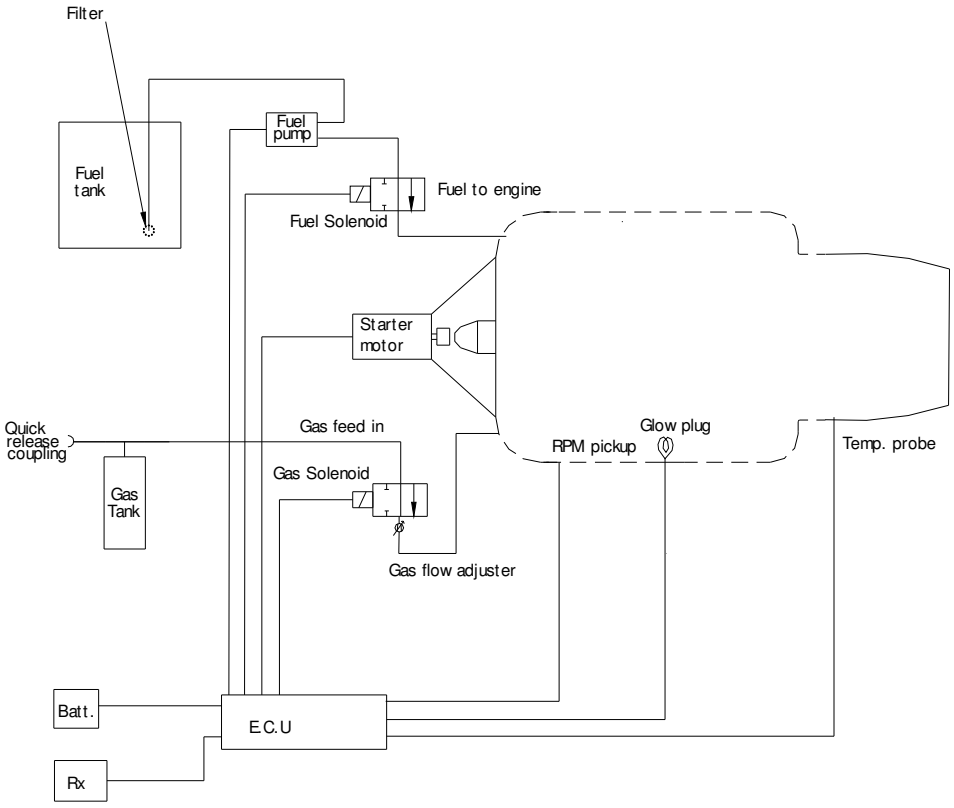
The normal setup for gas supply is via external cannister fitted with a variable tap. The outlet of this tap feeds a male quick connector which plugs into a mating female connector fitted to the aircraft.

Inside the aircraft this female quick-release connects to the engine with the 3mm green pipe supplied. If a gas solenoid is fitted, the supply from the female quick release feeds the solenoid directly. A small screw-down flow controller is fitted at the output of the gas solenoid valve which can be adjusted to set the gas flow to the engine (1-1/2 to 1-3/4 turns is normal). The flow is then outputted via green 3mm tube to the engine.

NOTE: Direction of flow **must** be in at the bottom and out the side – this is important as the valve only regulates flow in this direction. If connected inversely flow is not controlled **at all**.

If on-board gas supply is desired, a small gas tank can be supplied and this should be mounted vertically. The tank is filled to approx ¼ full, via the quick release, self sealing coupling (which can be bulkhead mounted) from an external liquid gas supply. The outlet of the gas tank is fed via 3mm tube direct to the gas solenoid valve and the flow is then controlled by the screw-down valve on its outlet in the normal way.

Schematic showing layout of components for Autostart installation



Auto-start setup and operating notes

The Autostart notes form a quick reference sheet to help you set up and use your Wren 75 gas turbine engine and "FADEC" Auto-start v6.11 ECU. The engine is supplied ready-to-run and has already been tested with all components supplied so you know it is properly prepared.

