Website: www.nova-jets.com
Email: sales@nova-jets.com
Phone: +1-765-387-9320

Swiwin Turbines

SW Brushless Series

Kero Start

Full Autostart with Auto-Restart

Operations Manual

Table of Contents

Diagrams

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 Turbines 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 Turbines 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.

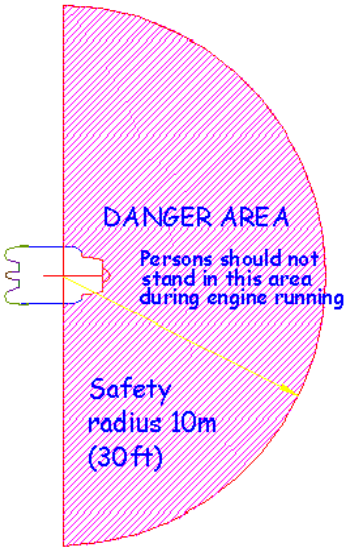


Figure 1 Safe Distance

Please refer to figure 1. Always ensure, that all bystanders maintain a safe distance from the engine. At least 10m (30ft) clear of the area to the side and rear of the engine, Turbines 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. The warranty is void if dry chemical extinguisher is used to put a turbine fire out.

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 even
worse is an extinguisher that was not operational.

Failsafe - Failsafe. Please read carefully the notes on setting the failsafe on your radio to ensure safe operation in event of interference or loss of signal.

Ear Protection – Turbines produce excessive Db levels of noise. Always use ear protection 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 and from contact with skin. Always store it in a marked container and out of reach to children.

Inhalation of Smoke from Turbine Exhaust – Turbine oil is a known carcinogenic. Prolonged and repeated exposure to turbine exhaust ([1]when using turbine oil) can be a health endangerment.

Ground Assistants - Use a qualified ground assistant during all Start-Up procedures. Purchaser agrees to use an assistant who is familiar with the operations of a micro turbine.

Keep assistants close and be sure that they understand their role before starting the engine. One assistant should carry 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. Turbine oil or Mobil DTE may be used for lubrication purposes.

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 – under no circumstance

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 for repair.

6. Exclusions

1. 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

2. 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.

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

5. 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. If the estimate is refused, the turbine will be returned to the user. Owner agrees to cover all return shipping costs. This document constitutes the entire warranty between SWIWIN and the owner and supersedes all prior agreements and/or understandings.

