SWIWIN SW600PRO 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 sw600pro 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.

玄云动力
SWIWIN TURBINE

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1. ENGINE INTRODUCTION

welcome to use the swiwin sw600pro engine. thank you very much for your trust and support. this engine has the following characteristics:

1.overall design has a high degree of integration, easy installation, and convenient operation. the engine as a whole consists of two main parts: the engine body and the ecu (v5).

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

•*brushless starter motor* •*ignition head* •*temperature sensor*

Engine

COMPONENTS INTEGRATED WITHIN THE ECU CONTROLLER

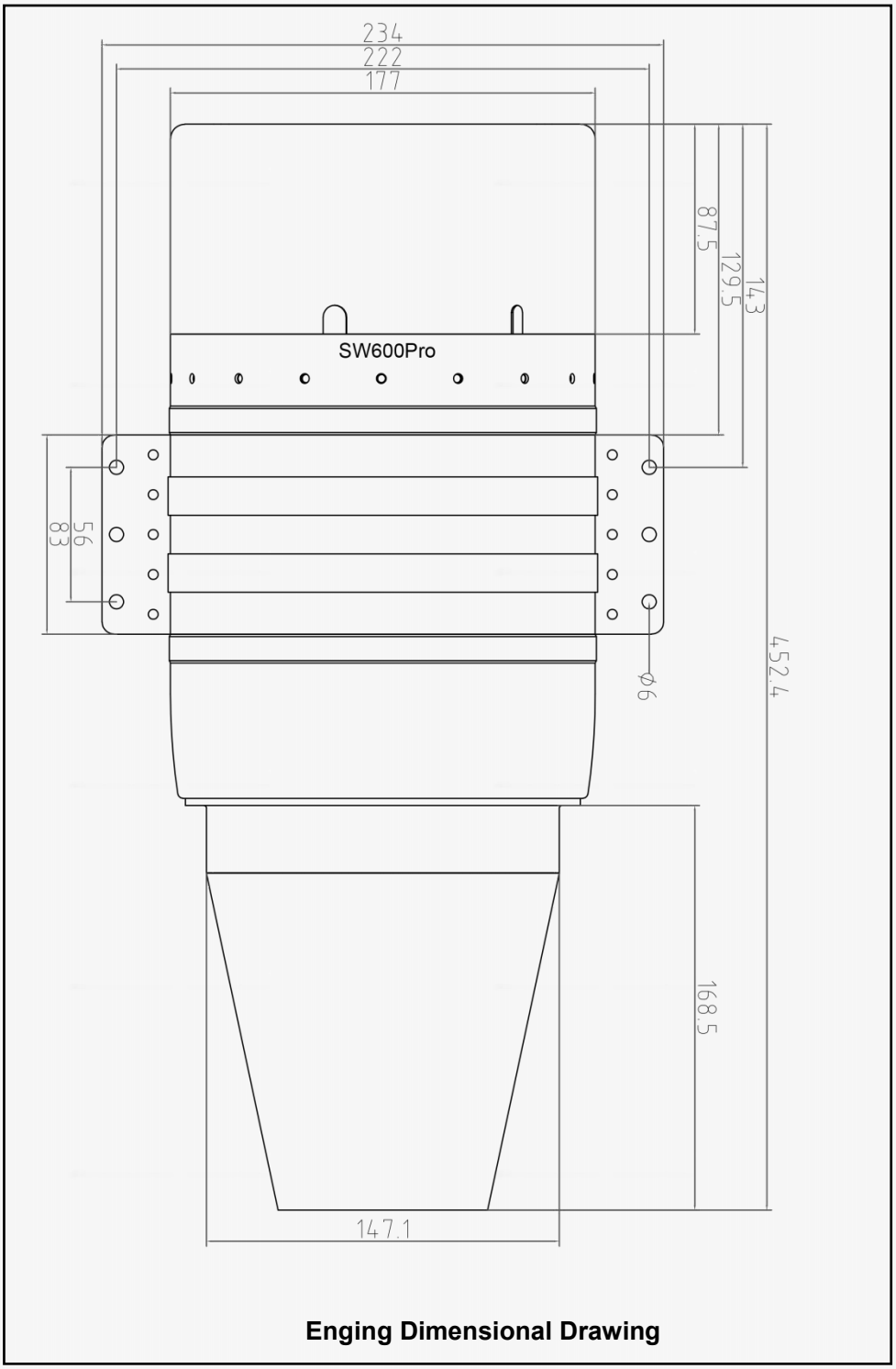
•*oil control valve body assembly* •*ecu board*