After simply pre-setting the ECU to your transmitter and plugging up of the components into the ECU you will be ready to start. The engine uses a gas supply to provided initial heating of the combustion chamber. This is normally plugged in from an external supply using a quick connect, or as an option can be carried on the plane in a small gas cannister.

The ECU controls the fuel and gas supply using solenoid valves. These are provided with pipe fittings for simple connecting up. The valves are closed when not powered. If using external plug-in gas, the gas solenoid valve and regulator may be omitted and a useful weight saving made.

Setting the ECU to your radio.

The ECU battery needs to be connected in order to carry out this procedure. Disconnect the lead to the starter and glowplug until the set-up is complete and you are familiar with the system (to prevent a possible attempt at start. The ECU signal lead should be plugged into the throttle channel of your receiver. Plug in the ECU display into the ECU.

Digital trims.

If you have a transmitter with digital trims you can simulate the trim up/down function using the "Throttle Cut" switch, which is usually a function switched through a switch mounted on the transmitter. Consult your radio manual for this function. Setting the ECU using the "Throttle Cut" function is done in the same way except that when trim-up is required you switch the "Throttle Cut" to off, and when trim-down is required, you switch to "Throttle Cut" on.

For initial testing the digital trims can be used if you don't want to have to explore the "Throttle Cut" function just yet. The trim up/down function is used to switch the engine to "ready to start" and "off", and would not normally be used to vary the idle rpm. Note - some transmitters may need throttle reversing - see later.

Setting up ECU (Engine Control Unit)

Remove all rates, mixes and throttle travel settings in the transmitter. The setup assumes the use of a transmitter with manual trims. If you have a transmitter with digital trims see note on previous page.

As the display does not photograph well we have reproduced the display readings as a green box.

Turn on the transmitter and receiver. On power-up the screen should come on and after a few seconds should stabilise to the opening screen and should show as right: (If the temp'' probe is not connected it will show as 0'C). "T" = ambient temp'.

```
Trim Low        T=020'C
RPM 00000       PW 000
```

There are four buttons on the display. The buttons are: ▼ ▲ - + .To scroll through the different screens use ▼ ▲ . The buttons **-** **+** are used to change the values stored.

Press the Up button (▲) and scroll through the menus until you find the one showing :

```
      Info  Run
Start Radio
```

Press the minus (**-**) button and the screen will change to:

```
Transmitter
adjust          Enter
```

Press the **+** button to enter the radio setup screen. You should then see this screen:

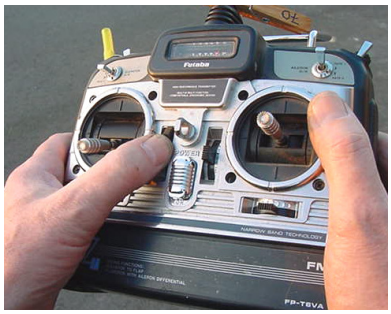
```
Stick   Up   Trim   Up
     (Full power)
```

On your transmitter, place the throttle stick and trim to maximum and press the **+** button to set the value into the ECU.

The screen will now change to:

```
Stick Down
Trim Down   (Stop)
```

Move the throttle trim (or switch the "engine cut" switch to on) and throttle stick back to zero and again press the **+** 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 max position or switch "Engine Cut" switch to off, and again press the **+** button.

The display should then show:

```
     Thrust curve:
        LINEAR
```

Lower trim to zero. Now switch off the receiver.

Turn the receiver on again, if you have done all the steps correctly the opening screen will show "Trim Low" and if you raise your trim to full it should change to "Ready" and a blue led will light on the ecu. If not, you will need to reverse the throttle channel on your transmitter and repeat the radio setup.

This completes your radio set-up. It should only need doing again if the radio settings are changed or installation moved to another radio but it is worth rechecking periodically.

Failsafe function.