Operation and Setup

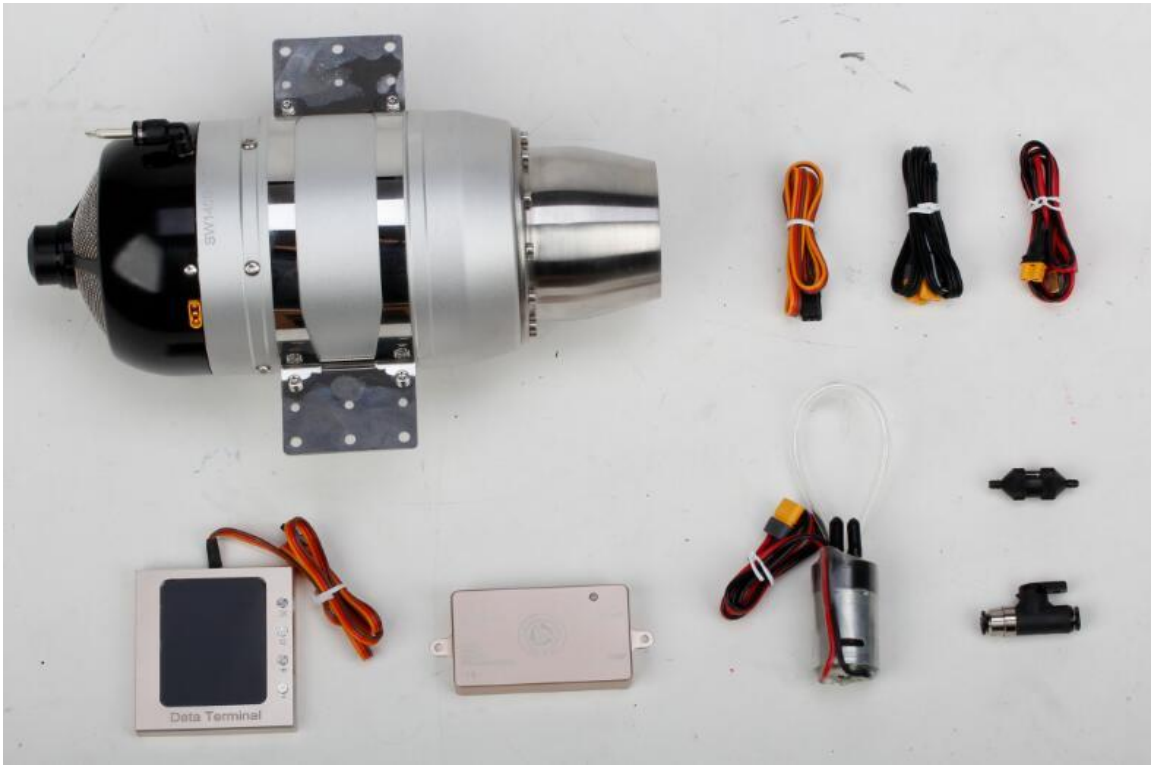


Figure 2 Items Included in Motor Kit

Please refer to Figure 3 below for steps 1 and 2

1. Refer to Figure 3 below. Connect one end of the RJ45 black data cable (provided) to the motor receptacle. Connect the other end of the black RJ45 cable to the ECU connection labeled “Sensor Cable”

2. Connect the yellow power cable (Male) to the ECU port labeled “Power Cable”.

Figure 3 ECU Connections and Power Connection

Refer to Figure 4 below for steps 3 and 4.

3. Connect one end of the servo cable (provided) between the ECU port labeled “Throttle” and the other end to your receiver #3 input.
   - Please note “S” signal and “-“ on ECU polarity. The ECU and/or GSU will not function properly if not connected properly.
4. Connect the battery cable to ECU port labeled “Battery”. The battery connector can be deans or XT60 type.
5. Connect the pump (deans) to the pump cable and the other end to the ECU port labeled “pump”.
6. Connect the GSU to the ECU port labeled GSU. Orange signal toward top of ECU. Please observe correct polarity or the terminal will not operate properly.

Figure 4 Engine Connection and Pump

Figure 5 ECU Connections

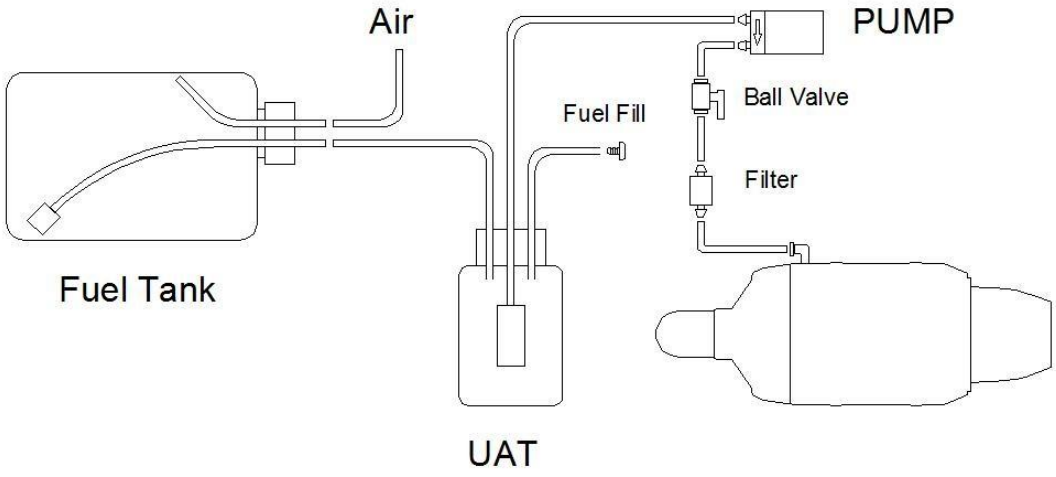


Figure 6 Motor Setup

Motor Setup

Introduction – for first time users and for first time use of any engine, it is strongly recommended that the motor be placed into a test stand for the first time. There are a hundred reasons to do this. There is only one good reason to mount a brand new motor into a plane for the first start time and the answer is there is no benefit. I have had countess discussions with people who have spent hours or days to install a new engine and all the ancillaries then have to undo their work to test the motor because of startup issues. There is just no upside to not taking the time to adequately test the engine before putting it into a plane.

