# SWIWIN Turbines

# *SW Brushless Series*



Kero Start

Full Autostart with Auto-Restart

Operations Manual

# Introduction

This manual is intended to aid the user in setup and running practices associated with the SWIWIN SW series micro turbines. This manual is not intended to take the place of a primer on micro-turbines. It is assumed that the user has working knowledge and experience with turbines and that each user is familiar with best practices before attempting to run a turbine.

# Non- Disclaimer

Turbines are inherently dangerous to run. Please read these instructions completely over and over then read them over and over AGAIN. You must be entirely familiar with the operation of this turbine before attempting to run this unit. It is strongly advised that if this is a first time turbine that the user engage the help of a seasoned pilot or turbine mechanic in order to help to familiarize the user with the operation and to minimize potential risks involved. This entails risk to the engine and risk to yourself and any bystanders.

SWIWIN USA will not take any responsibility for any damages or injury to the user or bystanders. Our responsibility is explicitly limited to the motor and to the internal workings and ancillary supplies offered with the turbine.

SWIWIN USA advises ALL users (novice or pro) to test their motors in a test stand before mounting them in a plane. The reason for this is to familiarize yourself with SWIWIN motor operation and to ensure reliable operation before mounting the engine in the plane.

If you have any questions, do not run the turbine. If you are unsure about how to operate the unit, do not run the turbine.

# Safety First

Users need to be versed in model jet turbine operation. Purchaser acknowledges the risks and dangers involved. Turbines are potentially hazardous to operate and pose a risk to the user and any bystanders.

- Risk of Explosion
- Risk of expelled turbine blades (rear)
- Risk of Burns
- Risk of long range effect of inhalation of smoke from turbine oil additives
- Risk of death or injury due to loss of control of a turbine or turbine propelled model

User accepts full responsibility for all risks including those to any bystanders. User accepts responsibility and bares all risks associated with operation of SWIWIN turbine engines.

# Warning to Bystanders

User acknowledges the risk of injury or burns to bystanders during start-up or while operating a turbine. User agrees to take all steps necessary to ensure that all persons are situated a safe distance from the operations of the engine.

Please refer to figure 1. Always ensure, that all bystanders maintain a safe distance from the engine.
clear of the area to the
rarely catastrophically malfunction but in the rare event of an issue, it is best to maintain a safe distance.

Fire extinguishers – It is absolutely crucial to have at least one CO2 extinguisher and a Class ABC extinguisher on hand at all times. CO2 is the only recommended application for a motor fire. A dry chemical extinguisher will work to extinguish a fire but the residue left behind from dry chemical extinguishers does heavy damage to a running turbine. If a chemical extinguisher is used to douse a running engine fire, the motor will need to be completely dissembled and cleaned.
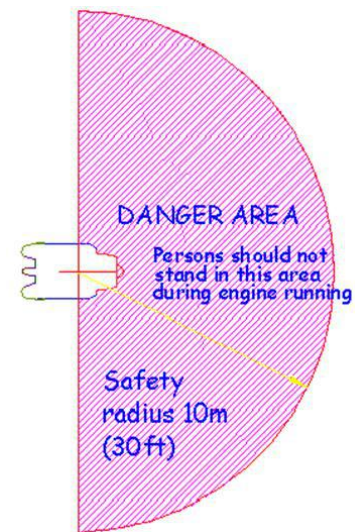


figure 1

Important Note: Please be sure to inspect all extinguishers each day that a turbine is being used. There are countless recounts by pilots and assistants where they reached for a fire extinguisher and it was not where it needed to be and/or the extinguisher was not operational.

Failsafe. Please read carefully the notes on setting the failsafe on your radio to of interference or loss of signal.

Ear Protection – Turbines produce excessive dB levels of noise. when running the engine.

Burns - Exhaust gases are very hot (up to 1000°C) and can cause burns to skin or damage to objects close to it – keep exhausts clear of anything which is affected by such heat.

Turbine Oil Toxicity - Turbine oil is poisonous. Keep it away from the mouth and eyes andfrom contact with skin. Always store it in out the role of fireman. Ensure that they are aware of what to do in event of emergency and where to position the extinguishers.

Turbine Oil – Turbine oil is required for operation of your turbine. Use of any non-approved oil such as 2 cycle oil voids the warranty.

# SWIWIN Limited Lifetime Warranty

SWIWIN warrants each turbine to be free from defects in materials and workmanship during normal usage, according to the following terms and conditions.

