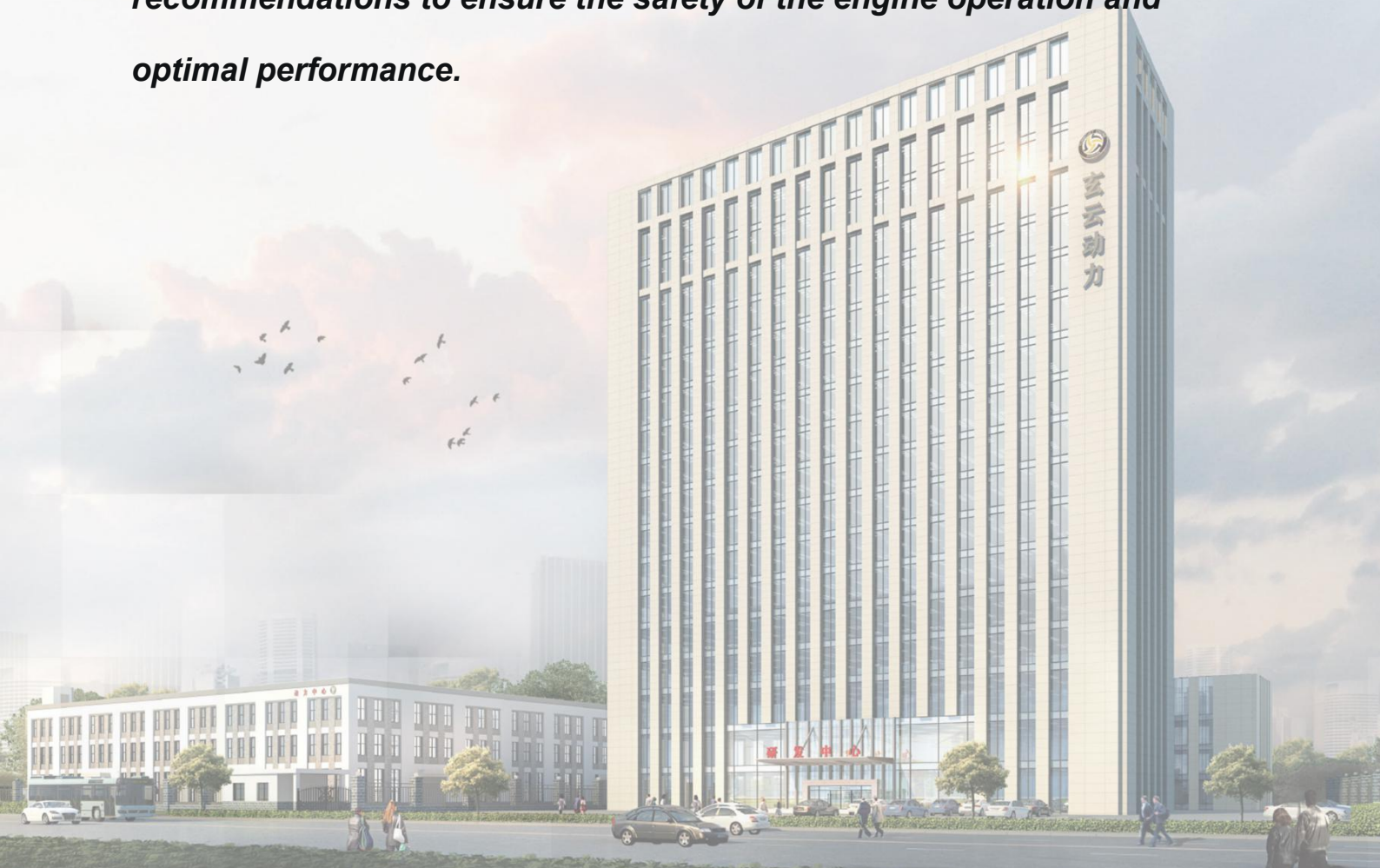
HOBBY (B-SERIES) ENGINE TECHNICAL MANUAL

you and us

welcome to the age of turbojet models! swiwin is ready to take you to experience different flight fun!

firstly, please carefully read this manual to have a comprehensive understanding and impression of the engine, engine components, and operating process, in order to ensure the safe operation and optimal performance of the engine.

this manual will introduce you to how to install, operate, and maintain the engine. if you still have any questions, please feel free to contact us. we will wholeheartedly provide you with sales, technical, and after-sales support services for the swiwin hobby engine. this instruction manual aims to provide users with detailed usage guidelines and recommendations to ensure the safety of the engine operation and optimal performance.



CATALOGUE

1.PRODUCT OVERVIEW

welcome to use the swiwin hobby (b-series) engine. thank you very much for your trust and support. this engine has the following characteristics:

1.the overall design of hobby model engine is integrated, easy to install, and easy to operate. the engine as a whole consists of several parts, including the body, external ecu controller, external oil pump, and various connecting harnesses.

2.the engine consists of components such as the intake duct, compressor, combustion chamber, turbine, and tailpipe. the airflow is drawn in by the intake duct, compressed by the compressor, and enters the combustion chamber where it mixes with fuel for combustion. the high-temperature and high-pressure gas generated drives the turbine to rotate (the turbine drives the compressor through the shaft), and the gas expands and accelerates in the exhaust nozzle before being discharged to generate thrust.

ELECTRONIC COMPONENTS INTEGRATED WITHIN THE ENGINE BODY:

- *tcu (electronic control unit)*
- *brushless starter motor*

● BRUSHLESS PUMP

ECU CONTROLLER COMPONENTS:

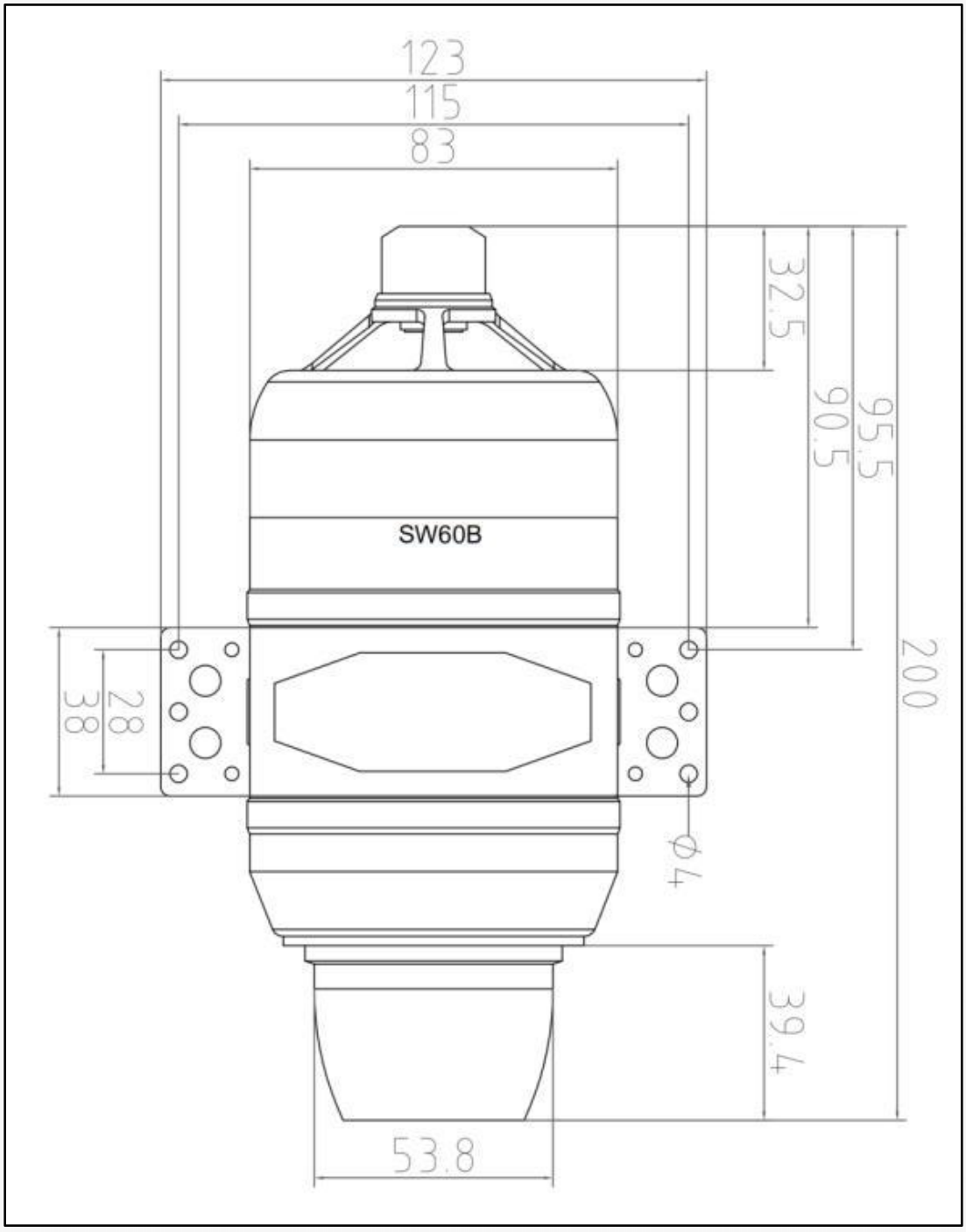
● *ecu (electronic control unit)*

ecu (v3) completes control of engine starting, acceleration and deceleration, steady state, and parking based on input control commands. under actual flight altitude, flight speed, and climate conditions, the ecu (v3) adjusts the fuel supply of the oil pump to maintain stable engine operation at a certain speed.