Mount the engine in a test stand that will minimally handle the full thrust of the engine. This means secure it properly and weight the table if needed. A workmate bench can work for a small 60 sized engine but is not suitable for securing a larger engine. Mount the engine securely into whatever apparatus you select. Do not do this indoors. Do route the exhaust outdoors or into a pipe that goes outdoors. Mount the ancillaries neatly where you can see them. Do not skimp on this step. Note the orientation of the parts and the plumbing. Make sure the valve is off. Then work on the electrical. It is difficult to mix up polarity with all of the enhancements to the wiring we provide now but depending on how you are supplying LiPo current please observe correct polarity to the ECU. If you mix up polarity on the LiPo end, the ecu will instantly be fried. There is no warranty on a fried ecu so please observe correct polarity.

Please refer to Figure 6 - 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

Radio Setup and Training – Learn RC

Refer to Learn RC below. It may take some getting used to the functions of the GSU. Highlight maximum on the GSU, raise the radio stick and trim to max. Note the signal level changes as you raise stick and trim. Depress OK to lock in the new "maximum" value.

Highlight Idle on the GSU and lower the stick while leaving trim at maximum level. Depress Ok and lock in the "idle" value

Highlight Minimum on the GSU and lower the trim to a value you select as stop. The stick should be at minimum now. Press Ok to lock in the "minimum" value.

Servo Tester in Place of a Radio

For test purposes, a servo tester can be used in place of a radio. The use of a servo tester provides a means to isolate the motor especially if there are any suspected radio issues. Ensuring that the engine works properly first is a good measure. The setup and utilize a servo tester, refer to the radio setup. Maximum is maximum signal out for the tester. Minimum or stop is set to the lowest output of the tester and idle is a value in-between which is arbitrary and up the user.

Priming the Pump

Before using the turbine for the first time it is imperative to prime the pump and remove all air from the lines before attempting to start the engine.

To prime the pump:

1. Connect a section of fuel line to the input of the pump and to a vessel with fuel in it

2. Connect another section of fuel line to from the output of the pump to the same vessel. This will establish a loop.
3. Initiate the test pump function by going to the main screen then stepping down to "test". Select the first option "test pump". With the OK button depressed the pump will gradually begin to spin faster and faster until a steady stream of fuel can be seen entering back into the vessel. Be sure all air bubbles have been expelled from the fuel line.
4. Once the operation is complete remove fuel line from the vessel and install on the motor.

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.

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. Turn on power to the Radio Controller. Note an audible sync tune when the radio is powered up. This lets the user know that the motor is online with connection to the radio.
4. Turn on the fuel valve.
5. Raise the trim to 100% and observe ECU status switches from stop to "ready". If the ECU does not transition to ready state, recheck the ECU to radio connection and retrain if needed.
6. Raise the throttle stick to full then to min. This will initiate a start sequence.
7. The starter motor will begin to spin. The ECU will switch to ignition, then to preheat, then to ramp.
    - **Ignition** - This is the first phase of startup. During the ignition phase, there is a minimal flow of fuel (based on pump voltage you select) to the plug. During ignition, listen for a sizzling sound. This occurs as fuel begins to flow across the white hot glowplug. As heat increases, the engine will then transition to preheat. View the transition on the screen. Temperature should be on a continuous rise.
    - **Preheat** – As the engine transitions to "preheat" the motor will increase rpm to the value set in the startup menu – "preheat RPM". Fuel continues to flow through the plug based on the value set in "gas valve". At this time, the main jets begin to flow fuel.
        - Note: Depending on the software release of your engine, a main "fuel Valve" setting may not be visible in the startup values. This parameter has been eliminated on newer releases.

- **Fuelramp** – After the motor has reached a suitable heat level, the motor enters the "Fuelramp" phase. The motor begins to ramp and the pump begins to pump more and more aggressively. The rate at which the engine increases speed is based on the startup value set in "percentage fuel ramp". Higher numbers equate to a faster start sequence but it is advised to be conservative when changing ramp values.

Tip: Adjust pump start, ramp start and % ramp to fine tune the startup. Please note that these values have no effect on the running state of the engine.

First time use

After the motor reaches idle speed the ECU will train to the motor. For first time only use, the ECU will display a message to "raise stick". Raise the stick to full and allow the motor time to reach full output. Next, the ecu display "lower stick". Lower the stick (not the trim) to minimum. After the motor reaches idle speed, the ECU will transfer control to the user and switch to "running" status.