1. The warranty is transferable to any subsequent user. There is a $50 admin fee which will be collected when ownership of the motor is transferred. Please make sure that each user registers the motor with SWIWIN at the time of transfer so that service can be maintained on the motor.

2. Warranty period commences on the date of purchase.

3. First year warranty covers all parts except for batteries.

4. Lifetime warranty coverage applies after year one and covers the following items:

     a. Combustion chamber

     b. Shaft

     c. Shaft tunnel

     d. Diffuser

     e. Injectors

     f. NGV

     g. Turbine wheel

5. Lifetime Warranty does not cover the following items:

     a. Damage to Can

     b. Crash Damage

     c. Starter motor

     d. Glow Plug

     e. Any FOD damage including and not limited to:

     i. Broken compressor blades ii. Scored intake cover

     f. Diffuser

     g. Solenoid/valves

     h. Pump

     i. ECU

     j. GSU

# Terms

1. Within the initial 1 year warranty period, SWIWIN will repair or replace, at SWIWIN's discretion, any defective part(s), with new or factory rebuilt replacement items if such repair or replacement is required and is due to a malfunction during normal usage.

2. SWIWIN will cover labor charges associated with any warranty repair.

3. SWIWIN warranty coverage is limited to replacement of parts and repair of the unit and does not apply to any other losses or damages, consequential or inconsequential to the failure.

4. Buyer is required to register the motor with SWIWIN at the time of purchase. Please retain all receipts and paper work.

5. Buyer agrees to cover the cost of shipping the turbine to SWIWIN USA for repair exclusions.

6. Warranty and/or extended coverage does not apply under the following circumstances:

     a. The turbine is used for commercial or institutional (school) use

     b. The turbine has been stored improperly

     c. The turbine was submerged in water

     d. The turbine has been modified in any fashion

     e. Any attempt to repair

     f. Any dismantling of the turbine

     g. Any crash regardless of cause

h. The turbine was not cooled properly

i. Improper electrical connections

j. Turbine serial number has been removed or altered.

k. Turbine is found to have been operated with 2 cycle oil

7. If a problem occurs during the warranty period, please contact our service department and take the following steps:

     a. Contact SWIWIN in order to coordinate shipping of the turbine to the service center for evaluation and repair.

     b. Send the turbine to our repair center. Please include all user information including address and daytime phone number, email address, etc. Please also include a photo copy of the original sales receipt.

8. Owner agrees to cover charges for all parts and/or labor charges not covered by this warranty.

9. In the event that a turbine is returned and it is later determined that the engine has failed due to issues that are not covered under the warranty (see above conditions) the owner will be provided with a repair estimate.

     a. If the estimate is refused, the turbine will be returned to the user. Owner agrees to cover all return shipping costs.

10. This document constitutes the entire warranty between SWIWIN and the owner and supersedes all prior agreements and/or understandings.
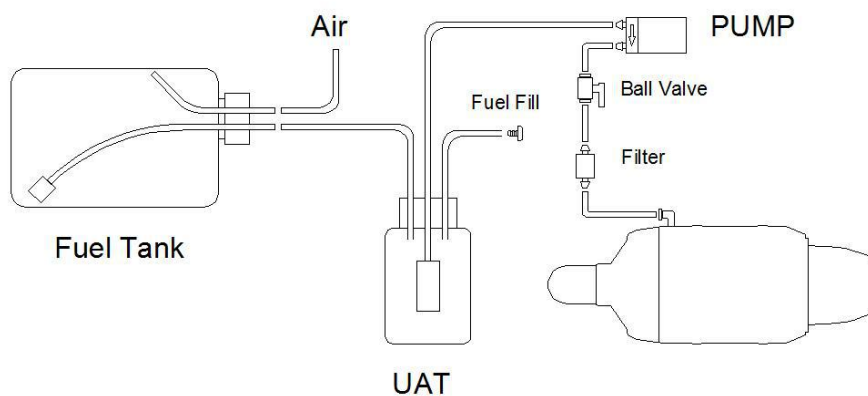
# Operation and Setup



Figure 2, Items Included in Motor Kit

| | |
|---|---|
| <br>ECU | 1. Connect one end of the servo cable (provided) between the ECU port labeled "ppm/sbus/sbus2" and the other end to your receiver<br>2. Connect the Battery cable to ECU port labeled "3S LIPO BATT"<br>3. Connect the pump to the deans connector on the battery cable<br>4. Connect the GSU to the ECU port labeled "GSU/PC".<br>5. Connect the engine cable to the ECU port labeled "ENGINE". |
| <br>Engine cable | <br>Brushless pump and Traditional pump |
| <br>Throttle line | <br>Battery power cable |