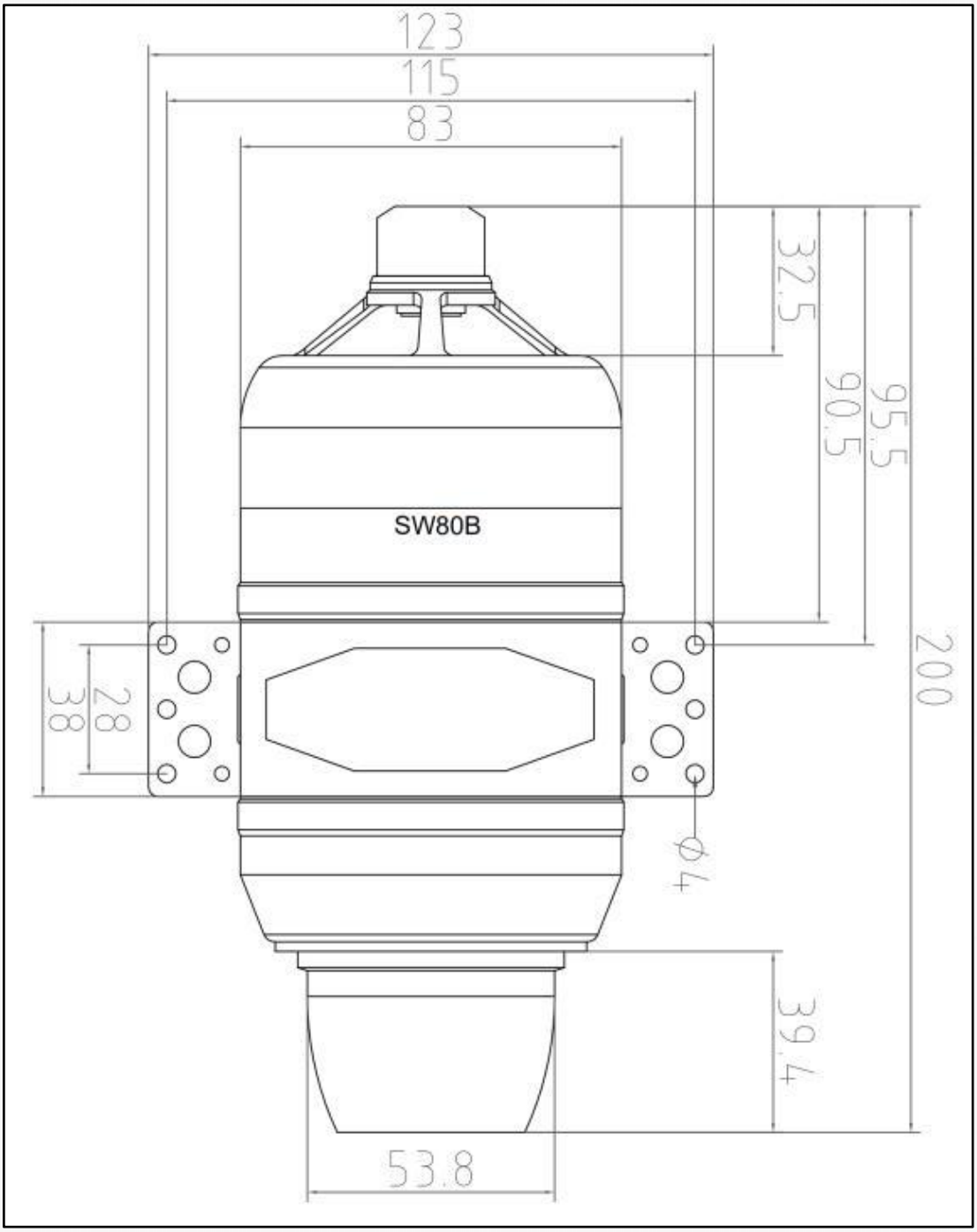
2.PRODUCT SIZE DIAGRAM

2.1 DIMENSIONAL DRAWING

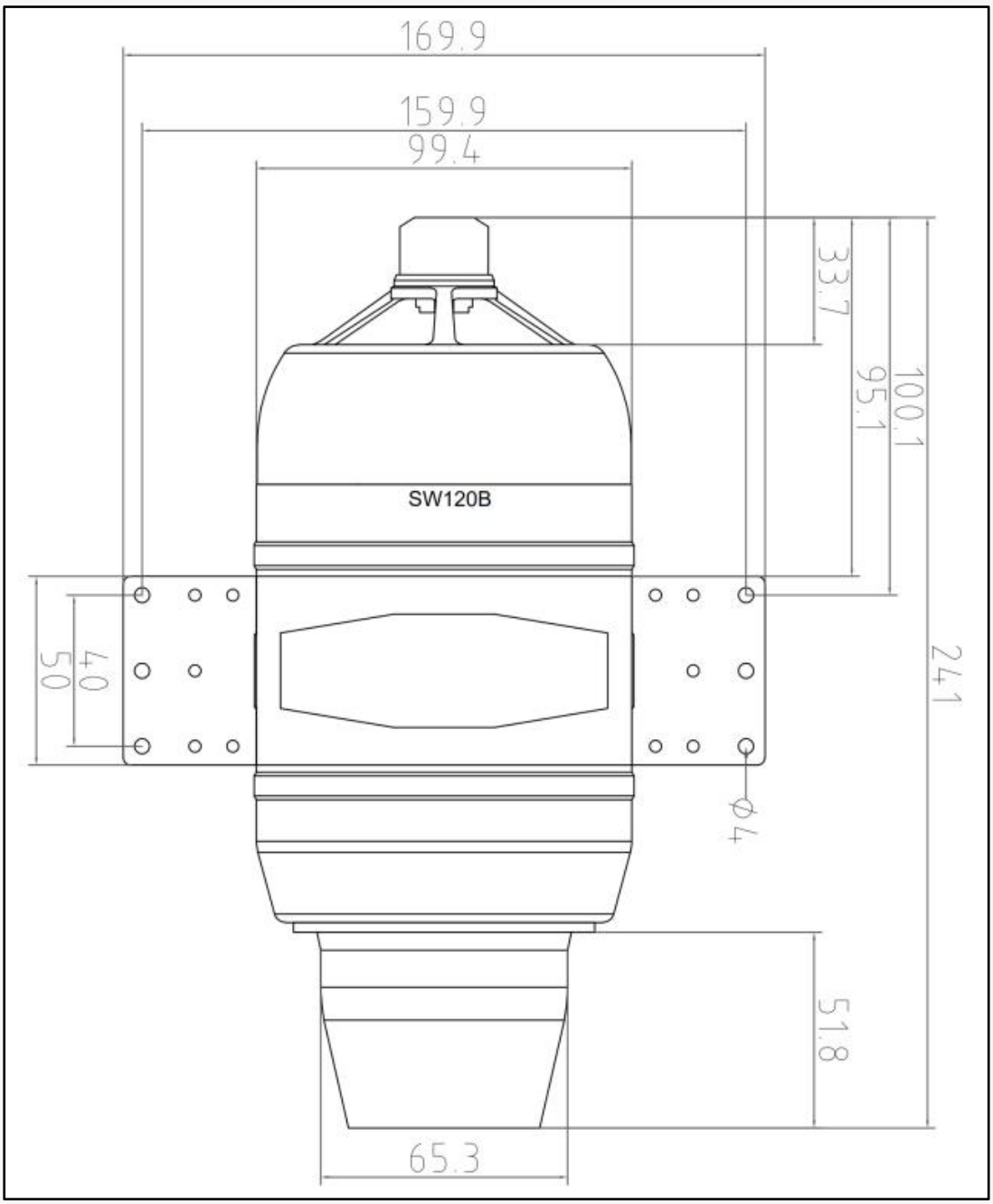
2.1.1 SW60B DIMENSIONAL DRAWING



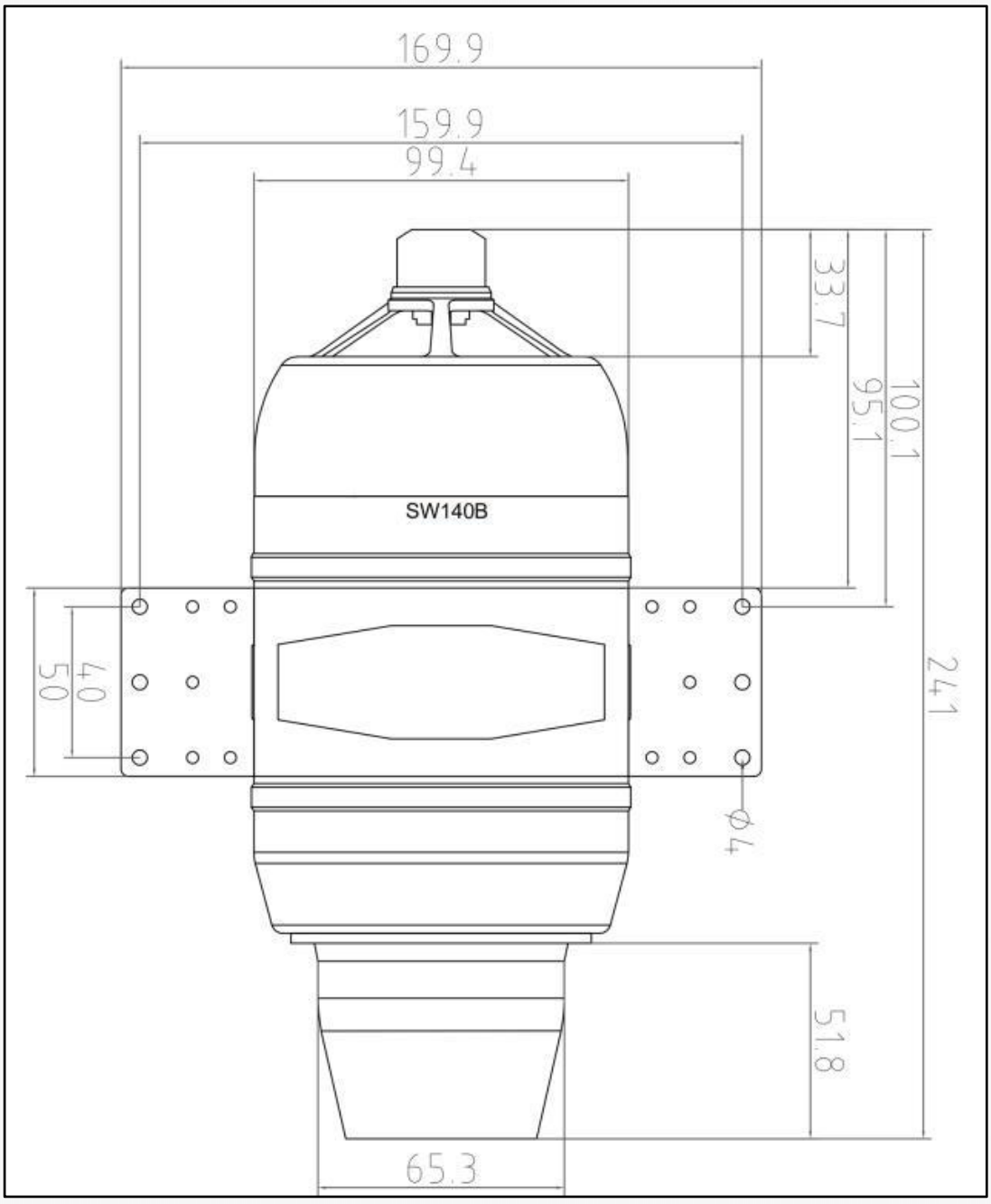
2.1.2 SW80B DIMENSIONAL DRAWING



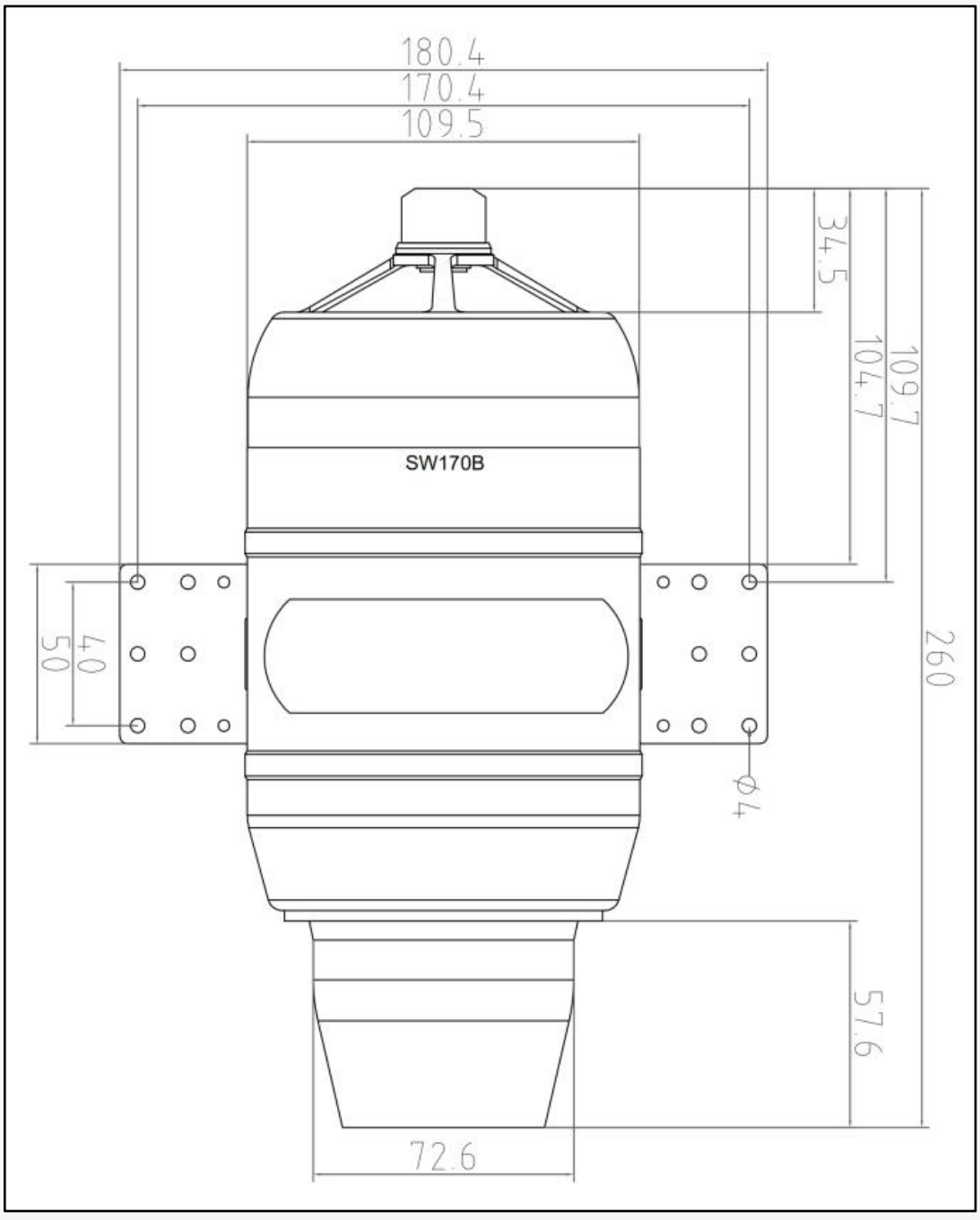
2.1.3 SW120B DIMENSIONAL DRAWING



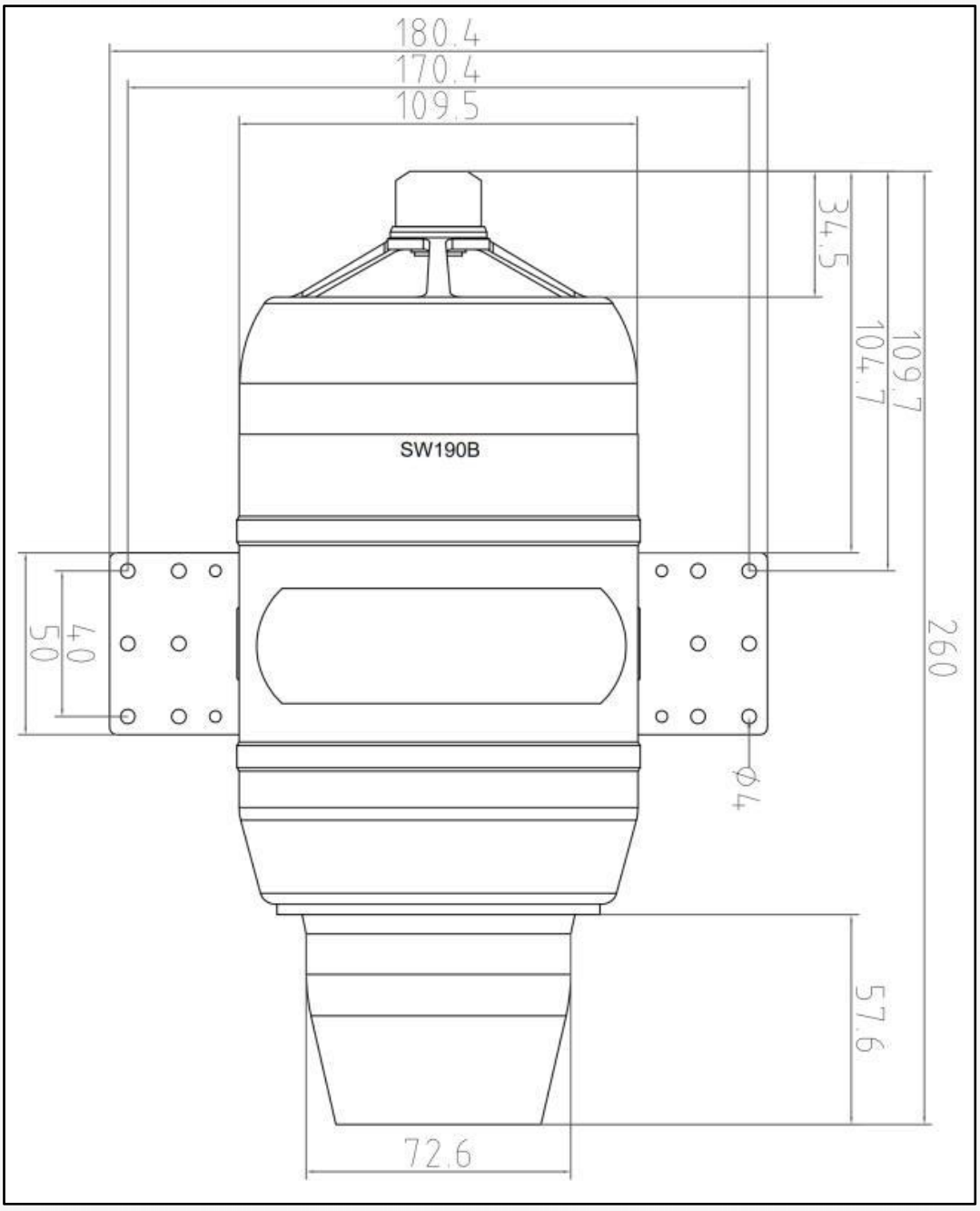
2.1.4 SW140B DIMENSIONAL DRAWING



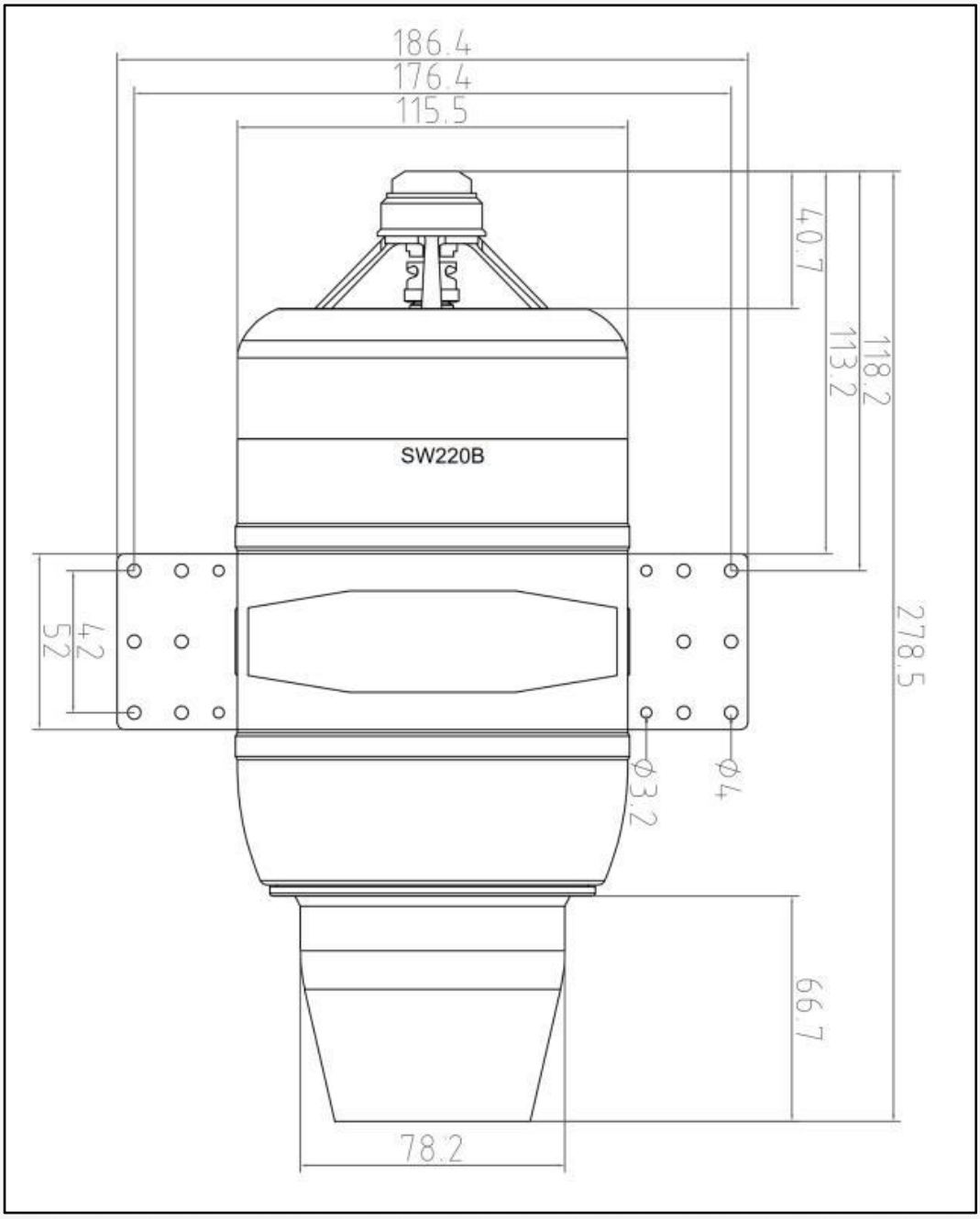
2.1.5 SW170B DIMENSIONAL DRAWING



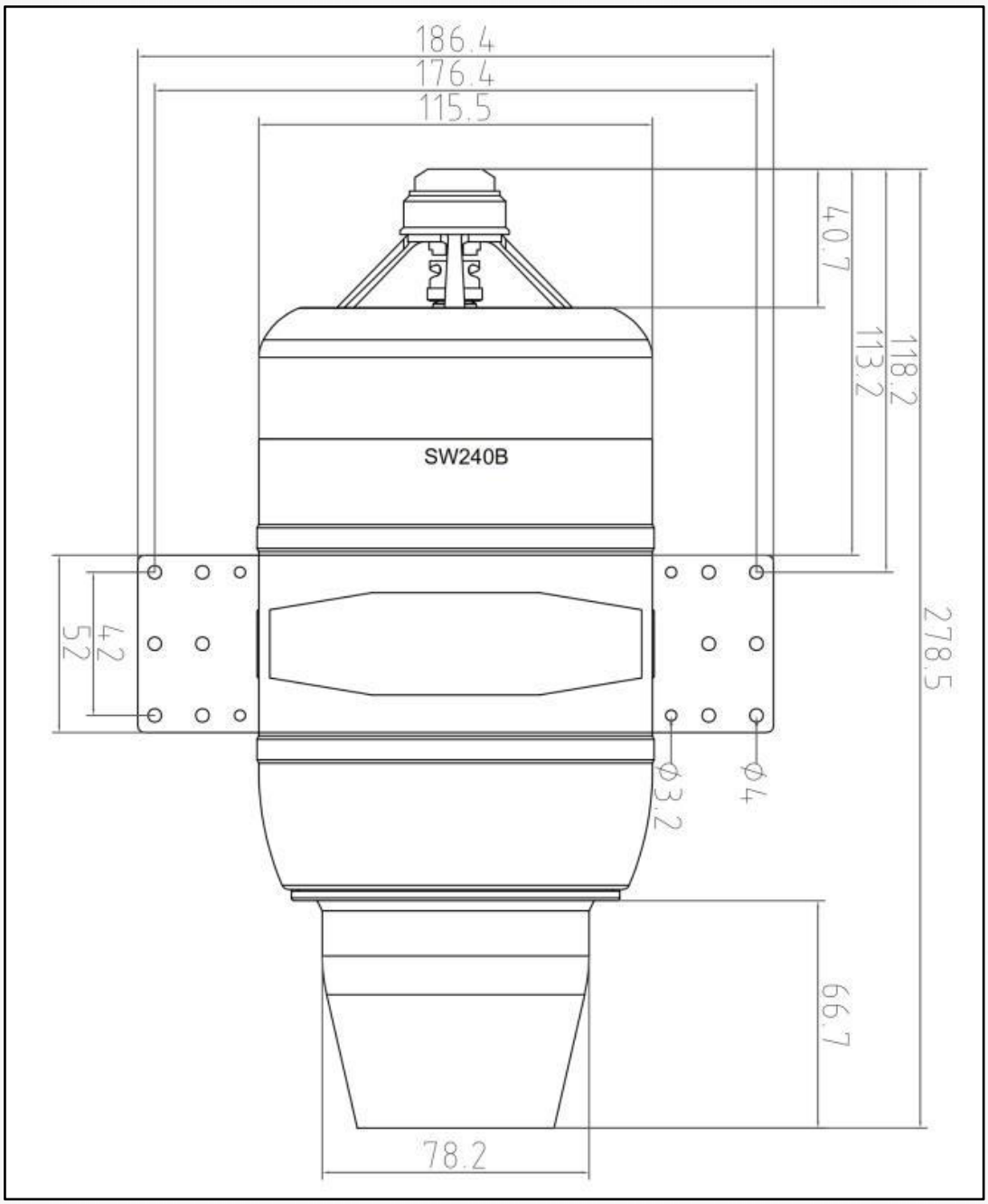
2.1.6 SW190B DIMENSIONAL DRAWING



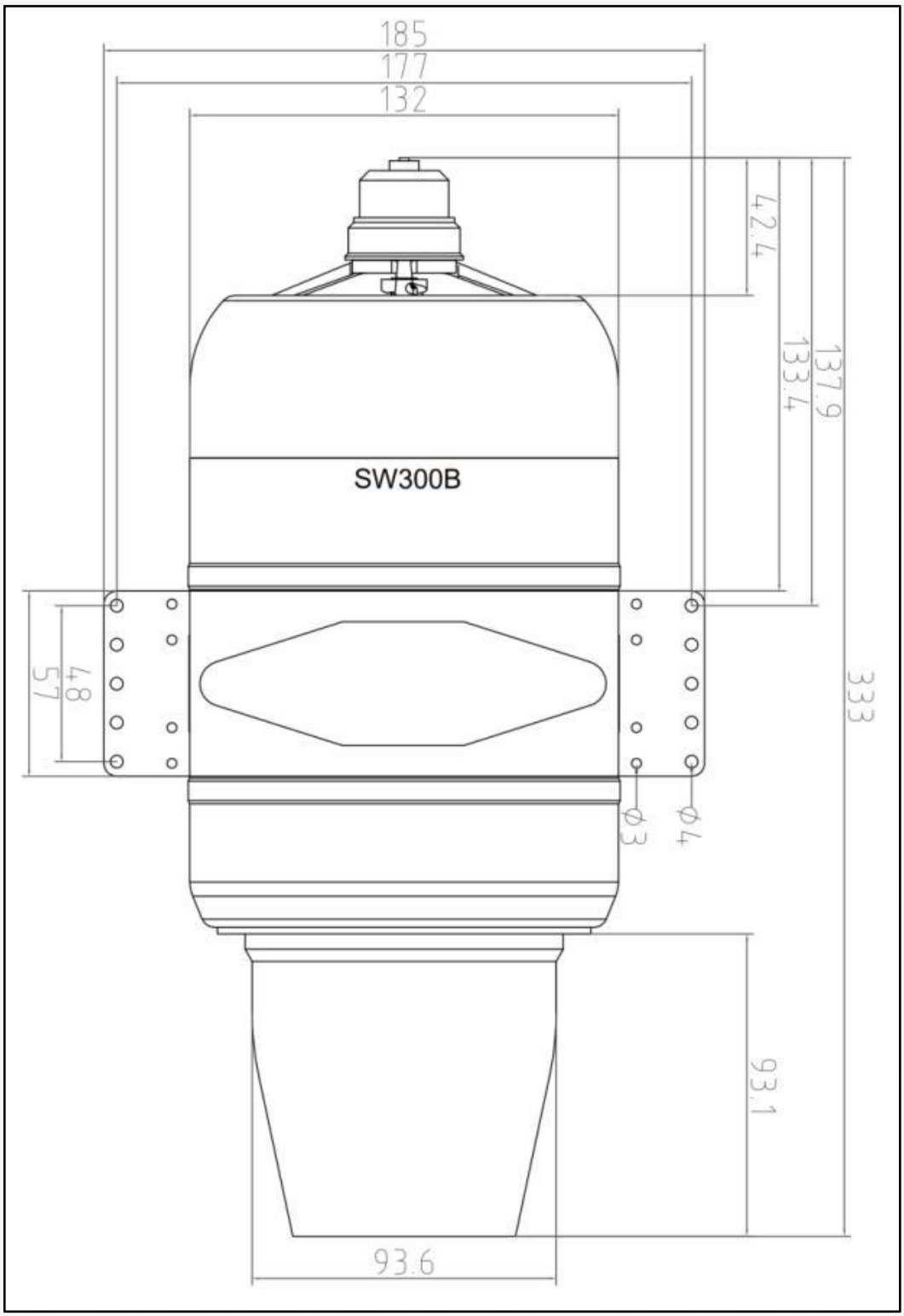
2.1.7 SW220B DIMENSIONAL DRAWING



2.1.8 SW240B DIMENSIONAL DRAWING



2.1.9 SW300B DIMENSIONAL DRAWING



2.2 BASIC ENGINE PARAMETERS

PROJECT	SW60B	SW80B	SW120B	SW140B
thrust	6kg	8kg	12kg	14kg
diameter (mm)	83mm	83mm	99.4mm	99.4mm
length (mm)	200mm	200mm	241mm	241mm
weight	800g	800g	1280g	1280g
ecu weight	42g			
usage temperature	-40℃~50℃			
max usable height	5000m			
maxi longitudinal overload during catapult takeoff	10g			
max allowable flight speed	300m/s			
supply voltage	3s lipo battery			
starting system	one key electronic start			
rpm range	50,000-150,000	50,000-156,000	38,000-125,000	38,000-130,000
standard thrust	58.8N	78.4N	117.6N	137.2N
exhaust temperature	750℃			
fuel consumption	200g/min	270g/min	350g/min	380g/min
fuel	aviation kerosene			
lube oil	3%-5%			
maintenance cycle	25h/time			

PROJECT	SW170B	SW190B	SW220B	SW240B	SW300B
thrust	17kg	19kg	22kg	24kg	30kg
diameter (mm)	109.5mm	109.5mm	115.5mm	115.5mm	132mm
length (mm)	260mm	260mm	278.5mm	278.5mm	333mm
weight	1500g	1500g	1740g	1740g	2560g
ecu weight	42g				
usage temperature	-40℃~50℃				
max usable height	7000m				
maxi longitudinal overload during catapult takeoff	10g				
max allowable flight speed	300m/s				
supply voltage	3s lipo battery				
starting system	one key electronic start				
rpm range	38,000-116,000	38,000-120,000	38,000-115,000	38,000-118,000	38,000-98,000
standard thrust	166.6N	186.2N	215.6N	235.2N	294N
exhaust temperature	750℃				
fuel consumption	480g/min	550g/min	620g/min	780g/min	820g/min
fuel	aviation kerosene				
lube oil	3%-5%				
maintenance cycle	25h/time				

2.3 PARAMETERS OF ENGINE OPERATION CONTROL

PROJECT	SW60B	SW80B	SW120B	SW140B
pump voltage	0.6V-0.9V	0.6V-0.9V	0.7V-1V	0.7V-1V
rpm start up ramp	100%			
pump start up ramp	3			
glow plug	5-7V	5-7V	5-7V	5-7V
valve	40	40	20	20
ignition rpm	6,000 rpm	6,000 rpm	4,000 rpm	4,000 rpm
preheat rpm	10,000 rpm	10,000 rpm	6,000 rpm	6,000 rpm
rpm off starter	28,000 rpm	28,000 rpm	25,000 rpm	25,000 rpm
rpm acc	15	15	25	25
rpm dec	15	15	25	25
max rpm	150,000 rpm	156,000 rpm	125,000 rpm	130,000 rpm
idle rpm	50,000 rpm	50,000 rpm	38,000 rpm	38,000 rpm
minimum speed	35,000 rpm	35,000 rpm	33,000 rpm	33,000 rpm
max temp	1000℃			
low volt	10.0V			
restart	close			
restart glow plug	consistent with the fire head voltage			
pump limit	13V			
idle stable	5-8			
pop-up time	0.5S			
ejection voltage	4V	3.5V	4V	3.5V
run voltage	3.5V	3.5V	4V	4V
rpm stable	50			
cool	5,000 rpm			