Note: the actual messages displayed may be different depending on the software revision. Please refer to the notes regarding specific software revisions.

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.

Shut down the turbine

1. Lower the stick to minimum
2. Lower trim to minimum
3. As trim is lowered to the threshold initially set, the motor will shut down and initiate a cool down 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. Depending on the software release the engine may turn continuously until a safe temperature is reached or with brushed starters the starter engages intermittently until the engine is cooled (80C).
4. Turn off the fuel
5. Turn off power to the controller
6. Turn off power to your radio

Figure 7 Brushless ECU

Figure 8 Pump and Engine Connection

Figure 9 Power ECU Connections

Figure 10 Throttle Cable

Figure 11 Optional Temp/RPM Monitor

Figure 12 GSU

Figure 13 Engine Cable

Figure 14 Power Cable

Figure 15 Fuel Pump

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

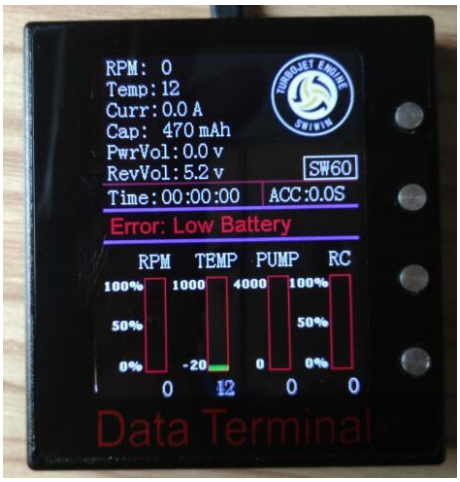
ECU/Motor Electrical Connections

Do not exceed these voltages!

Receiver voltage：5-8.4V(5S Nimh or 2S Life or 2S Lipo)

Power voltage：9.9-11.1V (3S Life or 3S Lipo)

ECU/GSU Operation



GSU Screen Button Function

"OK" Invoke a change or command **"C"** Clear a screen
"+" Increase a value
"-" Decrease a value

Initial Screen

RPM – Current running status of the turbine
Temp – Current temperature of engine
Curr – Electrical current in use
Cap – Main Battery that has been used
ACC – Response time from idle to max. in seconds.

Screen Bottom – Running Status

RPM – 0 – 100%
Temp – 0 – 1000 Celsius
Pump – output measured in volts – ex. 4300/1000 = 4.3 volts
RC – throttle position from 0 – 100%

Large font Running Screen

Press "C" to toggle between large screen and normal

Main menu – initial screen

From the initial screen, press "OK" key, click "C" to toggle back to boot screen

StartUp – enter startup menu **Adjust RC** – Train Radio to ECU

Cooling – set cooling rpm

Running – enter Running menu

Other – enter other parameters menu **Test** – enter Test menu

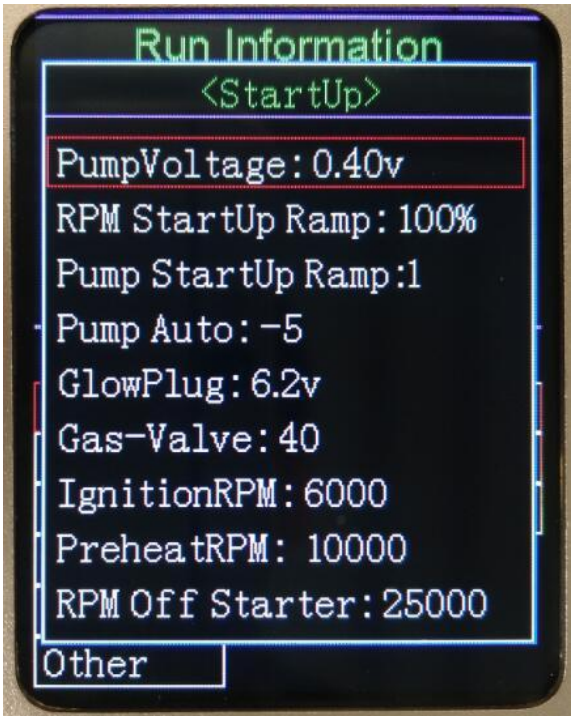
Language - switchable Chinese or English

DispAllMenu – select to show all hidden menu – see next pic for all menu screen

Start Up Screen (advanced functions)

PumpVoltage - Set pump voltage Typical value is from .4 to .5. This sets the initial pump volume when the motor is initially started. The flow should be a drip, drip, drip.. not a heavy flow at all.