The ecu contains a failsafe function that will stop the engine in the event of loss of radio link or continued radio interference that masks the normal signal, but will allow the engine to continue to operate in the case of short glitches. The system works with PCM, PPM and IPD systems.

PPM systems.

In case of loss of radio link, corrupted or signal pulses outside the programmed window of operation, for the first 0.5 secs the FADEC will do nothing and keep the engine at its last valid setting. If during this time the radio link is recovered or signal pulse-width returns to within the programmed window, control is returned.

If after this 0.5secs the signal still is missing or bad, the FADEC will command the engine to "idle", and keep it at idle for a further 1.5secs. After this 1.5secs (total 0.5+1.5secs=2secs) the FADEC will command the engine to shutdown.

If the signal returns during this 2s, the FADEC will take this signal as good and reset the 2secs timer and engine control will return.

PCM/IPD systems.

The user should program the “failsafe” function of the radio to send a signal lower than the normal “stop” signal (ie if normal “stop” is –100%, then program the failsafe to output –125%).

When the receiver enters into "failsafe" mode, it will issue a signal to the FADEC of -125% that is outside the valid command window, (between STOP (-100%) and Full power (+100%) . In this case the FADEC will follow same procedure as described in PPM mode and shutdown the engine after 2s of failsafe. In this event the FADEC will record the cause of shutdown as a “Failsafe” shutdown.

If the failsafe setting is programmed on the TX to the same point as the “STOP” command, the system will act exactly the same, except that the FADEC will record in its memory that the cause of the last shutdown was "User-Off". This could make it more difficult to troubleshoot a in-flight shutdown.

This system allows the engine to fly through minor interuptions of signal or glitches, thus avoiding the engine shutting off unnecessarily, while maintaining the safety of automatic shutdown in cases of loss or corruption of radio link.

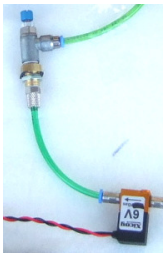
IMPORTANT - ALWAYS PROGRAMME THE FAILSAFE TO SHUT OFF THE ENGINE.
NEVER FLY A TURBINE AIRCRAFT WITH THE FAILSAFE SET TO “HOLD”.

Checking operation of the gas (propane) start.

The gas required is from a gas canister available from hardware stores (screw-top variety) and will ideally be 30% propane 70% butane, the higher propane mix means less gas needed and quicker starting. Other suitable types are those sold for the “Taymar” and similar blowtorches but check carefully the propane content. Do your gas filling outside in open air away from sources of ignition, no smoking etc.

The gas tap supplied should be screwed onto the canister (ensure tap is off first) and checked to ensure there are no leaks.

If you are using off-board gas then simply plug the quick release into the matching female connector. If this is the first time then do a quick visual check to ensure you have connected the quick release female either direct to the engine or through pipework to the gas solenoid, if fitted.



If you are using onboard gas then again ensure all the pipework to the engine is complete and the flow restrictor is set to no more than 1-1/2 turns out. Direction of flow is in to solenoid first, then to bottom of flow control valve, then out the side to engine (see left). Keep your your fire extinguisher close whenever filling the gas tank. Connect the gas canister to the quick-release coupling and invert the cylinder so the valve is at the bottom, and open the valve. Liquid gas will be seen to travel down the tube to the tank. Disconnect the tank when the flow ceases.

The tank does not need to be any more than about 1/3rd full for several successful starts. Do not attempt to fill more than this as it is unnecessary and will not aid gas supply.

To confirm all is connected correctly, check the operation of the starter and gas system. This should be done outside in the open air away from flammables as we are generating a flame here. Turn off the receiver, wait a few seconds and then turn back on again (this is how you reset the ECU). Always start with the HDT display plugged into the ecu.

With the throttle stick down, raise your trim to full-up and confirm the display shows “Ready”.