PROJECT	SW170B	SW190B	SW220B	SW240B	SW300B
pump voltage	0.5V-1V	0.5V-1V	0.5V-1V	0.5V-1.2V	0.5V-1V
rpm start up ramp	100%				
pump start up ramp	3				
glow plug	5-7V	5-7V	5-7V	5-7V	5-7V
valve	40	20	40	40	40
ignition rpm	3,000 rpm	3,000 rpm	3,000 rpm	3,000 rpm	3,000 rpm
preheat rpm	5,000 rpm	5,000 rpm	5,000 rpm	5,000 rpm	4,000 rpm
rpm off starter	22,000 rpm	22,000 rpm	20,000 rpm	20,000 rpm	16,000 rpm
rpm acc	25				
rpm dec	25				
max rpm	116,000rpm	120,000rpm	115,000rpm	118,000rpm	98,000rpm
idle rpm	38,000rpm	38,000rpm	38,000rpm	38,000rpm	33,000rpm
minimum speed	28,000rpm	28,000rpm	28,000rpm	28,000rpm	20,000rpm
max temp	1000℃				
low volt	10.0V				
restart	close				
restart glow plug	consistent with the fire head voltage				
pump limit	13V				
idle stable	5-8				
pop-up time	0.5S	0.5S	0.5S	0.5S	0.4S
ejection voltage	4V	3.5V	4V	4V	4V
run voltage	4V	4V	4V	4V	5V
rpm stable	50	50	50	50	20
cool	5,000 rpm	5,000 rpm	5,000 rpm	5,000 rpm	4,000 rpm

note: all data are measured at isa condition（temperature：15℃&pressure：1atm）.

3. SAFETY INSTRUCTIONS

3.1 SAFETY NOTICE

1.thank you for using the swiwin micro turbojet engine. the working state of the turbojet engine is essentially highly extreme mechanical work, which poses a certain degree of danger. the operator must be familiar with the operating points and recognize the risks before use. careless operation can easily cause damage to the turbojet body and personal injury. please carefully read the operating instructions in the manual and strictly follow the operating regulations. if this is your first time operating a turbojet engine, please learn how to operate it under the guidance of experienced personnel. before starting the turbojet engine for the first time, please carefully read this manual.

2.when the engine is running, there is a loud noise. testing or visiting personnel must confirm that their health is good before entering the safe area for testing or visiting. it is strictly prohibited for personnel with cardiovascular and cerebrovascular diseases or sensitive to noise to conduct engine testing or visiting.

3.due to the fact that the exhaust gas from the engine can fill the enclosed space in a very short period of time when it is in a large state, it is strictly prohibited to start and operate the engine inside the enclosed room, otherwise it may cause injury to personnel, and in severe cases, it may lead to suffocation, shock, or even death.

3.2 ENGINE SAFETY OPERATION

before installing the engine on the aircraft, it is recommended to complete at least one start-up and operation on the ground test platform to familiarize oneself with the engine operation process.

3.3 SELECTION OF ENGINE FIRE EXTINGUISHERS

1.to prevent fires, carbon dioxide fire extinguishers must be prepared during testing. other types such as foam, dry powder or water-based extinguishers are not recommended. fire extinguishers with foam or dust will damage engine parts, and water-based fire extinguishers will damage electronic components such as circuit boards or ecus.