Pump Voltage, Pump Auto, ramp, startup ramp and Ramp Percent values have zero effect on the engine after the engine is running.



Test over a piece of rag or a canister. Each pump is different even for the same brand of pump. .2 - .8 is a huge change. Make adjustments .02 - .04 increments at a time.

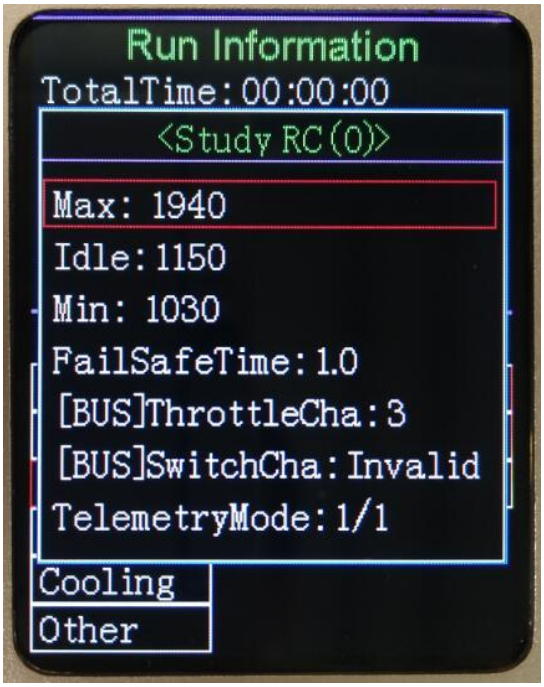
RPM StartUp Ramp – Set ramp profile – On new engines please follow the default parameters. Once familiar you can raise this value in order to speed the start time of the turbine. Typical values from 60 – 80%

PumpStartUp 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. Typical values from 0 – 5.

Pump Auto - Sets the power of the pump when it is started at beginning of the fuel ramp. The ECU has the ability to automatically adjust the pump power to start it at the lowest possible speed. Typical values from -5 – 0.

GlowPlug – Set Glow Plug Voltage. Typical value from 6.0 to 6.8. Set this to the lowest value to achieve a reliable start.

GasValve and MainValve - Set the percentage of time of the main fuel valve is open at beginning of the switchover phase. This percentage will increase automatically with RPM until arrive to fully open when the RPM of next phase are reached. The time where the burner valve is open is complementary to the injector time, so when the main valve is open at 80%, the burner is 20%. Typical value 50%-70% Please note recent software revisions may have removed the main valve setting.



Ignition RPM – Set the RPM where ignition phase commences
Preheat RPM – Set the RPM value for preheat phase to begin.
RPM Starter Off – Set the RPM where the starter motor will disengage.

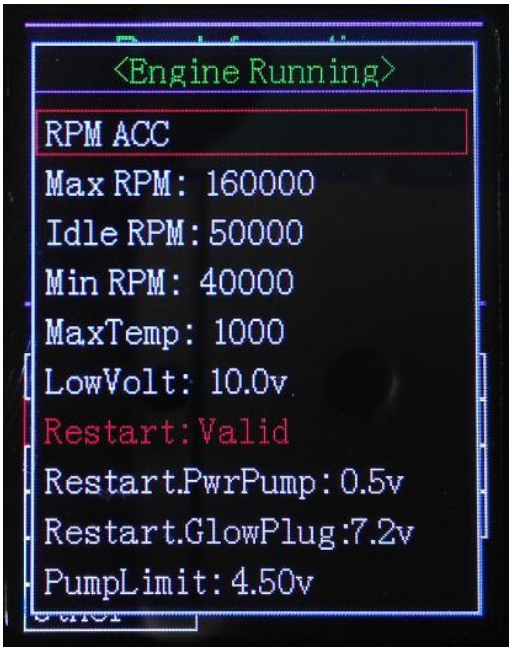
Learn RC

This menu is to train the transmitter to the ECU. Be sure to depress OK to lock in the value that you select.
Max – Throttle up, trim up
Idle – Throttle down, trim up
Min – Throttle down, trim down
FailSafeTime – set fail safe time in seconds

Cooling

Sets the cooling rpm after shut down or when starter is manually run using test functions.

*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.