# Motor Setup



Please refer to Figure 3 - Motor Setup above

1. Connect the motor festo fitting to a section of 4mm tubing (included).
2. Route the tubing to the filter then to the shut off as shown.
3. Connect the other end of the shutoff with 4mm tubing to the output of the supertrap pump.
4. Plumb the UAT as shown and per the UAT instructions (UAT is not included)
5. Plumb the Fuel tank per the manufacturer instructions noting orientation above.
6. Connect Input of fuel pump to UAT fuel out fitting
7. Double check your fittings
8. Use 20 gauge stainless wire to secure tubing to non-festo connections

# Startup Operation

Prior to running the turbine walk around the aircraft or motor stand and make sure that all power and data connections are placed properly.

1. Turn the fuel valve to the on position
2. Turn on power to the receiver and observe GSU startup. The motor and GSU will sync up with an audible signal.
3. If this is the first startup, use the test menu and locate "test pump" function.
4. Prime the lines with fuel using the test pump function. The fuel line to the motor can be placed into a tank to circulate fuel then connected to the motor when primed.

Failure to conduct this exercise will cause the motor not to run.

Note: Some users report running the pump for a few minutes with fuel circulating to "break in" the pump before running the engine for the first time.

5. Turn on power to the Radio Controller. Note an audible sync signal when the radio is powered up. This lets the user know that the motor is online with connection to the radio.
6. Raise the trim to 100% and observe ECU status "ready"
7. Raise the throttle stick to full then to min. This will initiate a start sequence.
8. The starter motor will begin to spin. The ECU will switch to ignition, then to preheat, then to ramp. As the motor begins to ramp the pump begins to pump more and more aggressively. When the motor reaches idle speed the ECU will train to the motor. For first time users, the ECU will switch first to "learn RC" then will indicate learn stick high. Raise the throttle to full and allow the motor and ECU to train to full RPM. Please be sure to brace the aircraft from moving now.
9. The ECU will now indicate learn Stick low.
10. Return the stick to low position. The motor will now switch to "running" and motor function is transferred to the user.

# Shutdown Procedure

Always observe proper shutdown and cooling of the turbine. Failure to observe proper shutdown by not properly

cooling the unit will render damage and will void the warranty.

To shut down the turbine

1. Lower the stick to minimum
2. Lower trim to minimum
3. The motor will shut down and initiate a cooldown sequence by turning on the starter motor to an RPM defined in motor parameters. This cool down speed is determined in cooling menu of ECU setup. The default cool down speed is 7000 rpm. The motor turns continuously until a safe temperature is reached. Please note that it is normal with new ECU releases for the starter to spin continuously until the motor is cooled. Previous firmware releases spun the motor intermittently to save the life of the motor.
4. Turn off the fuel
5. Turn off power to the controller
6. Turn off power to your radio

# ECU

The SWIWIN ECU was designed from the ground up and is based on 32 bit microprocessor functionality and designed specifically for SWIWIN Turbines.

The ECU offers the following benefits:



- Data Logging Auto start Automatic Restart
- Color Screen visible in direct sunlight
- Configurable thrust curve with very fast throttle response
- Telemetry function
- BUS input

ECU/Motor Electrical Connections
Do not exceed these voltages!
Receiver voltage：5-8.4V(4S Nimh or 2S Life or 2S Lipo)
Power voltage：11.1V (3S Lipo)