2. the exhaust temperature of the engine tailpipe is relatively high. in order to prevent fires, it is strictly prohibited to start and operate the engine in areas with flammable and explosive materials.

3. if the engine fails to start multiple times or if the fuel tank pressure is too high, it may cause a large flame during startup. when the aircraft is started, if there is an open flame at the tail nozzle and it lasts for more than 3 seconds, it can be considered as a large flame. at this point, quickly close the oil circuit ball valve, the flame will disappear immediately, and then proceed with the shutdown operation. after the engine enters automatic cooling, it can be restarted.

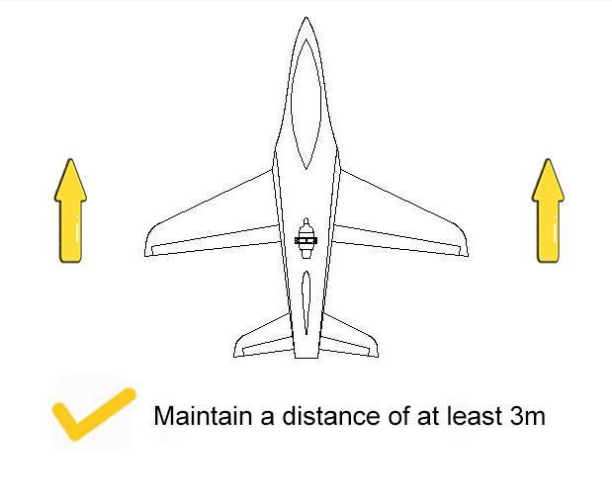
3.4 ENGINE NOISE PROTECTION

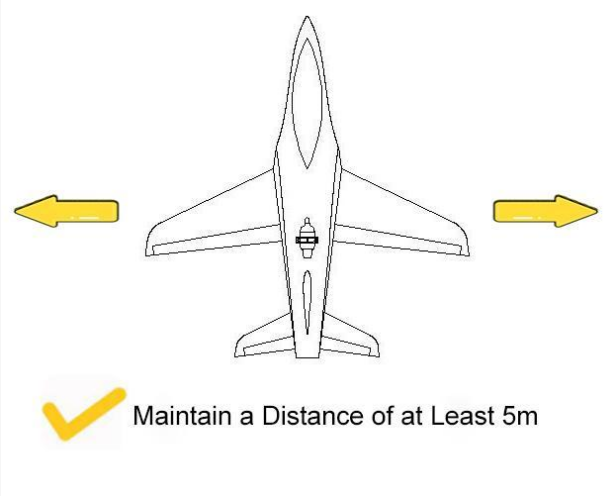
1. when the engine is running, it produces loud noise. to prevent noise from harming the operator's health, testers must take protective measures and wear hearing protection devices.

2. testers should seek medical attention promptly if they experience any adverse reactions (including but not limited to dizziness, tinnitus, nausea, loss of appetite, difficulty breathing, arrhythmia, etc.).

3.5 SAFE DISTANCE

the engine operates at extremely high rotational speeds. when the engine is running, it must maintain a safe distance from the aircraft, with a distance of 3 meters in front of the engine (intake direction) and 5 meters on both sides. when the engine is running, all personnel must be in a safe area.





3.6 HAZARDOUS AREAS OF THE ENGINE

1.during engine operation, a large amount of air will be drawn in while high-temperature and high-speed gases will be expelled outward. it is prohibited to place any items that may be inhaled, such as cables, plugs, fuel tanks, and fuel pipes, in the engine air intake.

2. it is strictly prohibited to enter hazardous areas during engine operation.

THE FOLLOWING FIGURE SHOWS THE HAZARDOUS AREAS DURING ENGINE OPERATION

●confirm that no personnel have entered the hazardous area during operation.

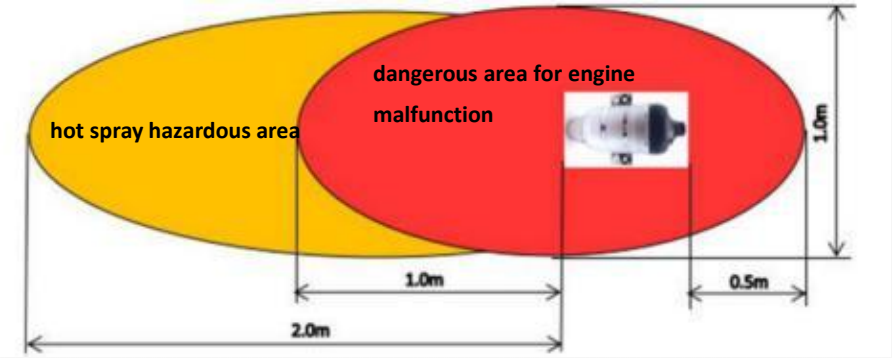
●when operating the engine, safety goggles and earplugs must be worn.

●ensure that there are no debris that may be inhaled in the intake area.

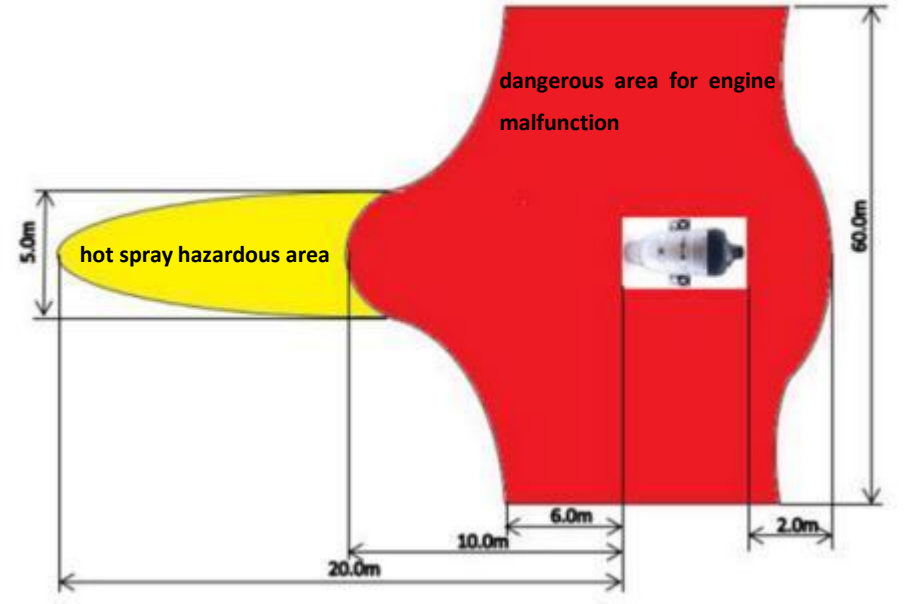
●keep your fingers away from the intake area when operating the engine.

●prepare fire extinguishing equipment before operating the engine.

DANGEROUS AREAS DURING ENGINE START- UP AND IDLE



ENGINE 20% THROTTLE TO FULL THRUST DANGER ZONE



hobby (b-series) engine uses the simplest structure to achieve the most extreme working state, and each component is designed and produced to the extreme. do not disassemble it privately. once the engine is disassembled, it must be reinstalled precisely according to specifications to achieve its original performance. random installation may cause serious safety hazards! therefore, when your engine needs to be disassembled and repaired, please log in to the swiwin official website and contact after-sales personnel.

1) please ensure that there are no personnel involved in the operation process in these hazardous areas, and be familiar with safety precautions before starting the engine. be sure to wear safety equipment (earmuffs, gloves, helmets, etc.) when operating a jet engine

2) ensure that there are no components or foreign objects in the intake area that may be compressed and sucked into the intake port! because the engine will produce a large suction force! keep your fingers away from the air intake! do not rotate the pressure wheel with your fingers!

3) ensure that there is fire extinguishing equipment (containing at least 5 kilograms of carbon dioxide fire extinguisher).

3.7 FIRE HANDLING METHODS

after an engine failure causes a fire, the fire can quickly spread between the battery, engine, and fuselage. the disposal method for encountering the above situation on the ground is:

1.on site operators should maintain a high level of calmness, avoid panic, immediately evacuate unrelated personnel around, and first ensure personnel safety.

2. under the premise of ensuring personal safety, the power should be immediately cut off, the oil circuit ball valve should be closed, and carbon dioxide fire extinguishers should be used to extinguish the burning parts. at the same time, attention should be paid to cooling and protecting the fuel tank and engine to prevent the fire from spreading to these parts. if the shape of the aircraft remains intact, align the nozzle of the carbon dioxide fire extinguisher with the position of the aircraft intake duct, and intermittently press the handle every 0.5 seconds to pulse inject carbon dioxide into the interior of the aircraft.

3.if there is scattered fuel on the ground, try to tow the aircraft away from the danger zone first, and then extinguish the flames on both the aircraft and the ground.

4.INSTALLATION AND DEBUGGING

SWIWIN HOBBY (B SERIES) ENGINE INSTALLATION FIXED ENGINE

the hobby (b-series) engine is equipped with a dedicated fixing clamp. before operating the engine, the clamp has already been installed on the engine. you only need to fix the clamp on the test bench. pay attention to the optimal installation position of the engine: rotate the engine to make the oil inlet at the 12 o'clock position.

5. ENGINE USAGE INSTRUCTIONS

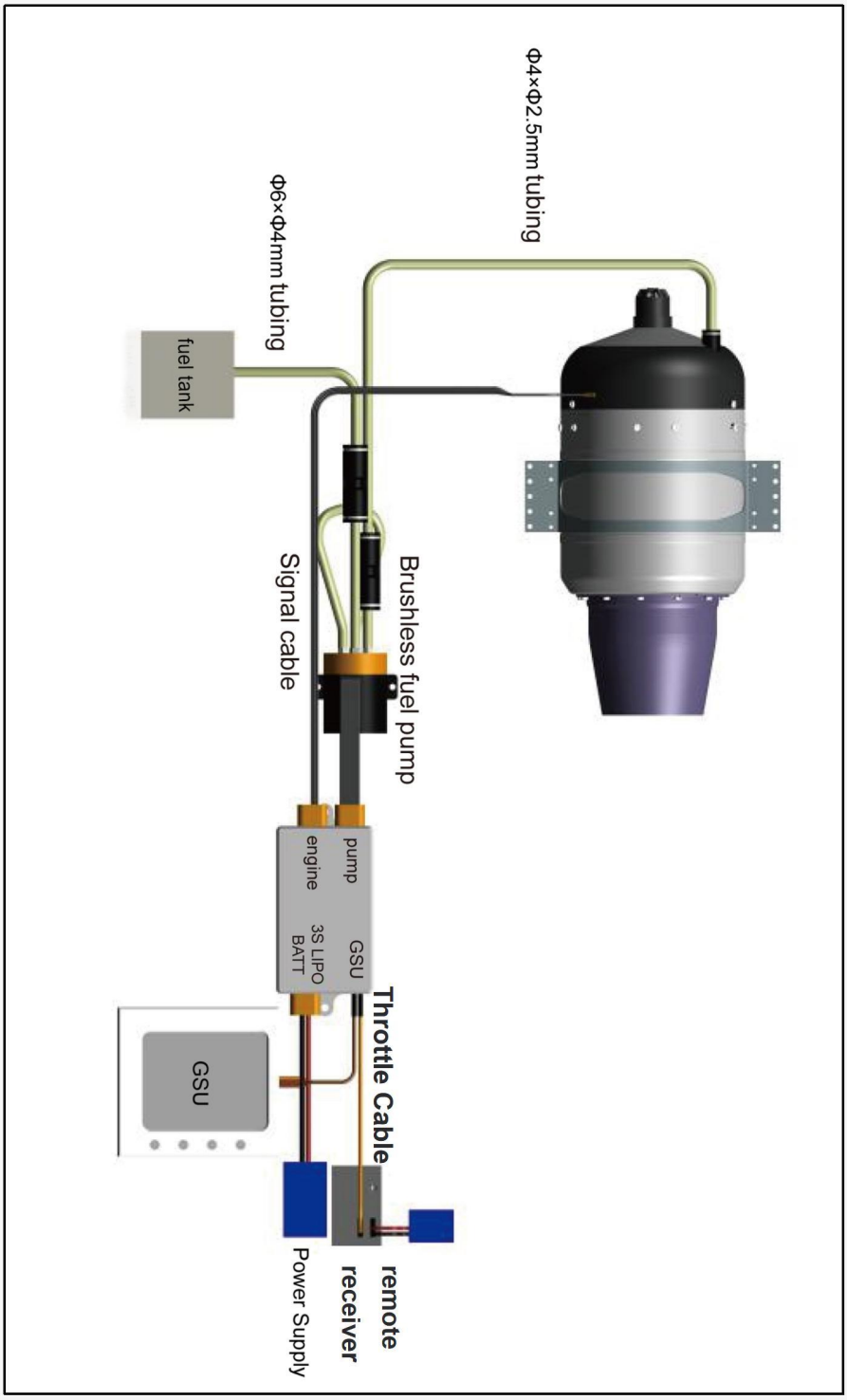
5.1 ENGINE PACKING LIST

open the package, the engine packing list is as follows

 Engine	 ECU（V3）	 GSU
 Fixed	 Brushless Fuel Pump	 Filter
 Switch valve	 Power cable	 Signal cable
 Throttle cable	 Tubing	

5.2 ENGINE CONNECTION DIAGRAM

OPEN THE PACKAGING, FAMILIARIZE YOURSELF WITH EACH COMPONENT, AND CONNECT THEM AS SHOWN IN THE FOLLOWING DIAGRAM(REMOTE CONTROL AND RECEIVER PRODUCTS NEED TO BE PREPARED BY ONESELF)



explain:

1.if your order has no special requirements, the default accessory only supports remote control startup.

*2.oil connection: the accessories included with the box have prepared two types of tubing for you, namely, ϕ6 * ϕ4mm and ϕ4 * ϕ2.5mm. the ϕ6 * ϕ4mm tubing is used to connect the inlet pipe of the fuel tank and the brushless fuel pump, and the ϕ4 * ϕ2.5mm tubing is used to connect the engine inlet quick connect plug and the pump outlet pipe.*

attention: after connection, pay attention to checking the tightness of all oil pipe connection points and ensure the cleanliness of the oil circuit.

3. circuit connection:

signal cable: connect the engine and ecu v3 "ENGINE" interface.

pump cable: connect the brushless fuel pump to the ecu v3 "PUMP" interface.

throttle cable: connect the ecu v3 "PPM" interface to the receiver signal channel.

power cable: connect the ecu v3 "3S LIPO BATT" interface to the dc power supply.