Running Display This menu control running parameters

RPM ACC – Press "OK" to access acceleration curve

Max RPM – Set maximum RPM

Idle – set idle RPM

Min RPM – set stop RPM - if motor RPM falls below this setting, motor will shutdown.

MaxTemp - Set maximum running temp. If motor exceeds this value, ECU will automatically limit fuel in order to reduce the temp.

LowVolt – set low volt warning

Restart - Can be set "valid" for enable or "invalid" disabled, flame out automatically restart or not

Restart power pump – set power to pump on restart. Normal range from 0.5 – 1.1 Volt

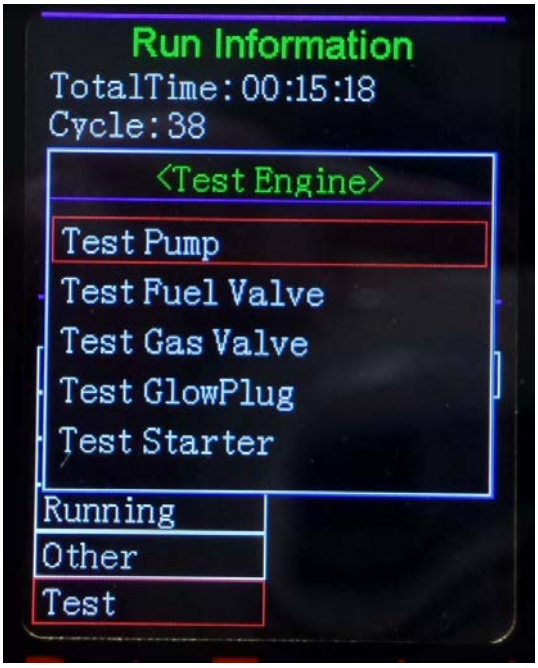
RPM Acceleration Curve/Delay time

Set FULL (high speed) - The ECU will automatically calculate the response of IDLE the acceleration rate of value (low speed). 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.

- Raise value to decrease response time
- Lower value to increase response time.

Note: The performance of the motor in the air might not be comparable to

performance in the air meaning you might achieve lightning fast response on the ground and find that the motor may not behave the same in the air. Be conservative with the response curve.



Test function menu

Press “OK” to access test functions

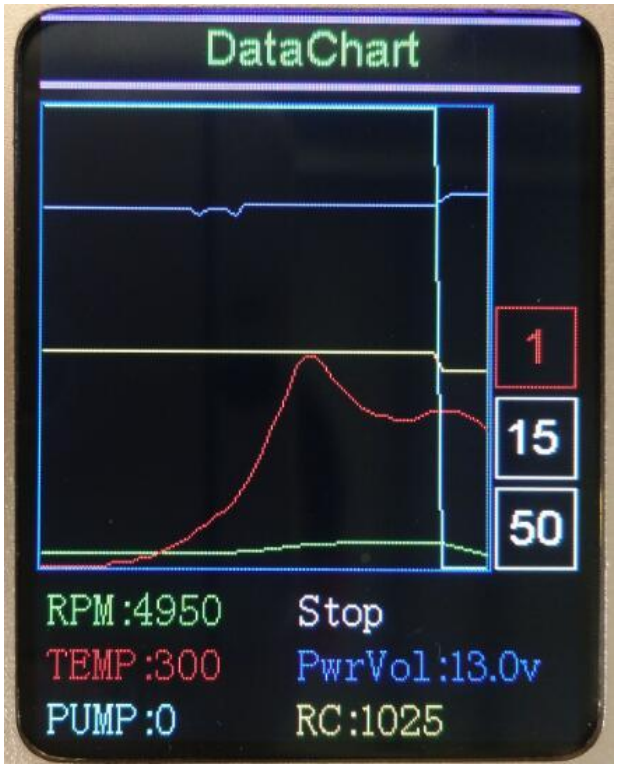
Test Pump – depress OK and hold OK to increase pump speed. Pump increases gradually. Test pump initiates fuel solenoids simultaneously. Be careful not to flood the engine.

Test Fuel Valve – press “OK” to activate fuel valve. You will hear click, click, click

Test Gas Valve – press “OK” to activate Gas Valve – this controls fuel to the glow plug. You will hear click, click, click

Test Glow Plug – press “OK” to activate Glow Plug circuit. A glow can be seen from the rear of the motor.

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

Record running data use the increment and decrement key to step through events in the data chart.