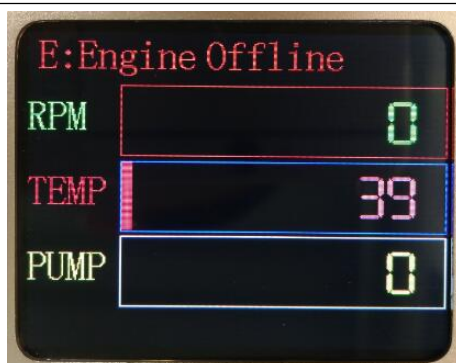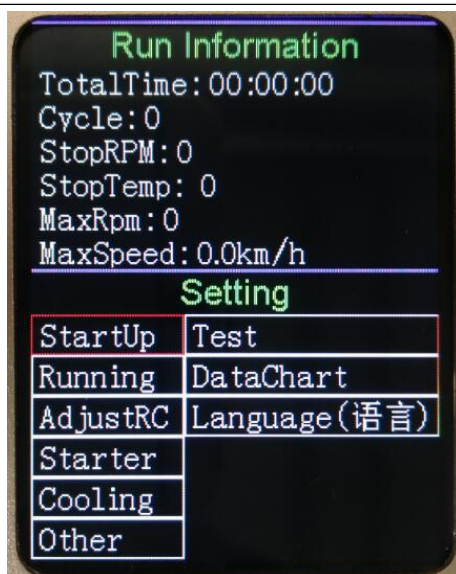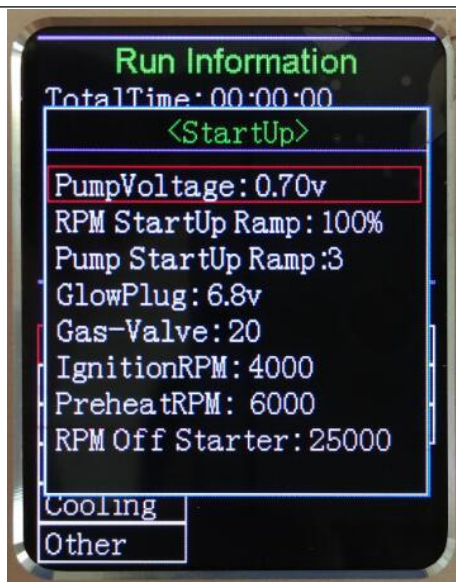| | |
|---|---|
|  | **GSU Screen Button Function**<br><br>"OK" Invoke a change or command "C" Clear a screen<br><br>"+" Increment a value "-" Decrement a value<br><br><br>Initial Screen<br><br>RPM – Current running status of the turbine<br><br>Temp – Current temperature of engine Curr – Electrical current in use<br><br>Cap – Main Battery that has been used ACC – Response time from idle to max. in seconds.<br><br>Screen Bottom – Running Status RPM - 0 – 100%<br><br>Temp - 0 – 1000 Celsius<br><br>Pump – output measured in volts – ex.4500/1000 = 4.5 volts<br><br>RC – throttle position from 0 – 100% |
|  | **Large font Running Screen**<br><br>Press "C" to toggle between large screen and normal |
|  | **Main menu – initial screen**<br><br>From the initial screen, press "OK" key, click "C" to toggle back to boot screen<br><br>StartUp – enter startup menu<br><br>Running – enter Running menu<br><br>Adjust RC – Train Radio to ECU<br><br>Starter – set starter power<br><br>Cooling – set cooling rpm<br><br>Other – enter other parameters menu<br><br>Test – enter Test menu<br><br>DataChart – running data records<br><br>Language - switchable Chinese or English |