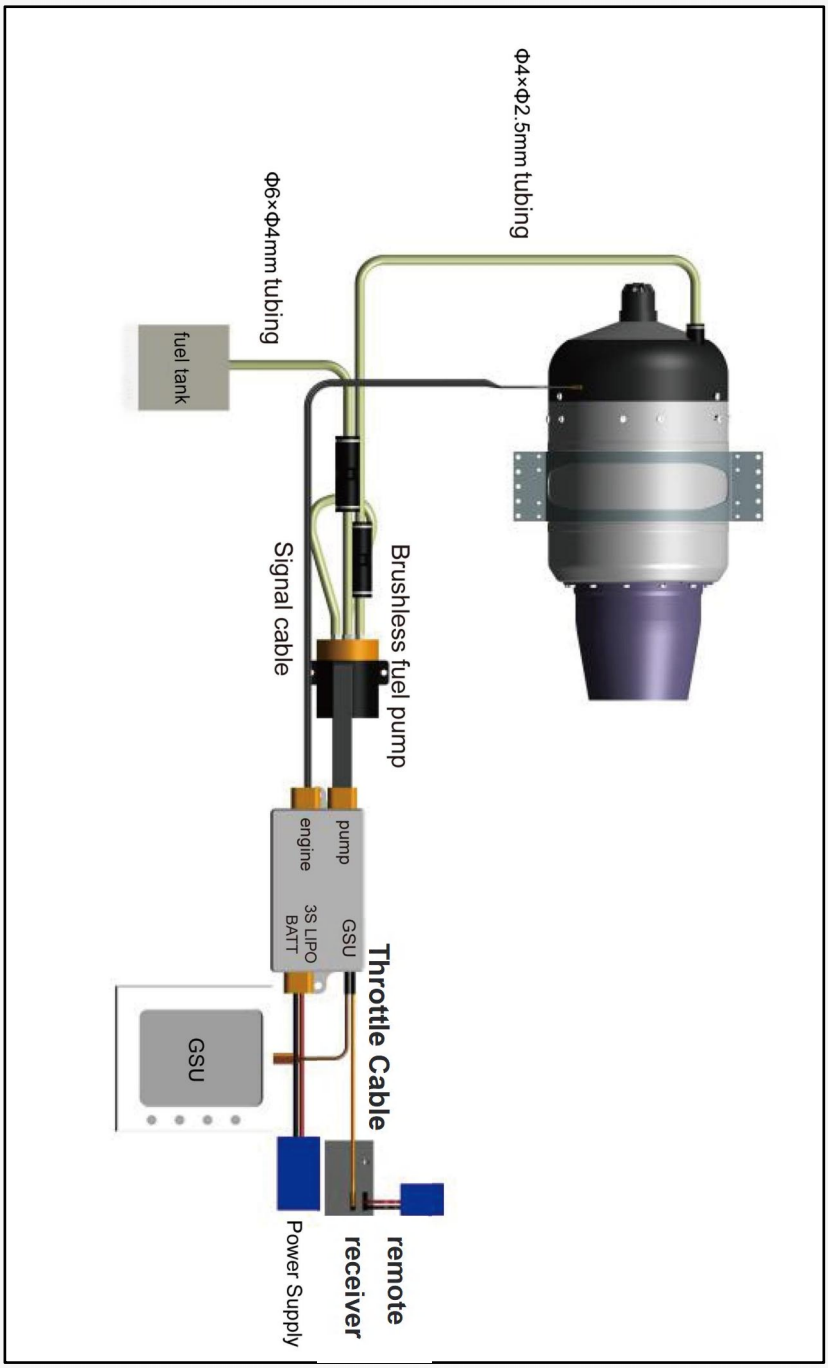
GSU: connect ecu v3 "GSU/PC" interface.

note: after the above connections are completed and powered on, the engine will emit a connection completion music prompt.

5.3 INSTRUCTIONS FOR CONNECTING ENGINES WITH DIFFERENT STARTING MODES

5.3.1 ENGINE CONTROLLED BY REMOTE CONTROL

INSTRUCTIONS FOR CONNECTING AND STARTING THE ENGINE CONTROLLED BY A REMOTE CONTROL(REMOTE CONTROL AND RECEIVER PRODUCTS NEED TO BE PREPARED BY ONESELF)



explain:

the engine is firmly fixed and connected to the engine, ecu, and oil circuit according to the diagram.

after all wire harness connections are completed, the ecu light emits a blue flashing prompt, indicating that the connection is intact. after connecting the engine, if there are no commands, the engine will intermittently emit a "beep" prompt sound.

1. determine the power supply voltage before connecting the engine. the model version engine uses 3s lipo batteries. pay attention to the remote control receiver battery meeting the requirements (generally choose 2s lithium battery), excessive voltage can burn out the receiver.

2. follow the instructions for using the remote control to complete the frequency matching between the remote control and the receiver.

3. use the monitor (gsu) to calibrate the remote control and engine throttle.

after calibration is completed, use the gsu testing function to test the main fuel pump. press and hold the "test main fuel pump" button until the fuel line is filled with fuel. pay attention to stopping the fuel pump immediately when the fuel level enters the engine to prevent a large fire from spraying when the engine starts with rich fuel inside.

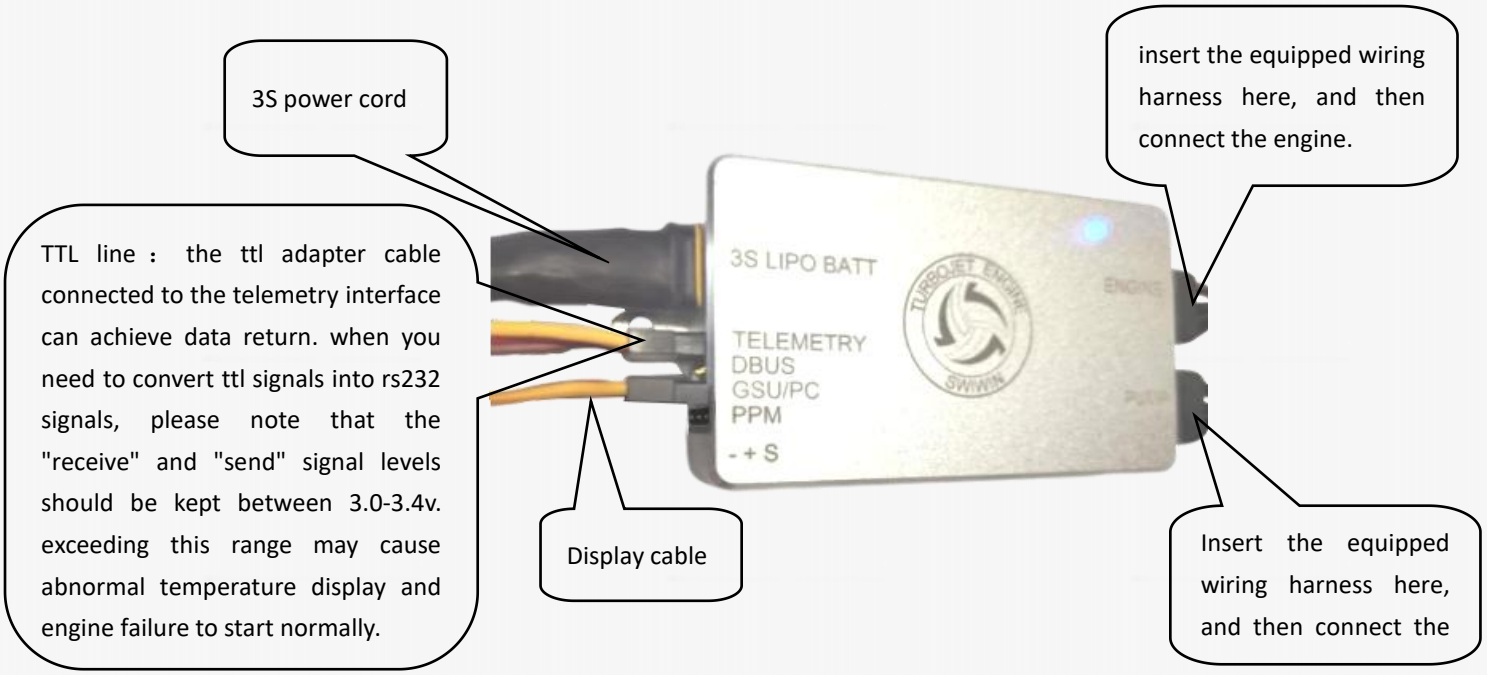
4. the engine starting process is divided into four stages: ignition, preheating, acceleration, and operation, which can be observed through the gsu during ground testing. before stopping the engine, first reduce the speed to idle, then adjust the remote control throttle lock to the cooling mode, and the engine will automatically cool down. the engine can be restarted in both cooling and shutdown states.

5. when using the remote control and connecting the ppm to the receiver, the signal level remains at 3.0-3.4v. exceeding this range may cause abnormal temperature display and prevent the engine from starting normally.

5.3.2 ENGINE CONTROLLED USING TTL SERIAL PORT TOOL

INSTRUCTIONS FOR CONNECTING AND STARTING THE ENGINE CONTROLLED BY TTL SERIAL PORT TOOL

attention: the plug for the 2s power supply needs to use this type of dupont plug.
the red line is the positive electrode, and the brown line is the negative electrode.



the ttl serial port control method can achieve computer control of the engine.

explain:

connect the engine, ecu, and oil circuit according to the diagram above.

1. connect the ttl adapter cable usb plug to the computer, and connect the dupont connector to the telemetry interface of ecuv3. pay attention to the insertion direction, align the brown wires of the two plugs (with the yellow wire facing up).

2. it is recommended to choose zk software to control the engine. the software can be obtained for free by contacting swiwin after-sales service.

3. the above operations are normal, and the zk software interface displays the engine parameters, indicating normal feedback.

first, use the testing function to test the main oil pump and exhaust the air inside the oil pipe. pay attention to the fuel level entering the engine and immediately stop pumping oil to prevent the engine from spraying large flames when starting with rich fuel inside.

4. the engine starting process is divided into four stages: ignition, preheating, acceleration, and operation, which can be observed through the gsu during ground testing. before stopping the engine, reduce the speed to idle first, and then click "stop cooling" to automatically cool down the engine. the engine can be restarted in both cooling and shutdown states.

5.4 ONE CLICK START

ecu v3 version submission 2.1.16/1.00.28 or above;gsu submission above 1.3.26， the following interface:

install the gsu "+" and "-" keys simultaneously for 3 seconds. on the monitor startup interface, select "start engine".the following interface:

① after sending the startup command, if there is no startup within 3 seconds, the control will automatically exit；

② after entering the startup mode, the gsu "+" and "-" keys can be used to control the engine speed, with "10"% in gear 1, for throttle control;the following interface:

③ after entering the startup mode, the throttle progress bar flashes continuously.

④ after entering the startup mode, press the "c" key to immediately stop and cool down, as shown in the following interface:

5.5 GSU USER MANUAL

gsu is a terminal for displaying and editing engine parameters, which can be connected or disconnected from the engine at any time. even during engine operation, you can adjust some engine parameters through gsu.

5.5.1 CONNECTION OF GSU

the gsu is connected to the engine through the ecu, and its connection interface is a dupont head, which is connected to the display cable interface on the ecu. after connection, the gsu displays the following interface to indicate successful connection.

5.5.2 GSU USER MANUAL

the default language for gsu factory settings is simplified chinese. if you need to modify it, select "language" in the settings interface. there are 4 options: english, simplified chinese, traditional chinese, and spanish.

5.5.3 METHOD OF CALIBRATING REMOTE CONTROL

click "ok" on the initial interface to enter the settings interface. the first time using the engine, the main functions are "study RC" and "test". the other parameters have already been debugged to the best state when they are sent out, please do not change them arbitrarily.

confirm that the throttle lock on the remote control is open before calibration.

select the calibration remote control on the monitor to enter the following interface.

click on 'max', push the throttle lever to the maximum, and click 'ok' to complete 100% throttle calibration.

click "Idle", push the throttle lever to the min, and click "ok" to complete the idle calibration.

turn off the throttle lock, click "min", push the throttle lever t o the minimum, and click "ok" to complete the shutdown st ate calibration.

after completing the above operations, the gsu returns to the initial interface, pushes the throttle control lever, and observes the rc value changing with the throttle, indicating that the remote calibration is successful.

5.5.4 METHOD OF TESTING THE ENGINE

before starting the engine, use the gsu testing function to confirm whether all hardware is working properly. the testing method is to select the test item and click the "ok" button. during the test, the solenoid valve made a clicking sound, and the motor started to drive the impeller to rotate normally. finally, when testing the fuel pump, it can be observed that the fuel level is flowing towards the interior of the engine, indicating that the fuel pump is working properly.

5.5.5 PREPARE TO LAUNCH THE INTERFACE

the engine operation interface consists of three parts: the top part shows the parameters of the previous engine operation. the middle section displays the engine operating status, with green font for normal status and red font for abnormal error messages. the bottom section displays real-time data on engine rpm,temp,pump,pc.

5.5.6 ENGINE START INTERFACE

pump voltage: controls the starting oil output, the higher the voltage, the more oil is supplied.

rpm startup ramp: it refers to a time period from ignition to clutch disengagement, during which the slope of the starter motor speed increases. the higher the slope, the faster the speed increase.

pump startup ramp:It refers to the fuel supply slope of the oil pump during the engine start-up phase. The higher the slope value, the greater the fuel supply.

glow plug: the voltage value supplied to the ignition head during engine ignition generally does not exceed 7v.

valve: when the engine is ignited, it controls the amount of oil in the ignition oil circuit. the higher the oil threshold, the longer the opening time, and the more fuel is supplied.

in addition to the above instructions, if you need to set other parameters, you can contact swiwin after-sales service to help you solve the problem.

5.5.7 TEMPERATURE CORRECTION

during the engine start-up process, the ecu controls the engine operation by judging the built-in temperature sensor. if the temperature sensor inside the engine differs significantly from the ambient temperature, it will affect the ecu's judgment and require the use of gsu for temperature calibration of the engine.

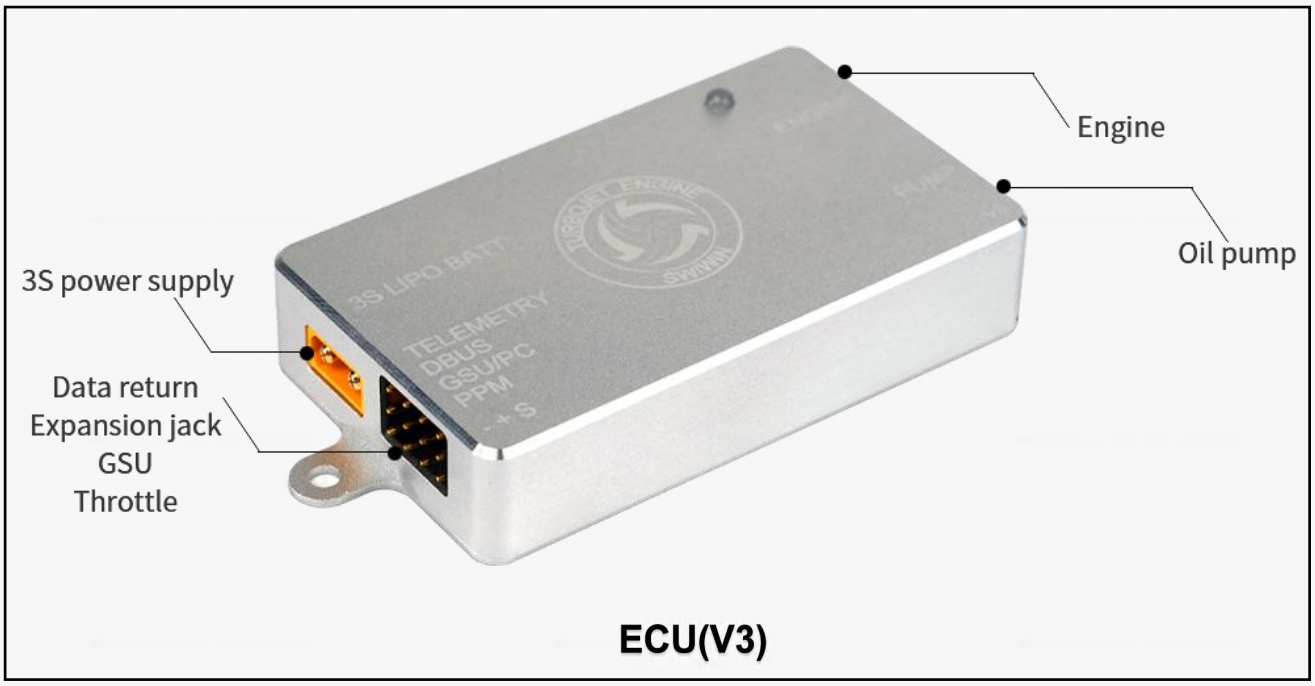
on the gsu main interface,select"other"

select 'ad just temp' and click '+-' to adjust the temperature up and down, keeping the corrected temperature consistent with the ambient temperature.