The propane system you have, decides which starting procedure is used – see the following:

For off-board gas using a gas solenoid and flow control valve.
Connect the external gas to the quick connector and open the gas cannister valve two turns open. Confirm the gas screwdown valve is set 1-1/2 turns open from fully off.

Raise the throttle stick to full and quickly back down again (within 1 second). This is the signal for the ECU to start the engine. The starter will kick in and spin the engine gently and the gas should light with a gentle plop. If the “plop” is too small then open the flow valve by half a turn. Do NOT open the flow valve on the gas solenoid wide open in an attempt to make the engine light quicker or better – you will only make a big “whoosh” when the gas does light and there will be far too much. Aim for the smallest amount required. Reduce the flow if the “plop” is too aggressive.

When ignition of the gas happens the temperature on the ECU display should be seen to rise fairly quickly and the starter will start to accelerate the engine. As soon as you see this lower the trim back to zero to terminate the start sequence. The gas solenoid will then shut off the gas supply to engine. Practice further starts and adjust the amount you open the flow valve so you get a quick temp rise but no external flame or aggressive burning noises. You will quickly find a setting that works best and lock the small lock-ring on the flow valve to hold the setting. If after a couple of attempts the engine stops with the temp reading above 100’C, lower trim to zero and you can use the throttle stick to pulse the starter in short bursts to cool the engine. Don’t try starting the engine while the temp is over 100’C.

On-board gas using propane tank, gas solenoid and flow control valve.
Once the gas tank is filled, use the same procedure as for “*off-board gas using gas solenoid and flow control valve*” above except there is no external gas cannister connected. Be sure to keep the flow control open to only the minimum. Never attempt to use this system without a flow control valve fitted.

If the tank needs the gas emptying for any reason, connect the gas cannister to the tank using the quick connector. Invert the tank so the outlet is downwards, open the cannister valve and the liquid propane should flow to the cannister. When the flow ceases turn off the cannister valve. There will always be some residual gas remaining in the pipework and gas tank so use the cannister valve without the cannister fitted to gently release remaining gas – **always do this in the open air away from sources of ignition.**

For off-board gas, without gas solenoid or flow control valve:
Connect the external gas to the quick connector but do not turn on yet. Raise the throttle stick to full and quickly back down again (within 1 second). This is the signal for the ECU to start the engine. The starter will kick in and spin the engine gently. At this point crack open the gas valve on your cannister a small amount until the gas ignites with a gentle “plop”. DO NOT open the valve several turns open in an attempt to make the engine light quicker or better – you will only make a big “whoosh” when the gas does light and there will be far too much flow – flame could even appear at the front of the engine. Aim for the smallest flow required. Remember you are controlling the flow with the cannister valve, so go gently.

When ignition of the gas happens the temperature on the ECU display should be seen to rise fairly quickly and the starter will start to accelerate the engine. As soon as you see this, turn off the gas and lower the trim back to zero to terminate the start sequence. Practice further starts and adjust the amount you open the gas cannister so you get a quick temp rise but no external flame or aggressive burning noises. You will quickly find a setting that works best. Try to reproduce the setting each time you make your starts until it becomes automatic. If the engine stops with the temp reading above 100’C you can use the throttle stick to pulse the starter in short bursts to cool the engine. Don’t try starting the engine while the temp is over 100’C.

In all cases, less gas rather than more usually works best but you will need to experiment. Remember you are not adding any lubricant to the engine by spinning it up on gas so don’t do this more that a few times or the bearings will dry out.

Running the engine.
Once you have done a few practice gas light-ups you can connect up your fuel tank and prepare for a proper engine run. Secure your test stand or aircraft firmly. Position it in a suitable place in a well ventilated

area, preferably outside and clear of any likely hazards. Connect the fuel valve back to the ECU and fill the tank. Check all leads and pipes are in the correct position and properly connected. Ensure your fire extinguisher is in position and you are ready.