The color corresponding to each parameter as follows

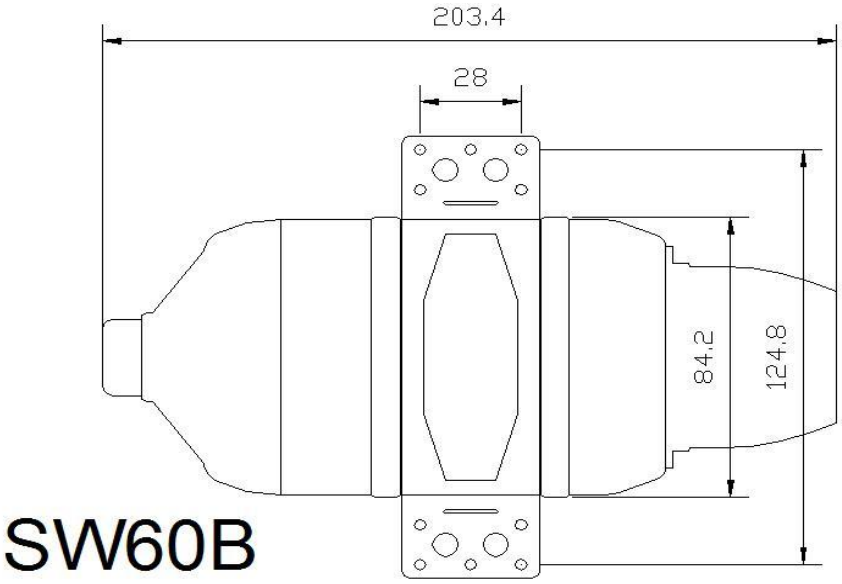
Red – Temp
Yellow – Throttle
position light blue –
Pump Green – RPM
Dark Blue - Power

ECU Parameters – Brushless starter

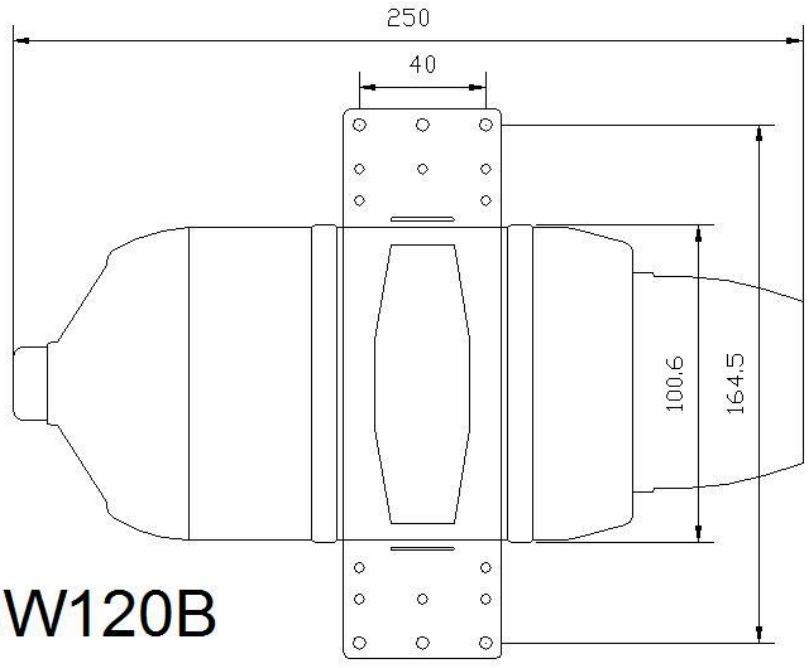
Auto Restart ECU Parameters – Parameters may vary dependent on firmware release

Menu	Parameter	SW60	SW120/140	SW180/210
Startup	Pump voltage	0.4	0.5	0.5
	RpmStartup ramp	80%	80%	80%
	Pump startup ramp	1	1	1
	Pump auto	-3	- 5	- 5
	Glowplug	6.2	6.4-6.8	6.4-6.8
	Gas valve	40-20	40-20	40-20
	Ignition rpm	6000	5000	3000
	Preheat rpm	10000	7000	5000
	Rpm off starter	25000	22000	15000
Starter	Eject time	0.4	0.4	0.4
	Eject voltage	3.0	4.0	4.0
	Run voltage	2.5	3.0	3.0
	Rpm stable	50	50	50
Cooling	cooling	6000	6000	6000
Run	Acc Curve	30	30	30
	Max rpm	160000	128000	120000
	Idle rpm	50000	38000	33000
	Min rpm	40000	33000	28000
	Max temp	950	950	950
	Low volt	10.0	10.0	10.0
	Restart	Valid	Invald	Invald
	restartpwrpump	0.6	0.6	0.6
	restartglowplugvoltage	7.2	7.2	7.2
	Pump limit	4.5v	7.5v	10v