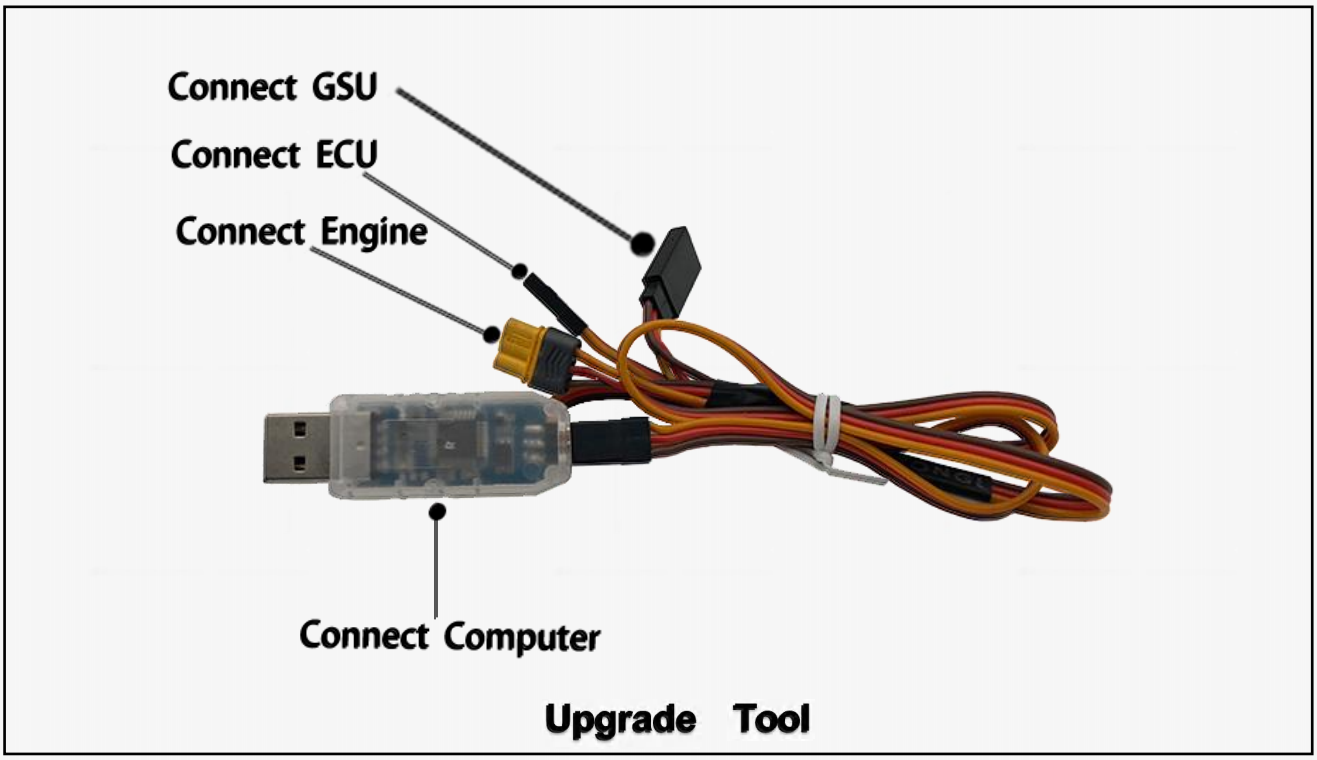
5.6 ECU USAGE INSTRUCTIONS

5.6.1 HARDWARE PREPARATION

the following hardware is required for downloading or changing settings and parameters of ecu (v3) data



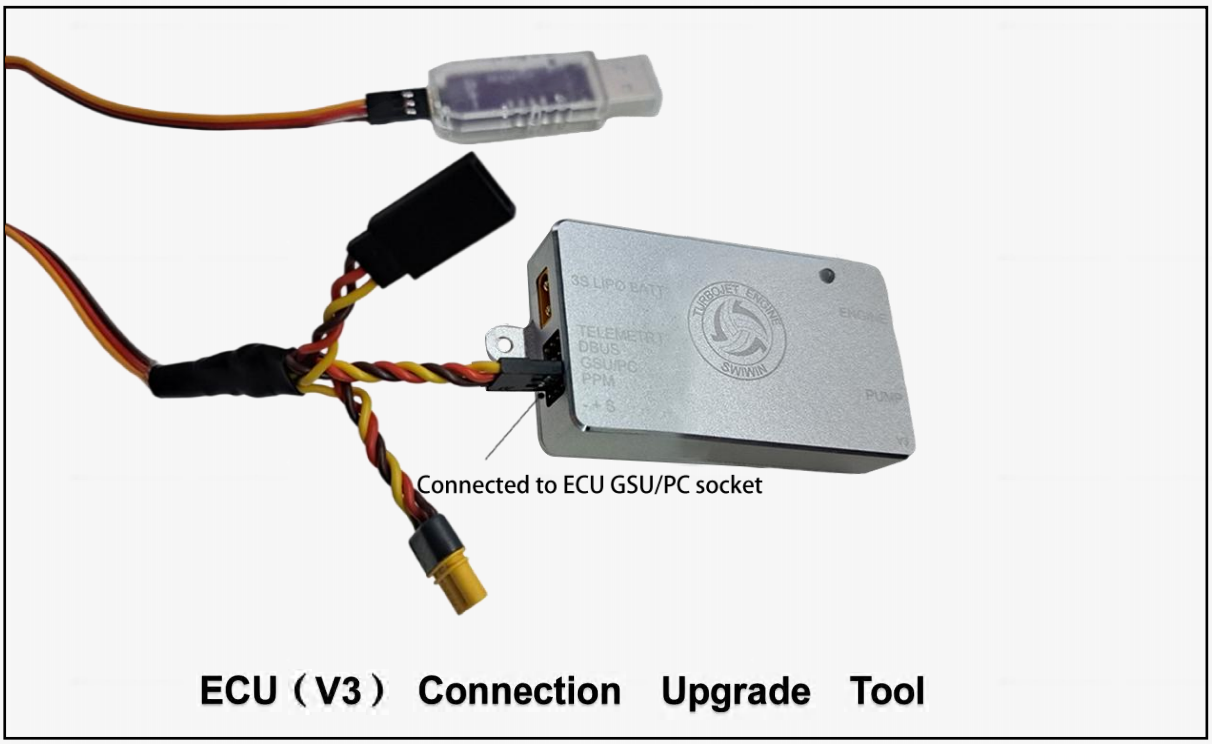
ECU(V3)



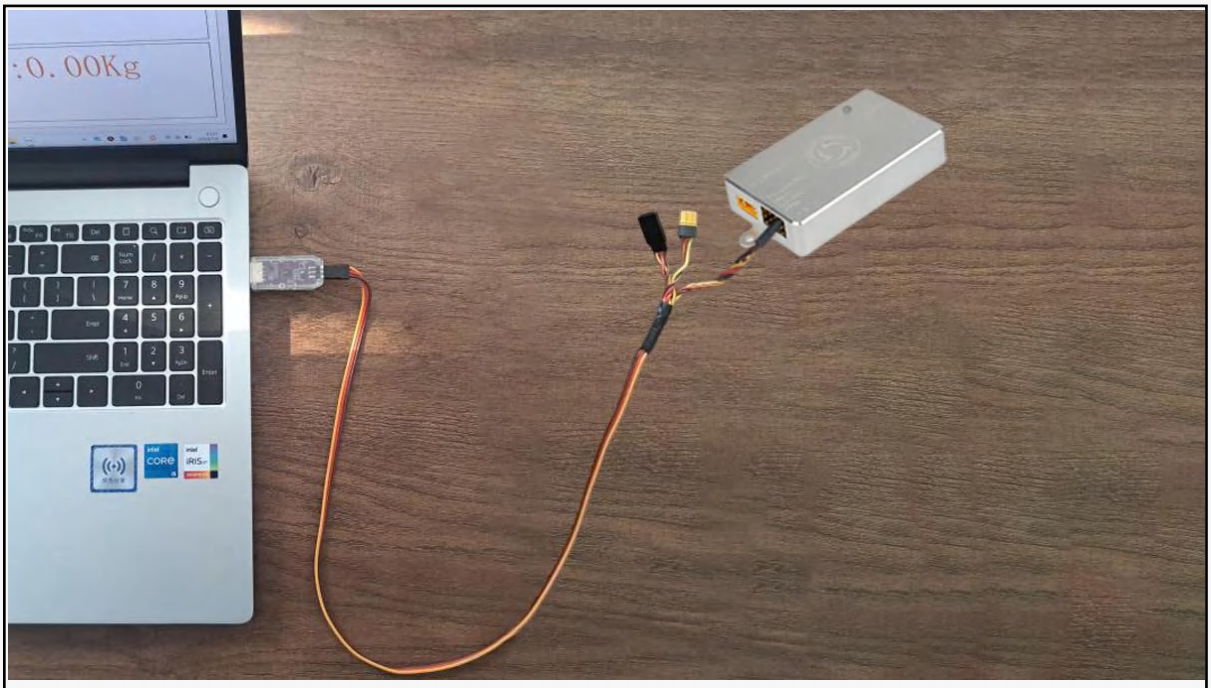
Upgrade Tool

5.6.2 CONNECT

connect as shown in the diagram, connect the gsu/pc socket of the ecu through the upgrade device, and then connect it to the computer.

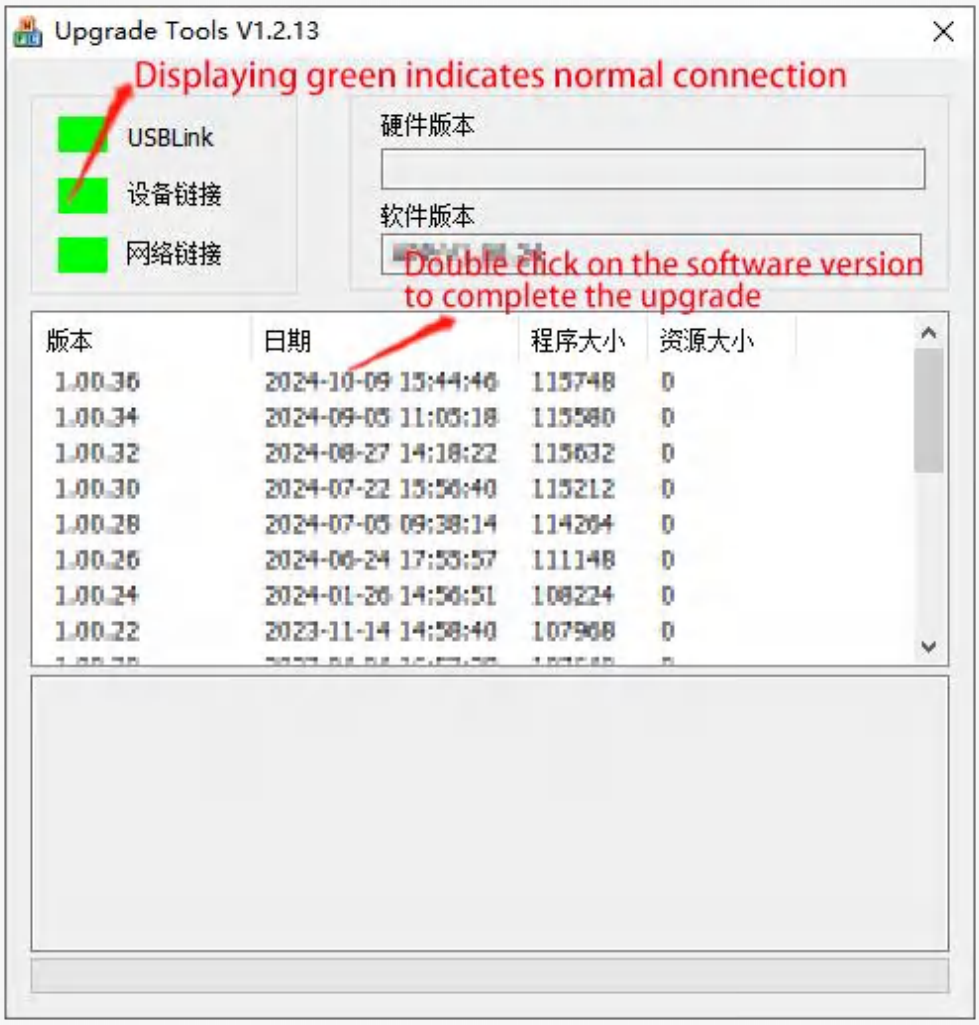


ECU（V3） Connection Upgrade Tool



Connect To Computer

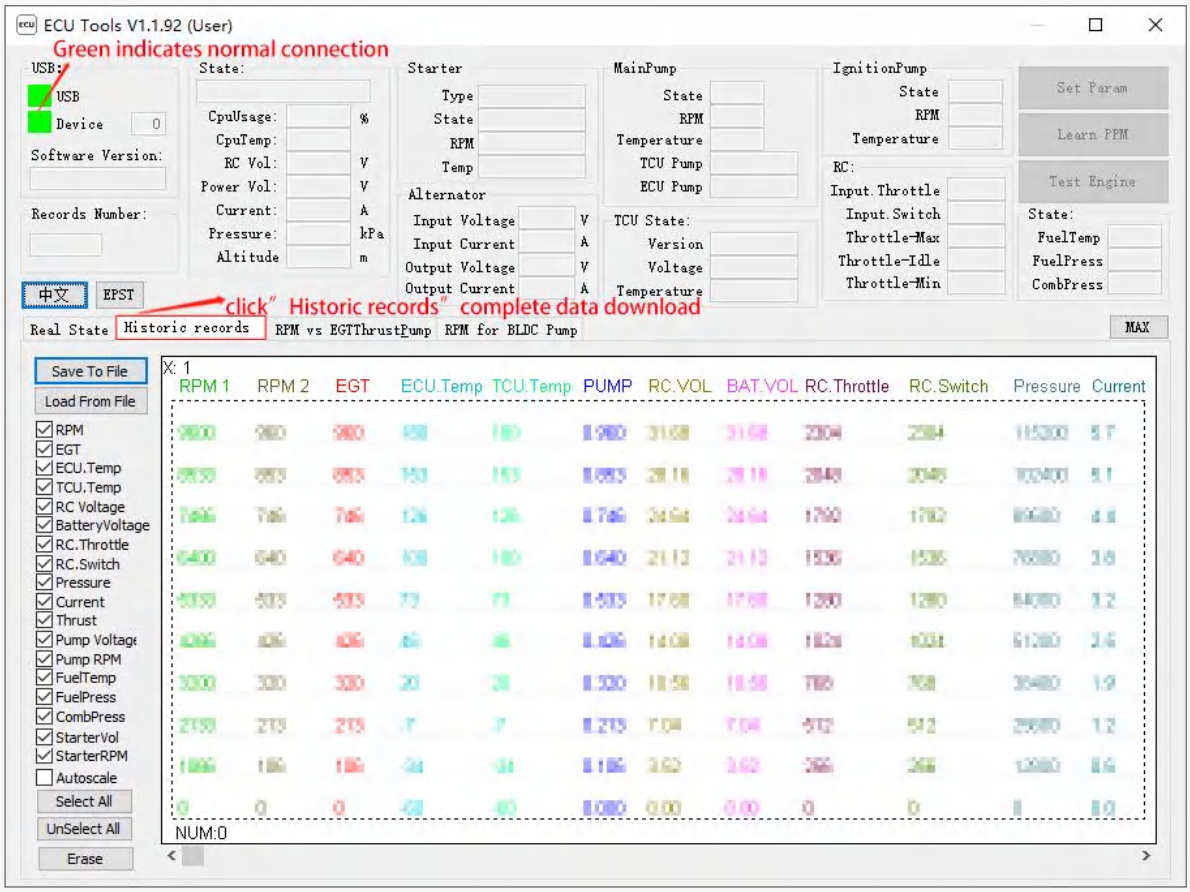
5.6.3 SOFTWARE UPGRADING



1、after the hardware is ready, log in to the swiwin website http://www.swiwin.com download upgrade tools.