Check the danger area is clear of onlookers and turn on the radio transmitter and receiver. Check for the "Ready" display when you raise your trim. Initiate the start in the normal way. As soon as the gas has lit and the starter is starting to accelerate the engine you should see fuel travelling up the clear fuel line to the engine. If the fuel line is empty the start may terminate showing "weak gas". In this case simply lower the trim and then try again. If it does the same again, restart but increase the gas supply slightly.

As soon as the engine is spinning up and fuel has arrived in the engine the note will change and a small flame may appear from the exhaust but this is normal. As the engine speeds up on the fuel past 25,000rpm you can gently close off the gas supply if you are running external gas, and disconnect from the engine/plane. The engine should accelerate up past 30,000rpm where you will hear the starter dis-engage, the engine should continue to accelerate up to idle at 45,000rpm. During starting the led on the ECU will blink to show the fuel pump is speeding up and "fuelramp" will show on the display.

When the engine has reached idle and stabilised the led will turn off and the display will show "running". Do not touch the throttle stick while the start is under way as the ECU will terminate the start sequence. If you are running external gas, the supply can be shut off and disconnected from the engine/plane if not done already.

If you *want* to terminate the start sequence, simply lower the trim to zero and the start will cease. The engine will stop hot however and it is best to cool it off. To do this if the engine has not reached idle, raise the throttle stick to about half and the starter will cut in and spin the engine up. Use the throttle stick to switch the start on and off until the engine has cooled. If the engine had reached idle then simply set the stick and trim to off and the engine will stop and go into "cooldown" on its own.

Throttle response.

Once the engine is at idle and the display shows "running" you can operate the throttle stick. Over a period of about five seconds, smoothly raise the throttle to full and the rpm should increase to close to 160,000rpm. Lower the throttle back to idle over a similar time and the engine should run back to idle. The ECU needs this cycle to relearn the throttle stick position to rpm match and it is good practice to do this at the beginning of all engine runs. You can now explore the response time of the engine. All turbines have a throttle lag, but the Wren 75 is remarkably quick to respond.

Shutting down.

When you are ready to shut down, throttle to around 80,000rpm for about five seconds and then lower stick and trim to bottom to stop the engine. As the engine comes to a stop the starter will kick in to spin the engine gently for the cool-down cycle until the engine has cooled to around 100'C. Wait until the cooldown is completed and display reads "stop". The receiver and transmitter can now be turned off.

Care and Maintenance

The engine, like most mechanical machines will appreciate being kept clean and dry. Keep the intake clear from ingress of grass, fluff and all the other small bits the engine will "find" from around itself while running. The engine has no consumable parts in the accepted sense of the word, however the rotor bearings will eventually wear and become noisy.

We recommend a service interval of 50 hrs.

Be careful to ensure your ECU battery is kept well charged in order that the engine is always started briskly and properly cooled down after a run.

General check-points:

Ensure that the ECU has sufficient charge before flying. If in doubt, charge before each flight.

Keep the hall pickup clear of stray magnetic sources such as fuel pump, solenoid valves, glow plug wire, or servo's, as the magnetic field generated can upset the rpm reading.

Note, the glow and starter wires are deliberately twisted tightly together to minimise stray interference. Do not straighten them out in the belief this will "neaten" your installation.

If you replace the glow plug, the last two turns of the element must be pulled out by about 1.5mm to ensure prompt gas ignition. If you had increased the plug power to eak out the last life from your old plug, then reset to 1.4v for the new one before making starts.

Do not fly with the display unit permanently attached to the ECU as this is a potential source of interference.

You must set-up the ECU with your radio before it will operate correctly, so do this first.

Propane/Butane gas mixtures work well in temperate climates. Beware of using too much gas in the belief this will ignite more easily. 100 % Propane can be used instead, but the pressure is higher and much more care should be taken especially in warm climates.

If this is your first turbine, we recommend you set-up and confirm the operation of your Auto-start installation on the test-stand, before installing into your model.