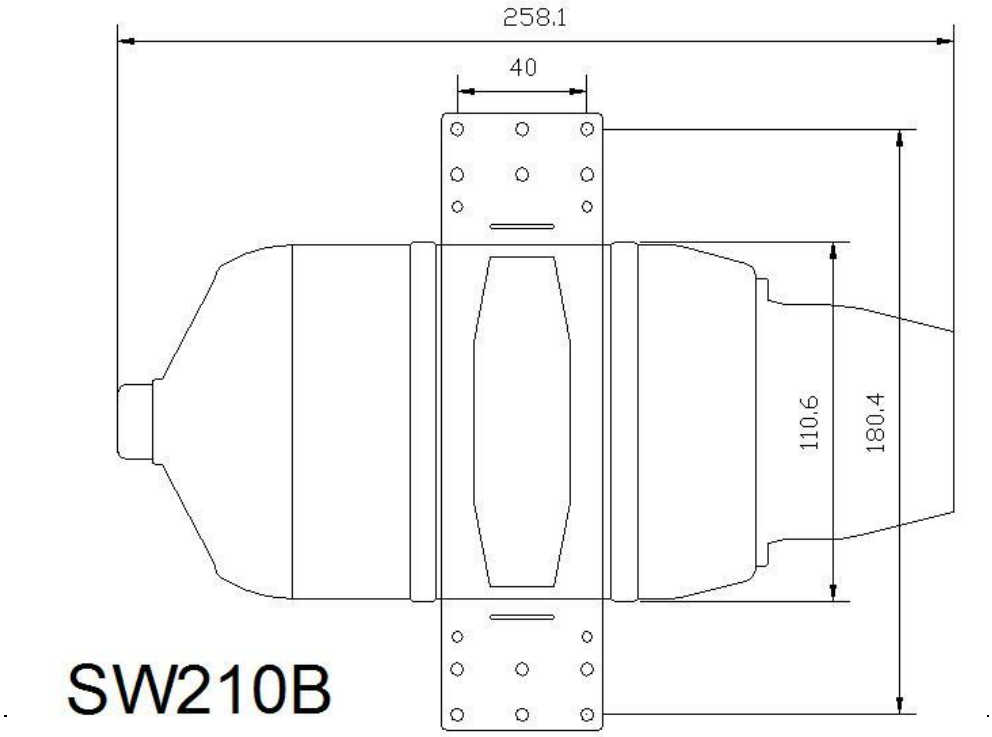
Engine Diagrams



SW60B



SW120B



Specifications

SW 60		
	Metric	**US**
Thrust	6kg	13.2lbs
RPM Range	50,000 - 160,000	
EGT	400 - 550 C	750 - 1025F
Fuel Consumption @ 83% power	181ml	6.12 oz
Fuel	kero or diesel	
Lubrication	5% kero, 3% diesel	
Start	full autostart	
Restart	auto restart	
Weight	800 g	1.76 lb
Diameter	83mm	3 1/4"
Length	226mm	8 5/16"
Maintenance Interval	25 hours	

SW 120		
	Metric	**US**
Thrust	12kg	26.4 lb
RPM Range	25,000 - 115,000	
EGT	560 - 590 C	1040 - 1275 F
Fuel Consumption @ 83% power	340ml	11.5oz
Fuel	kero or diesel	
Lubrication	5% kero, 3% diesel	
Start	full autostart	
Restart	auto restart	
Weight	1.4kg	2.73lb
Diameter	102mm	4"
Length	283mm	11 1/8"
Maintenance Interval	25 hours	
SW 140		
	Metric	**US**
Thrust	14kg	30.86 lb
RPM Range	38,000 - 128,000	
EGT	700 C	1292F
Fuel Consumption @ 83% power	380ml	12.84oz
Fuel	kero or diesel	
Lubrication	5% kero, 3% diesel	
Start	full autostart	
Restart	auto restart	
Weight	1.4kg	2.73lb
Diameter	102mm	4"
Length	283mm	11 1/8"
Maintenance Interval	25 hours	

INDEX