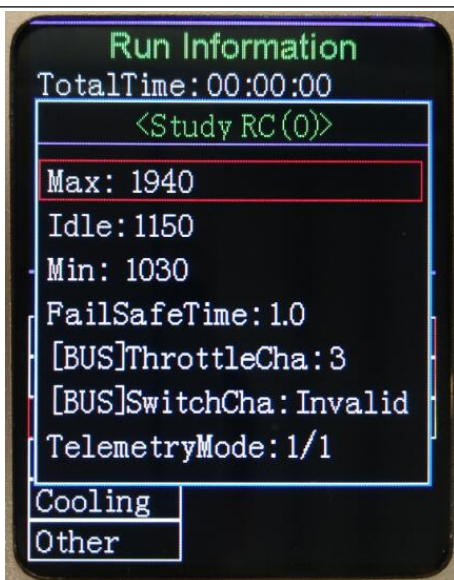| | |
|---|---|
|  | **Start Up Screen**<br><br>PumpVoltage - Set pump voltage Typical value is 0.4-0.5v<br>RPM StartUp Ramp – Set ramp profile starter , This parameter adjusts the speed of the starter increase during the "Preheat to RPM Off Starter" phase. Higher values mean a faster rpm increase. Increase this value if the engine too hot duing preheat to rpm off starter , and decrease it if flame out duing preheat to rpm of starter.<br>Pump StartUp Ramp - This parameter adjusts the speed of the fuel increase during the "Fuel ramp" phase. Higher values mean a faster fuel flow increase. Increase this value if the engine takes too long to arrive to idle, and decrease it if the starts are too hot, with the engine overshooting the idle speed.<br>GlowPlug – Set Glow Plug Voltage.<br>GasValve – Set the values of time of the gas fuel valve is open at beginning of the ignition phase.<br>Ignition RPM – Set the RPM where ignition phase commences<br>Preheat RPM – Set the RPM value for preheat phase to begin.<br>RPM Off Starter – Set the RPM where the starter motor will disengage. |
|  | **Running Display**<br>RPM Acceleration/Deceleeation Curve/Delay time<br>Higher values mean a faster rpm increase/decrease rate. Adjust according to weather, Altitude (ASL) or other conditions which require adjustments to delay time. It is best to select a value that is lower than a setting that yields the fastest possible response time in order to avoid a flame out.<br>Raise value to decrease response time, Lower value to increase response time<br>Max RPM – Set maximum RPM<br>Idle RPM – set idle RPM<br>Min RPM – set stop RPM , if motor RPM falls below this setting, motor will shutdown.<br>MaxTemp - Set maximum running temp.If motor exceeds this value, ECU will automatically limit fuel in order to reduce the temp.<br>LowVolt – set low volt warning<br>Restart - Can be set "valid" for enable or "invalid" disabled, flame out automatically restart or not.<br>Restart power pump – set power to pump on restart. Normal range from 0.3 – 0.7 Volt<br>PumpLimit – This value is used to set the limit to the pump to a reasonable limit and is based on observation of actual running values.    Set this value to 20% higher than what is observed on the main screen.    This prevents excess pump pressure.<br>IdlePumpStab – set pump stable delay on idle rpm, normaly SW60B tubine set 5-8, SW120-210 set 3-5 |

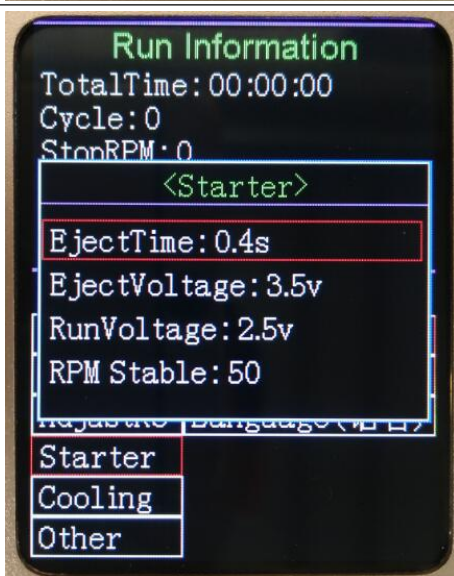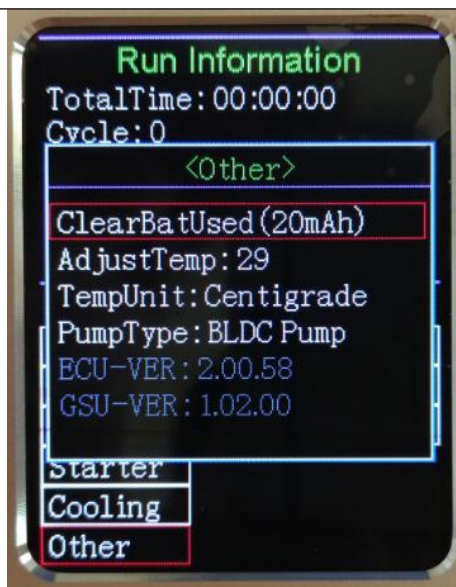| | |
|---|---|
|  | **Learn RC**<br><br>This menu is to train the transmitter to the ECU.<br><br>Max – Throttle up, trim up<br>Idle – Throttle down, trim up<br>Min – Throttle down, trim down<br>FailSafeTime – set fail safe time in seconds<br>[BUS] Throttle cha – setup throttle channel if use BUS Mode input<br>[BUS] Switchcha – setup switch channel if use BUS Mode input and switch startup function,if turn on this function ,ppm input will invalid, need use BUS mode for input<br>TelemetryMode – set telemetry mode 1/1 for single engine mode |
|  | **Starter**<br><br>Eject Time – sets the time for a reverse voltage pulse to disengage the starter.<br>Eject Voltage – sets the eject voltage in order disengage the clutch on startup<br>Run Voltage – Sets the voltage for the starter during startup<br>RPM Stable – rpm adjust rate of starter |
|  | **Engine Cooling**<br><br>Sets the cooling rpm after shut down or when starter is manually run using test functions.<br><br>*Please note that following a failsafe failure or flameout that the motor will not automatically enter a cool down sequence. This is because the ECU has no way of knowing the status of the motor whether flame out, crash or other. |