2、open upgrade tools to upgrade the software, double-click to select the corresponding software version, and wait for the upgrade to complete.

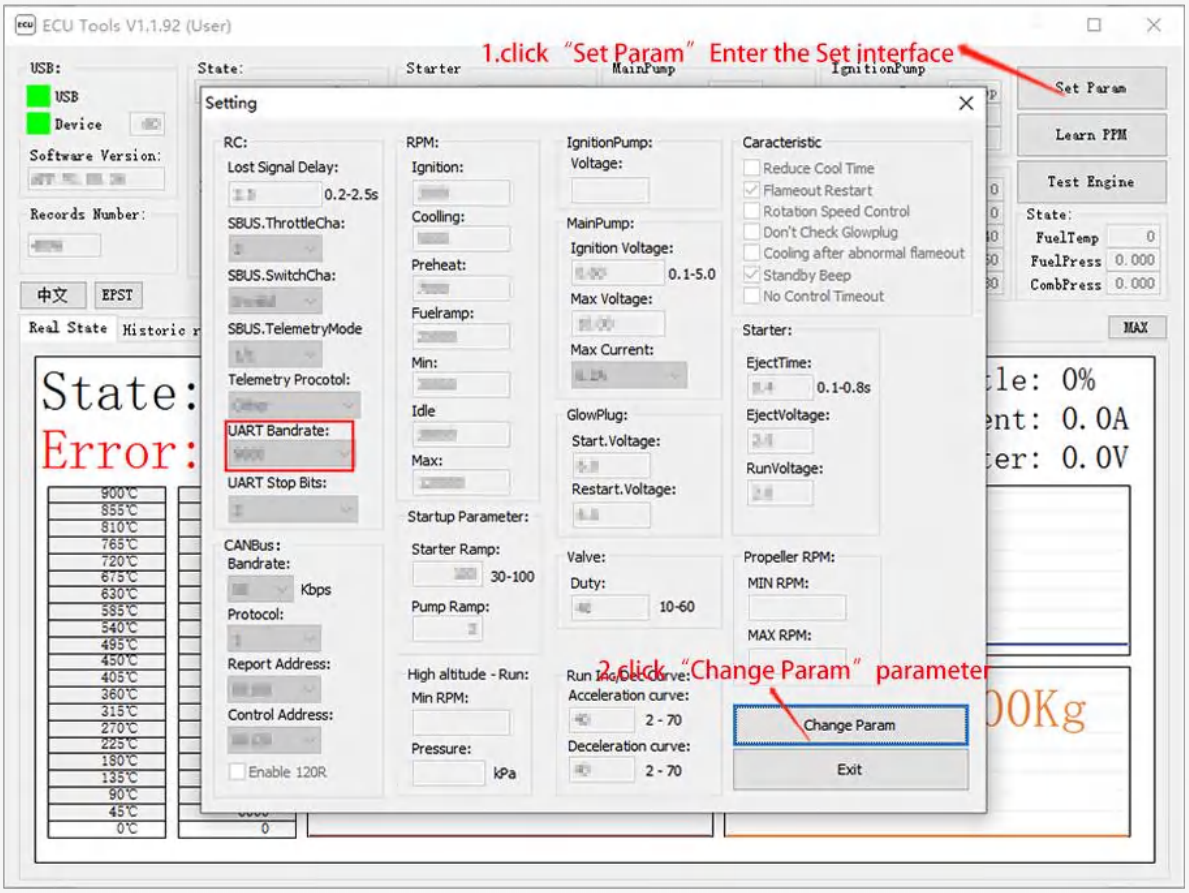
5.6.4 DATA DOWNLOAD



1、after the hardware is ready, log in to the swiwin website http://www.swiwin.com download ecu tools（user） software.

2、open the ecu tools（user） software, click on "history" and wait for the data to load, then click on "save data" to complete.

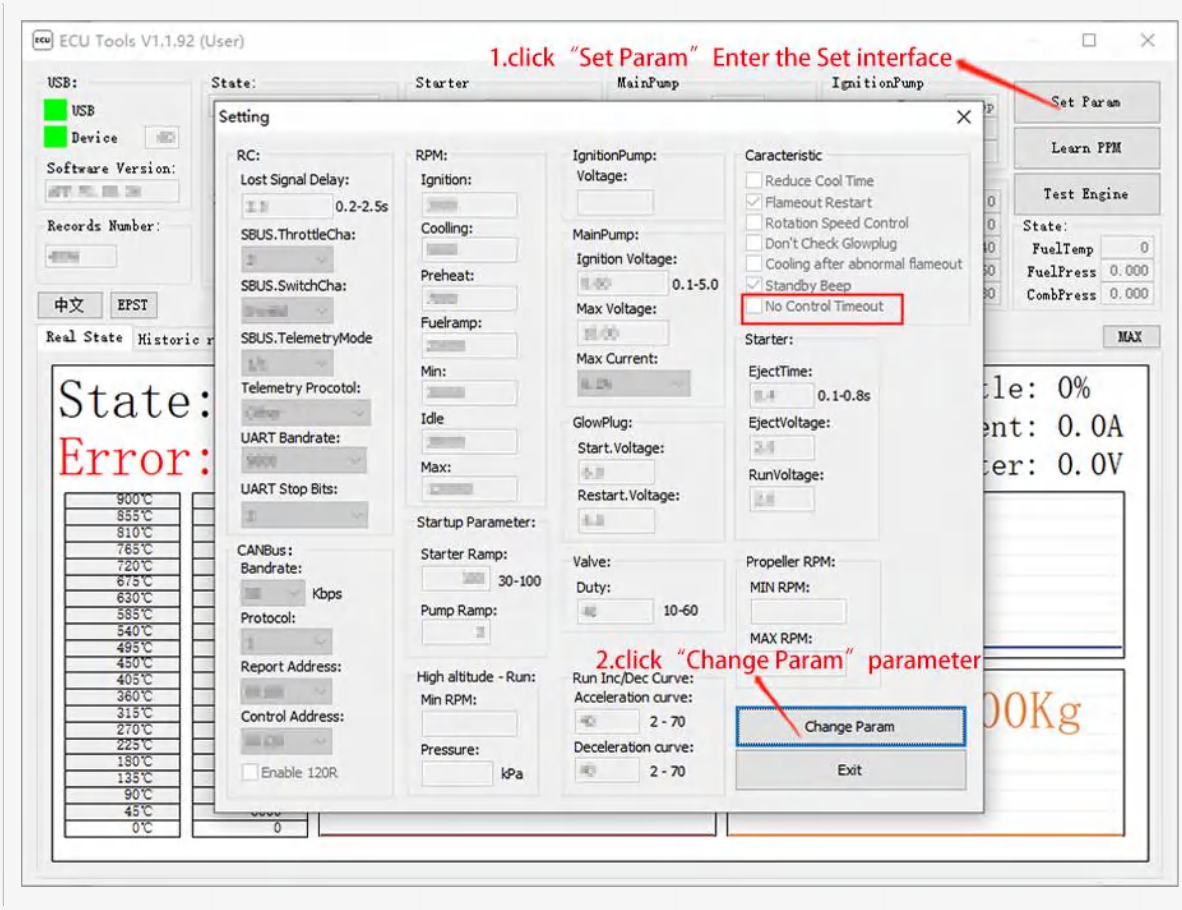
5.6.5 MODIFY BAUD RATE/CHANGE SETTING PARAMETERS



1、after the hardware is ready, log in to the swiwin website http://www.swiwin.com download ecu tools（user）software.

2、open the ecu tools（user） software, click "set parameters" to open the settings interface, and click "modify" to modify the settings and parameters.

5.6.6 CANCEL REMOTE CONTROL SIGNAL LOSS MONITORING



open the ecu tools（user）software, click on "set parameters", in the "characteristic parameters" column, check "cancel remote control signal loss monitoring". attention: after selecting "cancel remote control signal loss monitoring", the ecu will continue to execute the last command of the engine after receiving the signal interruption. if "cancel remote control signal loss monitoring" is not selected, the engine will stop directly after 2.5 seconds of signal interruption and immediately enter the cooling state.

you can also use the same method to change "acceleration cooling", "shutdown restart", "speed closed-loop control", etc.

note: at the factory, all parameters and characteristic parameters of the engine have been set according to the engine performance and customer requirements. please make sure to communicate with swiwin after-sales personnel before making any changes.

6. ENGINE DEBUGGING

6.1 SET OPERATION MODE

before running the engine for the first time, please check if the desired engine starting method has been set. you can prepare the necessary tools in advance based on the chart below.

STARTING MODE	REQUIRED SOFTWARE/HARDWARE	WIRING HARNESS CONNECTION
TLL SERIAL PORT START	ZK V0.1.32	2S LITHIUM BATTERY + TLL SERIAL PORT TOOL+COMPUTER
REMOTE CONTROL	REMOTE CONTROL, RECEIVER	SIGNAL LINE

choose the correct battery type

b-series engine power supply voltage requirement: 12.5v. (3s li-p0 polymer lithium battery)

note: you can choose the appropriate battery according to your needs.

6.2 CHECKLIST

preparation before starting the engine

●check the battery voltage.

●the battery level should be sufficient to meet the needs of this start-up plan.

●prepare at least one co2 fire extinguisher.

●confirm that 3% -5% lubricating oil is mixed in the fuel.

●the fuel level in the 5 fuel tanks is sufficient, and the fuel consumption of the model engine is 0.3-0.9l/min. the sufficient fuel level will be determined based on the flight time you have booked.

●the wiring harnesses of the 6 engines are connected correctly, the throttle calibration of the remote control is normal, and the data transmission from the handheld terminal/ground station is normal.

●the engine is firmly fixed, ensuring the safety of the surrounding environment, confirming that there are no debris near the engine intake, and ensuring that there are no obstacles or easily inhaled or blown objects in front of or behind the engine.

●check that the exterior of the engine, the inlet compressor impeller, turbine, and tailpipe are intact and undamaged.

6.3 PREPARATION OF FUEL SUPPLY SYSTEM

●after the oil pipeline is connected from the fuel tank to the engine inlet, there will be air left in the oil pipe. to ensure a successful engine start, it is necessary to perform oil pipe exhaust and filling operations. it is recommended to remove the fuel delivery pipe from the engine during the oil discharge operation, and then re insert the engine after the oil discharge operation is completed. if the fuel pipe is not removed from the engine, it may cause excessive oil accumulation inside the engine, which may result in excessive engine flame during the next engine start and cause overheating and damage to engine related components.

●check the fuel pipeline to ensure that it is clean, unobstructed, and not bent. ensure that the fuel tank to ecu and ecu to engine section oil pipes are filled with fuel and there is no rich fuel inside the engine. ensure that the intake valve of the fuel tank is open. if there is no intake valve in the fuel tank or the intake valve is not open, it will cause the oil circuit to be blocked and the engine to fail to start.

6.4 ENGINE START AND STOP

●the startup checklist has been checked and all wiring harnesses of the engine have been connected. the engine can now be started.

●when using the engine for the first time, it is recommended to install it on a dedicated test bench for testing. check if the connections between the fuel tank, oil circuit, engine, and ecu are correct.

●be sure to firmly fix all kinds of wires, oil pipes, etc. around the engine, and clean up other debris to ensure that wires, oil pipes, and debris are not sucked into the engine during operation.

6.5 USE REMOTE CONTROL TO START AND STOP

●before starting, use the monitor (gsu) to calibrate the remote control and engine throttle. after calibration is completed, use the gsu testing function to test the main fuel pump. press and hold the "test main fuel pump" button until the fuel line is filled with fuel. pay attention to stopping the pump immediately when the fuel level enters the engine to prevent the engine from becoming rich in fuel and spraying a large flame when starting. press and test the ignition solenoid valve and main solenoid valve. if you hear a "click click" sound, it indicates that the solenoid valve is functioning properly. test the starter motor (rotating the impeller clockwise) and the ignition head (using the gsu test function interface to detect current changes), and determine that all engine components are working properly before starting the test.

●before starting, the remote control throttle lever is in the minimum position, and the throttle adjustment is in the stop position. adjust the throttle to modulate the start gear, and the engine will start to ignite.

●the engine starting process is divided into several stages: preparation for starting, ignition, preheating, and acceleration. start successfully, engine speed reaches and maintains idle.

●after the engine reaches idle speed, the engine speed is controlled by adjusting the throttle through the throttle lever. 100% throttle corresponds to the maximum engine speed. note that the new machine should slowly accelerate to maximum speed and run steadily during its first operation, so that the ecu can learn the throttle.

●before the engine stops running, first adjust the throttle lever to the minimum. after the engine speed drops to idle, fine tune the throttle to the shutdown cooling gear, and the engine will automatically cool down and dissipate heat. during cooling, the starting motor of the engine will drive the compressor wheel at a lower constant speed until the exhaust temperature drops below around 100 ℃, at which point the engine will shut down.

●when the engine is running, the intake of air is like a vacuum state, and hands should never be placed near the intake duct of the engine. keep a clear space around the intake duct, fix the wires properly, and install protective nets. inhaling foreign objects into the

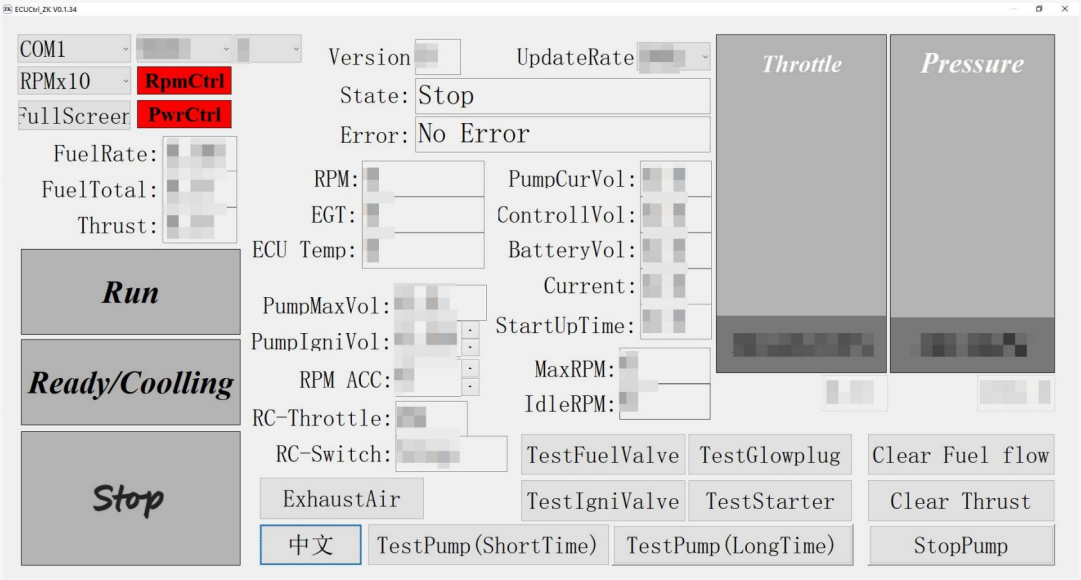
engine can cause serious damage.

the engine generates a large amount of high-temperature hot air during operation, and the exhaust temperature can reach up to 750 degrees celsius. pay attention to the surrounding insulation and temperature prevention measures. it is absolutely forbidden to start indoors. the engine will consume a large amount of oxygen, causing suffocation of personnel. the emitted hot air and strong airflow may ignite dry flammable materials and blow away debris.