A range of suggested settings for each menu are shown overleaf. These have been found suitable for most installations as initial settings, from which you can then adjust to suit your particular set-up as required.

ECU Settings.

The ECU is **pre-programmed** to work with the engine although some of the settings are accessible to the user to adjust if they wish. Please note that the starting cycle can be severely affected by changing some of these settings so ensure you understand the implications of the change if you want to experiment.

The settings used as defaults for this installation are reproduced here so you can get back to where you starter from if you need to.

Note the settings listed may differ slightly from those preset in your ECU as your system has been optimised during testing.

ECU basic settings in Main Menu.

ECU battery – 2 cells (LiPo), 1500-2000mAh (a larger capacity pack can be substituted if needed)
Max rpm – 160,000rpm.
Idle rpm – 45,000.
Stop rpm – 28,000rpm (if engine slows to this rpm the ECU considers the engine to have stopped and turns off the fuel pump).
Start temp – 100'C, can be reduced to 80'C on cold days.
Max temp – 800'C, this represents peak temp on starting.
Acceleration delay - ie ramp-up speed, - 8-12
Deceleration delay - ie ramp-down speed, - 5-10

Stability Delay - set to 100. This setting is a damper to even out speed variations due to fuel flow.

Pump Start Point – this setting teaches the ECU the slowest speed the pump will run at.
It is preset to "Auto+ 1 and should not need changing from this. If set too high engine idle will be artificially raised.

Start Ramp – 8. This is the rate of increase of fuel flow from initial start, coming up to idle (1=slowest, 10=fastest).

Glowplug power – set to 1.4v, raise if required to get reliable ignition. Ensure plug element is pulled clear of body. Be careful of overpowering the plug and blowing the element.

The "INFO" screen of the ECU display contains a timer which shows the total running time of the engine in minutes, the number of starts (cycles - CY) and the time in seconds of the last run.

Use this screen to keep track of your total running time and flight times.

Exhaust temp.

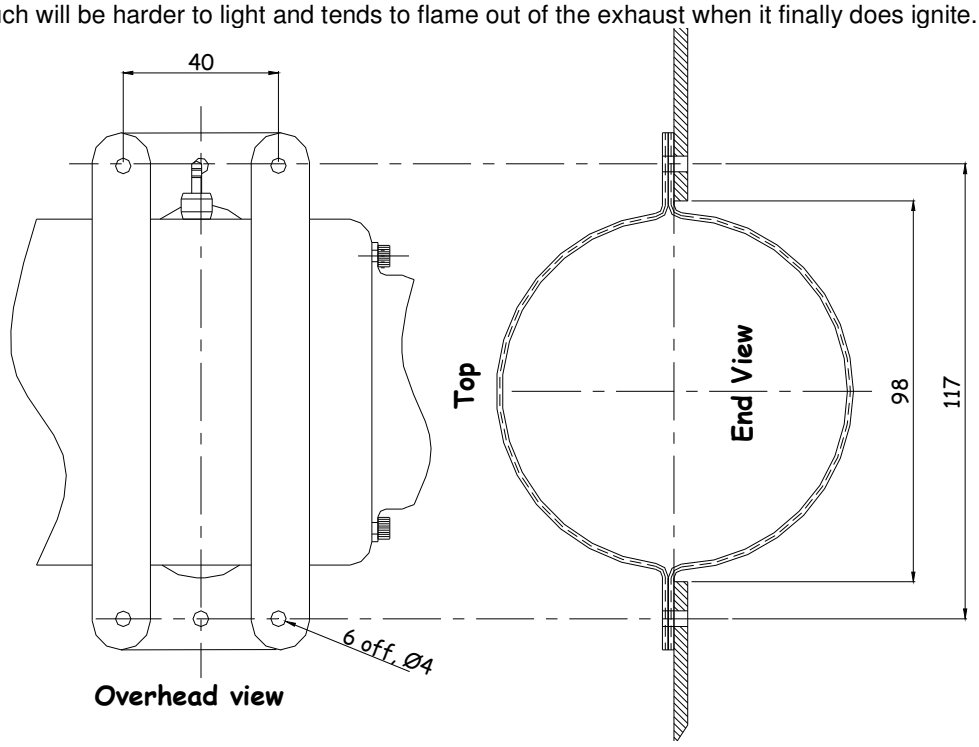
At all times the temp should remain below the value set in the main menu (usually 800'C). If the engine goes over this value the ECU will reduce the fuel pump power until the overheat has passed. It is quite normal to have very short term high temp spikes of a couple of seconds, but longer than this can result in overheating of the engine and the ECU may shut the engine down, and the cause should be investigated.