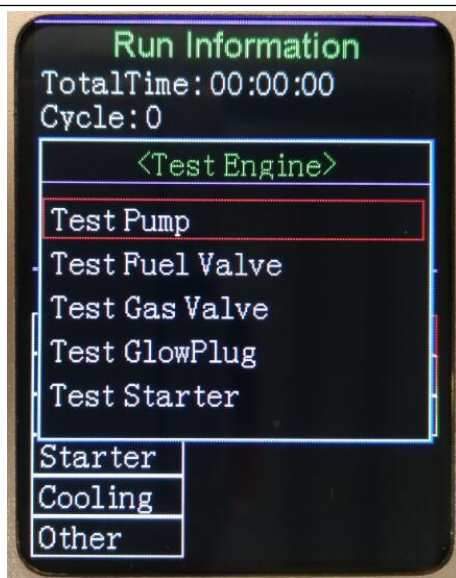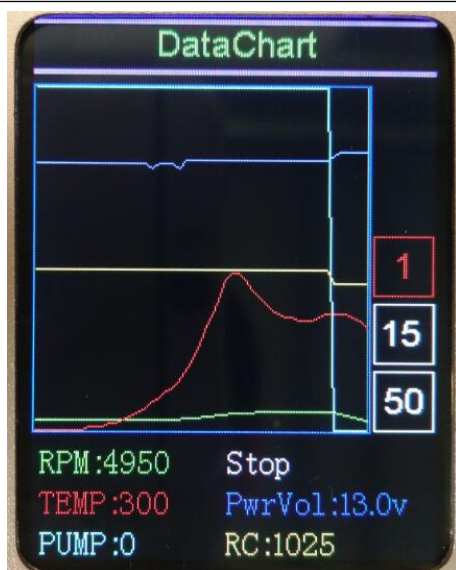| | |
|---|---|
|  | **Other**<br><br>Clear Battery used – reset the value to zero.    This allows the pilot to determine how much battery life is remaining.<br>Adjust Temp – Used to calibrate the temperature reading on the engine.    Unless there is an issue adjustments are not normally needed.<br>Temp Unit – set to Fahrenheit or Centigrade<br>Pump Unit – set DC pump or brushless pump<br><br>Firmware Version – Displays the current version firmware for the following engine controls:<br>TCU – Turbine control Unit<br>ECU – Engine Control Unit<br>GSU – Ground Screen Unit |
|  | **Test function menu**<br>Press "OK" to access test functions<br><br>Test Pump – depress OK and hold OK to increase pump speed. Pump increases gradually. Test pump initiates fuel solenoids simultaneously. Be careful not to flood the engine.<br>Test Fuel Valve – press "OK" to activate fuel valve.<br>Test Gas Valve – press "OK" to activate Gas Valve – this controls fuel to the glow plug.<br>Test Glow Plug – press "OK" to activate Glow Plug circuit. A glow can be seen from the rear of the motor.<br>Test Starter – Press "OK" to activate starter. Use this function to manually cool the motor. RPM speed of starter is set in the startup menu |
|  | **Data chart**<br><br>Record running data use the increment and decrement key to step through events in the data chart.ECU can record 34 minutes of running data.<br><br>The color corresponding to each parameter as follows<br><br>Red – Temp<br>Yellow – Throttle position<br>light blue – Pump<br>Green – RPM<br>Dark Blue – Power voltage |