●when flying, the speed is fast, and absolute attention should be paid to the safety of the airspace and ground.

●it is recommended to familiarize oneself with the entire system operation before installing the engine on the flight platform. please refer to the engine safety regulations when using the engine. due to changes in altitude and climate conditions, engine starting faults may occur. if the problem cannot be solved, please contact after-sales to arrange technical support.

6.6 PC SIDE CONTROLS START AND STOP



● *open the zk software. click on 'throttle control', and all parameters on the zk interface will return normally. click 'start' to start. if there is no feedback on the zk interface, click the button in the upper left corner of the page to select a different com channel or check the compatibility between the serial port tool and the computer.*

● *after confirming the feedback, use the gsu testing function to test the main fuel pump. press and hold the "test main fuel pump" button until the fuel line is filled with fuel. pay attention to stopping the pump immediately when the fuel level enters the engine to prevent the engine from becoming rich in fuel and spraying a large fire when starting. press and test the ignition solenoid valve and main solenoid valve. if you hear a "click click" sound, it indicates that the solenoid valve is functioning properly. test the starter motor (rotating the impeller clockwise) and the ignition head (using the gsu test function interface to detect current changes), and determine that all engine components are working properly before starting the test.*

●*click "start" to start the engine. after reaching idle speed, control the engine speed through the throttle lever, and click "stop/cooling" to stop the engine.*

7. ENGINE OPERATING STATUS AND FAULT DESCRIPTION

DISPLAY NAME	EXPLAIN
stop	the remote control fine-tuning is in the off gear or the engine control software has not sent a start command to the ecu.
get ready to start	the engine ecu receives the start command, and the engine is ready to start. this stage is very short, and the display shows that the engine will immediately enter the ignition state after the start is ready.
ignition	when in ignition state, the engine spark plug is energized, the ignition solenoid valve opens, the engine completes ignition, and the starter motor drives the engine to reach ignition speed, causing the internal temperature of the engine to rise.
preheat	entering the preheating state, the starter motor continues to drive the engine speed to increase by 1000-2000 revolutions per minute, and the internal temperature of the engine continues to rise.
accelerate	entering the acceleration phase, the starter motor continues to drive the engine speed to increase to the clutch disengagement speed, the starter motor stops working, the internal temperature of the engine reaches above 100 ℃, and ignition is successful.
function	after the acceleration phase is completed, the engine speed reaches idle, and thereafter, the engine speed needs to be controlled through the throttle, with 100% throttle corresponding to the maximum engine speed.
cooling	adjust the remote control to the shutdown cooling gear, and the engine starter motor drives the compressor wheel to run at a lower constant speed until the internal temperature of the engine drops below 100 ℃, and then the engine stops.
engine not detected	the connection between the engine and ecu is disconnected.
engine type	gsu running interface, the white box below the logo shows the engine model.
time	indicates the total time the engine has been running this time
acc	indicates the time it takes for the engine to reach maximum speed from idle, which can be adjusted by changing the acceleration/deceleration curve.

speed	gsu operation interface, "speed" indicates the real-time speed when the engine is running.
temperature	gsu operation interface, "temperature" represents the real-time internal temperature of the engine during operation.
oil pump power	on the gsu operation interface, "oil pump" represents the real-time oil pump power during engine operation.
remote control throttle	gsu operation interface, "remote control" represents the real-time throttle status during engine operation.

8. COMMON PROBLEM ELIMINATION

8.1 COMMON PROBLEM ELIMINATION

PROBLEM DESCRIPTION	CAUSE ANALYSIS	REMEDIAL MEASURES
engine ignition failed	the fuel pipe is not filled with fuel in advance, or the pipe is bent or blocked spark plug malfunction	fill the fuel pipe with fuel using the gsu testing function when using the gsu "test flame", there is no current displayed or no bright spot can be observed from the tail nozzle. in this case, contact swiwin after-sales service to return to the factory for repair
engine startup failure	low battery starting motor malfunction spark plug malfunction	battery charging depot repair depot repair
the throttle does not match the actual engine speed	remote control calibration not performed	re calibrate the remote control
starting motor slips and produces abnormal noise	there is fuel on the contact surface between the compressor nut and the starter motor clutch rubber ring rubber ring wear	clean the rubber ring with a cotton swab dipped in alcohol or cleaning agent replace the rubber ring

engine ignition successful but startup process aborted	there are bubbles in the fuel supply pipe the oil pump is not working	oil circuit leakage, check all quick connectors
unstable exhaust temperature or engine speed	remote control antenna signal is interfered with	identify sources of interference
z software has no data feedback	the power is not turned on signal line connection not in place/incorrect connection the computer does not have drivers installed the signal channel does not match the actual situation	turn on the power check if all plugs are connected properly, and if the serial port tool and signal cable 232 are connected correctly contact swiwin after-sales service to obtain drivers and install them unplug the usb plug from the computer, check the device manager, open the zk software, and select the corresponding signal channel

8.2 ECU ERROR FAULT ANALYSIS

during the operation of the engine, if there is a signal malfunction, the ecu will automatically report an error. the following table explains these faults.

ERROR NAME	EXPLAIN
overtime	during ignition: temperature remains unchanged for 20 seconds forced cooling: time exceeding 60 seconds
low battery voltage	the voltage of the power battery is lower than the minimum value (the minimum value can be modified) the voltage of the remote control receiver is below 4v
fire head malfunction	no flame current detected
abnormal oil pump	unable to connect to the oil pump motor controller (only

	supported on brushless motor version)
starting motor malfunction	during ignition: the engine speed cannot reach the ignition speed
low rotational speed	when igniting: the engine speed drops to 50% of the ignition speed during preheating: the engine speed drops below the ignition speed when accelerating: the engine speed drops below the warm-up speed during operation: the engine speed is lower than the set minimum speed
unstable rotational speed	during acceleration: engine rpm fluctuates up and down during acceleration: the engine speed drops significantly
high temperature	during ignition: the exhaust temperature is greater than the set maximum temperature value during preheating: the exhaust temperature is higher than the set maximum temperature value during acceleration: the exhaust temperature is greater than the set maximum temperature value for 4 seconds
low temperature	during preheating, there is a significant decrease in exhaust temperature during acceleration, there is a significant decrease in exhaust temperature
temperature sensor malfunction	during operation: exhaust temperature below 200 degrees celsius
lost remote control signal	remote control input signal lost, time exceeds set value
high starting motor temperature	the temperature of the starter motor controller is too high (only supported in the brushless motor version)
high oil pump temperature	the temperature of the oil pump motor controller is too high (only supported in the brushless motor version)
current overload	the working current of the ecu exceeds the design limit, and the current limit of different versions of the ecu varies
engine offline	ecu did not detect engine connection (only supported by bus controller version)

9.COMPATIBILITY

if using zk or flight control software to control the engine, the connection between the engine and your device involves compatibility issues.

9.1COMPATIBILITY OF SERIAL PORT ADAPTER CABLE CONNECTORS

NAME	PERFORMANCE INDEX	COMPATIBILITY
rs232 adapter yhl-b232	usb2.0, compatible with usb1.1 supports rs232 three wire serial port interface usb bus for direct power supply without the need for an external power source equipped with a set of 5v/500ma power outputs	support computer systems: windows 2000, windows xp, windows server 2003 (32, 64 bit)/vista/windows 7 (32, 64 bit) windows 8、windows10

9.2 UPGRADER COMPATIBILITY

NAME	PERFORMANCE INDEX	COMPATIBILITY
upgrade（zk-link v1.4）	-----	supported computer systems: windows7、 windows 8、windows10

10. STORAGE、LUBRICATION AND OIL TANK

10.1 STORAGE AND LUBRICATION

1.all models of swiwin engines can use kerosene or diesel as fuel, and are mixed with 3% -5% lubricating oil. this mixed lubricating oil is also used in the bearing lubrication system, and it is recommended to use xuan yun brand or mobil pegasus no.2 lubricating oil.

2. excessive addition of lubricating oil can lead to a decrease in engine performance; insufficient addition of lubricating oil can lead to insufficient lubrication of bearings, resulting in malfunctions. mild cases may reduce engine life, while severe cases may lead to engine shutdown faults.

3. it is necessary to ensure that the mixed fuel is clean and free of impurities, and to keep the interior of the fuel tank clean and free of impurities.

4. unused engines should be stored in a cool, dry, and well ventilated place, and regularly tested to ensure that the engine is in normal condition. the engine has been stored for more than 3 months. to prevent bearing corrosion, it is recommended to lubricate the engine thoroughly with fuel, place it vertically, and seal it with a sealed bag. if there are ground testing conditions, ignition testing can provide better maintenance for the engine. if necessary, you can also contact after-sales personnel to return to the factory for maintenance.

10.2 ENGINE OIL TANK

1. micro turbojet engines use aviation kerosene or diesel, with the addition of specialized turbojet lubricating oil. the fuel tank material can be fiberglass or oil resistant plastic, and there are two types of fuel tank structures: hard fuel tanks and soft fuel tanks (depending on the situation).

2. in order to prevent air bubbles from entering the engine and causing engine shutdown faults, an anti bubble fuel tank must be equipped. the anti bubble fuel tank is placed between the main fuel tank and the oil pump. when refueling, the air in the anti bubble fuel tank should be emptied first before refueling.

11. ENGINE MAINTENANCE AND UPKEEP

0the maintenance requirements and cycle of the product, including cleaning, replacement of/ parts, etc.

1. maintenance plan: regularly inspect and replace lubricating oil, air filters, and other components of the engine.

2. daily maintenance: regularly check the fastening of various connecting parts and pipelines of the engine, and clean the surface of the engine.

3. troubleshooting: if encountering problems such as decreased engine performance or abnormal noise, follow the maintenance manual and troubleshooting process for operation.

to ensure stable and reliable operation of the engine, regularly check the following during use:

- *is there any burning or discoloration on the engine casing.*
- *is the engine mount intact.*
- *is the air inlet and impeller intact.*
- *is there any leakage in the oil system and is the oil filter clogged.*
- *bearing: manually rotate the rotor and carefully distinguish the bearing sound. if there is a "rustling" sound, the bearing may be slightly damaged due to impurities or improper cooling. it is recommended to use clean fuel or replace the oil filter. if the bearings are clearly damaged after inspection, it is prohibited to use the engine again. you can log in to the swiwin official website and contact after-sales personnel to replace the bearings.*

the regular maintenance cycle for the hobby (b-series) engine is:25 hours per accumulated operating time.

12. AFTER SALES SERVICE

LIMITED LIABILITY WARRANTY

1.the service life of the engine is directly related to the operating environment and operating methods. the engine uses the simplest structure to achieve the most extreme working state, and each component is designed and produced to the extreme. the working conditions are extremely harsh. do not disassemble the intake duct and main shaft structure by yourself. once the engine is disassembled, it must be precisely reinstalled according to specifications to achieve its original performance. random assembly will cause the vortex jet body to lose balance, and high-speed operation will cause serious consequences.

2. swiwin promises to provide free product warranty service within the valid warranty period from the date of product sale, and customers do not need to pay for replacement parts. customers are requested to directly contact xuanyun's official after-sales service center to handle product repair matters.

(1 the implementation of free warranty service must meet the following conditions

a. the warranty period is 1 year from the date of product sale or within 25 hours of cumulative product operation (whichever comes first);

b. if the self purchased product is used normally within the prescribed product warranty period and experiences non-human performance failures;

c. no unauthorized disassembly, modification or installation without official instructions, or other faults caused by non-human factors;

d. the machine number, factory label, and other markings show no signs of tearing or alteration;

(2 the following situations do not fall under the scope of free product warranty services:

a. accidents such as collisions, burns, and crashes caused by human factors other than product quality issues;

b. damage caused by unauthorized modification, disassembly, or shell opening without official instructions;

c. damage caused by incorrect installation, use, and operation not following the instructions in the manual;

d. damage caused by all operational actions not following the product manual;

e. damage caused by handling in harsh environments, such as strong winds, rainy days, sandstorms, etc;

f. damage caused by manipulation in complex electromagnetic environments or strong interference sources, such as mining areas, transmission towers, high-voltage lines, substations, etc;

g. damage caused by interference with other wireless devices during operation, such as interference from transmitters, image transmission signals, wifi signals, etc;

h. damage caused by takeoff at a weight greater than takeoff weight;

i. damage caused by forced flight in the event of aging or damage to components;

(3 warranty notice)

a. users need to pay for the express delivery fee to return the problematic product. after receiving the problematic machine, xuanyun after-sales service center will conduct fault detection on the product to determine the responsibility for the problem. if it is a quality defect of the product itself, xuanyun after sales service center is responsible for bearing the inspection fees, material fees, labor fees, and courier fees to repair the product and send it back;

b. if the product does not meet the free repair conditions after testing, negotiate with the user to return the original machine and bear the shipping cost or pay for repair;

c. if the problem you encounter is not covered by the warranty or caused by human factors, we will charge inspection fees, replacement parts fees, testing fees, and labor fees according to the nature of the problem, and will communicate with the customer in advance;

d. please call xuanyun after-sales service center or consult through official wechat for the entire repair process and repair records;

e. the product must be properly packaged during return shipping to prevent damage or loss during transportation, and we will not be responsible for compensation.

3. if you need the engine to be returned to the factory for maintenance and repair, please log in to the official website of swiwin company ***http://www.swiwin.com or swiwin official account*** *to contact customer service, fill in the《engine maintenance application form》, and prepare the following relevant contents:*

ENGINE MAINTENANCE APPLICATION FORM			
NAME		THE DATE OF ISSUANCE	
Shipping Address			
Fault Description	_____ Model		
Other Service Requirements	☐ Technical Consultation ☐ Engine Maintenance ☐ Accessories Procurement		

13. DISCLAIMER

1. when the engine is running, unrelated personnel are strictly prohibited from standing around the engine. operators can only operate the engine within the safe operating area. the company will not be held responsible for any accidents caused by entering the dangerous area to operate the engine without following safety reminders.

2. most of the engine components are precision machined parts, and the rotor of the engine has already undergone precision dynamic balancing before assembly. disassembling and assembling the engine at will will will damage the rotor dynamic balance, leading to excessive vibration during engine operation and affecting the engine's service life. in severe cases, it may cause safety accidents. our company shall not be held responsible for any work accidents or personal injuries caused by the customer's unauthorized disassembly and assembly of the engine.

3. the area near the intake duct during engine operation is a high-risk zone, and any unsecured or loosely secured object may be sucked into the engine. it is strictly prohibited to reach any object or hand near the intake duct during engine operation. the company shall not be held responsible for any consequences arising from failure to follow the operating procedures.

4. it is strictly prohibited for the engine to work under overload. engine operating speed exceeding the maximum speed may cause the strength of engine structural components to fail, which may lead to serious safety accidents. our company shall not be held responsible for any losses or consequences caused by overloading the engine.

5. the company shall not be held responsible for any losses or accidents caused by unauthorized modification or use of the engine.

6.this internal combustion engine is only used for model rc, toy aircraft as power source,it can only be used for model airplane flight, model airplane flying show and other entertainment activities. according to the export control law of the people's republic of china and the export control law of the usa. it is strictly forbidden to modify the product for illegal use. it is strictly prohibited to resell the product to the export restriction country under the law in china. otherwise, all consequences will be at your own risk.

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