Priming the fuel system.

When the fuel system is initially installed the fuel lines will be empty. It is perfectly ok to simply go for a start with empty lines as they will fill quickly once the pump has started. However, if you want to prime the lines up to the engine, go into the "INFO" screen (press (▲) twice from the "trim low" screen. Scroll through using the (▲) button until you get to the Test/Prime Pump" screen. If you press the – button the pump will start up and the fuel solenoid open and you should see fuel moving up the pipe to the engine. Watch the fuel travelling up the line and press the + button as soon as it reaches the engine. ***Beware as the pump speeds up the longer the pump is left running and can easily flood the engine – watch it carefully***. Do not continue the prime beyond this point as the engine will be flooded with excess fuel which can cause a hot start. Once the line is full there is **no** need to repeat the priming process again.

Starter gas.

Problems lighting the gas are mostly related to plug element exposure, ensure the element is pulled clear so the gas can really "see" the element. It needs to glow bright yellow for good ignition, so adjust the "glow power" setting in the main menu as required. Note – only change the setting when you have fitted a fresh charged battery or you may accidently overpower it. Gas supply must be gas vapour – not liquid. Propane/Butane mixtures work best in all climates. Normally less gas is the secret - too much will be harder to light and tends to flame out of the exhaust when it finally does ignite.



The warranty.

Wren Turbines warranty this Wren 75 engine and associated equipment, free of mechanical defects in workmanship or materials for one year after purchase date, to 200 starts, or 50hrs running whichever comes first.

Engine Control Unit (ECU).
The ECU has a one year warranty which covers repair or replacement of the main unit and the display. Improper use like polarity reversal, short circuit, ingress of foreign matter or crash damage are excluded.

The performance figures are correct at sea level and 15'C ambient temperature.

Warranty Conditions:

1 The engine may not be dismantled except the removal of the fod screen, to access the service connections and speed sensor.
2 The fuel pump, ecu and rpm pickup may not be dismantled or manufacturers seal/covering broken by way of investigation. If either unit is suspected as defective it should be returned intact to Wren Turbines Ltd who will check the serviceability of the item and replace if found defective.
3 The engine MUST be started and operated exactly as instructed. This includes (i) correct mounting of the engine with correct inlet and exhaust ducting (ii) use of the correct battery packs (iii) use of the supplied fuel pump (iv) use and correct operation of the supplied ECU.
4 Only the recommended fuel is used.
5 Excludes parts damaged by excessive heat due to incorrect operation (starting, running, cooling etc).
6 Excludes parts damaged by ingestion of foreign objects (ie wires, model materials and fittings, water, sand or grit).
7 Excludes engine repairs where blockages in the fuel system have occurred due to use with unfiltered, or contaminated fuel.
8 Crash damage to the engine and its ancillaries is not covered by the warranty.
9 Warranty is not transferable.

Repair.

Damage or defective operation covered under the warranty terms will be repaired and tested at no cost to the original owner (other than post and packing). Repairs not covered under the terms of the warranty will be carried out by Wren Turbines Ltd, or their appointed agents, after agreement of costs.

Before returning the engine or ancillary equipment for service or repair, please contact Wren Turbines Ltd or Wren Agent to agree action and costs.

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