Spec



SW60B
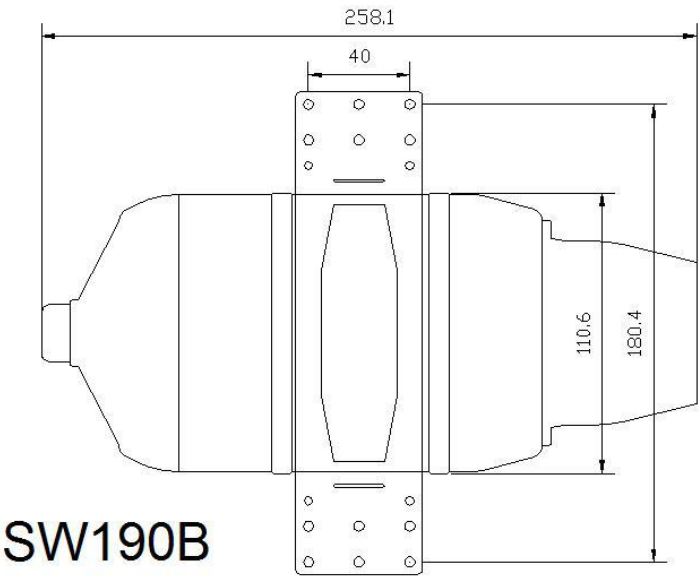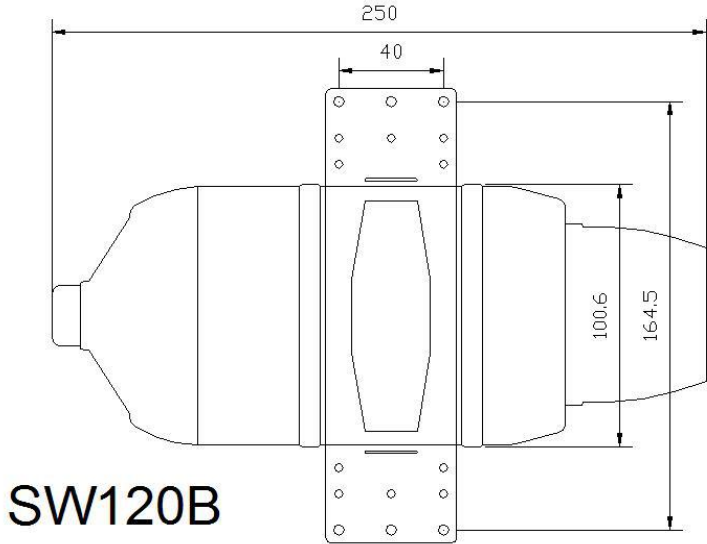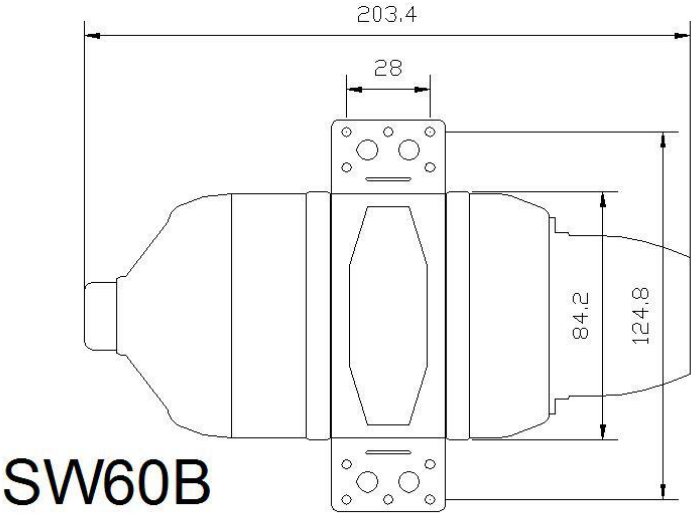


SW120B



SW190B

|  | SW60B | SW120B | SW140B | SW170B | SW190B |
|---|---|---|---|---|---|
| Diameter | 84mm | 100mm | 100mm | 110mm | 110mm |
| Length | 203mm | 250mm | 250mm | 258mm | 258mm |
| Weight | 783g | 1255g | 1255g | 1457g | 1457g |
| RPM range | 50,000-160,000 | 38,000-125,000 | 38,000-128,000 | 33,000-110,000 | 33,000-115,000 |
| Thrust | 60N | 120N | 140N | 170N | 190N |
| EGT | 650℃ | 650℃ | 650℃ | 650℃ | 650℃ |
| Consumption | 164g/min (144,000RPM) | 310g/min (112,500RPM) | 325g/min (115,200RPM) | 351g/min (99,000RPM) | 380g/min (10,3500RPM) |
| Fuel | kero or diesel | kero or diesel | kero or diesel | kero or diesel | kero or diesel |
| Lubrication | 5% kero 3% diesel | 5% kero 3% diesel | 5% kero 3% diesel | 5% kero 3% diesel | 5% kero 3% diesel |
| Maintenance Interval | 25Hours | 25Hours | 25Hours | 25Hours | 25Hours |

# Service