ECU（V5）

2.PRODUCT SPECIFICATIONS

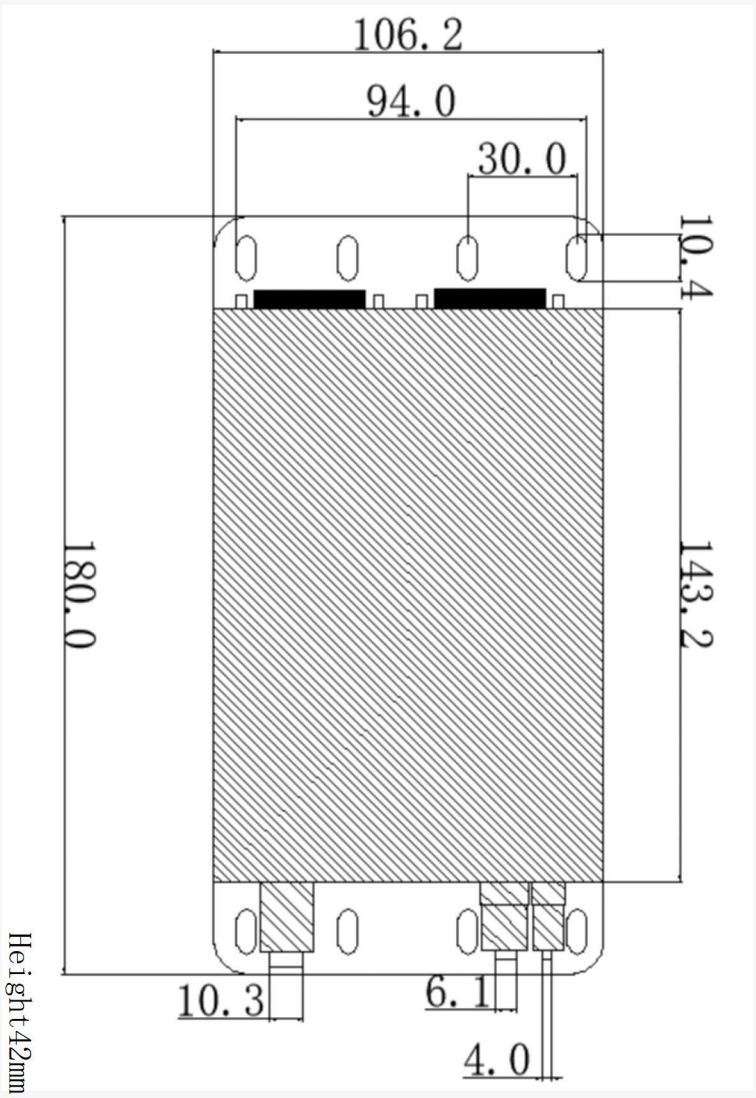
2.1 DIMENSIONAL DRAWING

2.1.1 ENGINE DIMENSION DIAGRAM



Enging Dimensional Drawing

2.1.2 ECU（V5）DIMENSIONAL DRAWING



ECU（V5）Dimensional Drawing

note:

1. the total design length of the sw600pro engine is 452.4mm, and the length of the tailpipe can be customized according to customer needs.

2. the maximum diameter of the sw600pro engine design is 177mm, which does not include the thickness of the engine fixing clamp. the engine fixing clamp can be customized according to specific customer requirements.

3.the total design weight of the sw600pro engine body is approximately 6600g, and the total weight of the ecu is approximately 910g.

2.2 BASIC PARAMETERS OF ENGINE

PROJECT	PARAMETER
model	SW600Pro
thrust	60kg
diameter (mm)	177mm
length (mm)	452mm
weight	6600g
ecu weight	910g
usage temperature	-40℃~50℃
max usable height	12000m
maxi longitudinal overload during catapult takeoff	20g
max allowable flight speed	300m/s
supply voltage	18V-32V
starting system	one key electronic start
rpm range	25,000-72,000
exhaust temperature	750℃
fuel consumption	1735g/min
fuel	aviation kerosene
lube oil	3%-5%
maintenance cycle	every 25 hours

2.3 PARAMETERS OF ENGINE OPERATION CONTROL

PROJECT	PARAMETER
pump voltage	1.8V
rpm start up ramp	100%
pump start up ramp	5
glow plug	6.6V
valve	40
ignition rpm	1,300 rpm
preheat rpm	2,000 rpm
rpm off starter	13,000 rpm
rpm acc	10
rpm dec	10
max rpm	72,000 rpm
idle rpm	25,000 rpm
minimum speed	15,000 rpm
max temp	1000℃
low volt	10.0V
restart	close
restart glow plug	same voltage as the ignition head
pump limit	25V
idle stable	5-8
pop-up time	0.5S
ejection voltage	5V
run voltage	4.5V
rpm stable	50
cool	3,000 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.

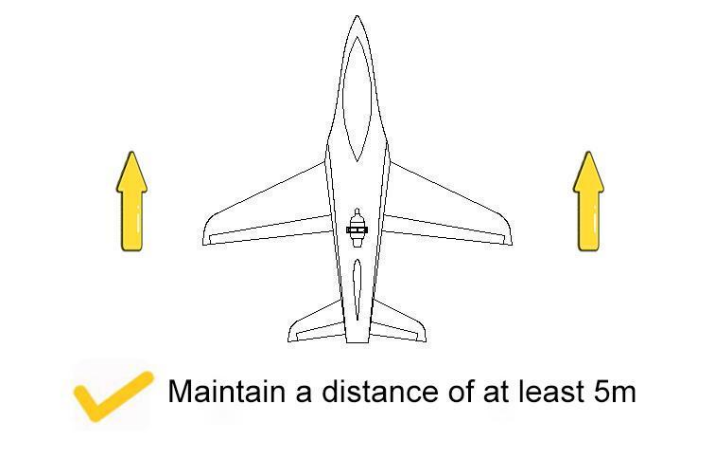
3.4 ENGINE NOISE PROTECTION

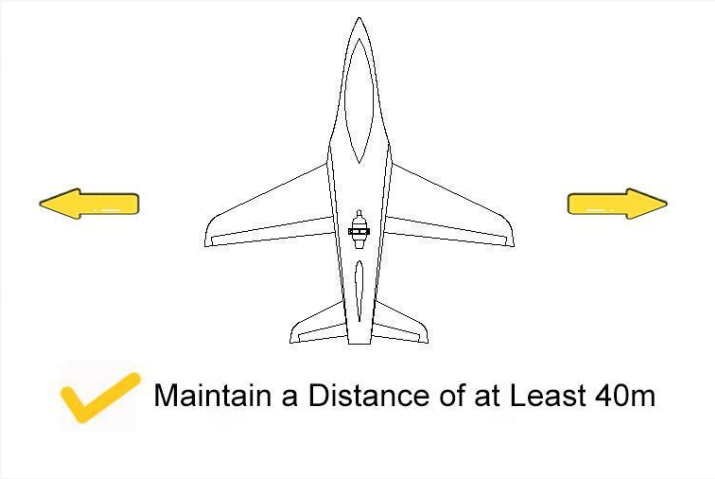
1. when the engine is running, it produces loud noise. to prevent noise from harming the operator's health, testers must take protective measures and wear hearing protection devices.

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 5 meters in front of the engine (intake direction) and 40 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.

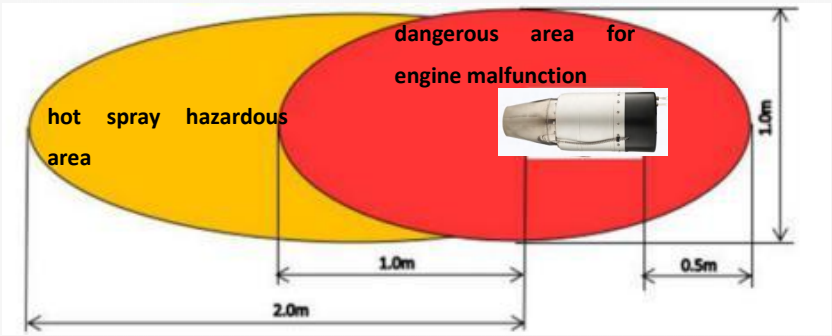
●when operating the engine, safety goggles and earplugs must be worn.

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

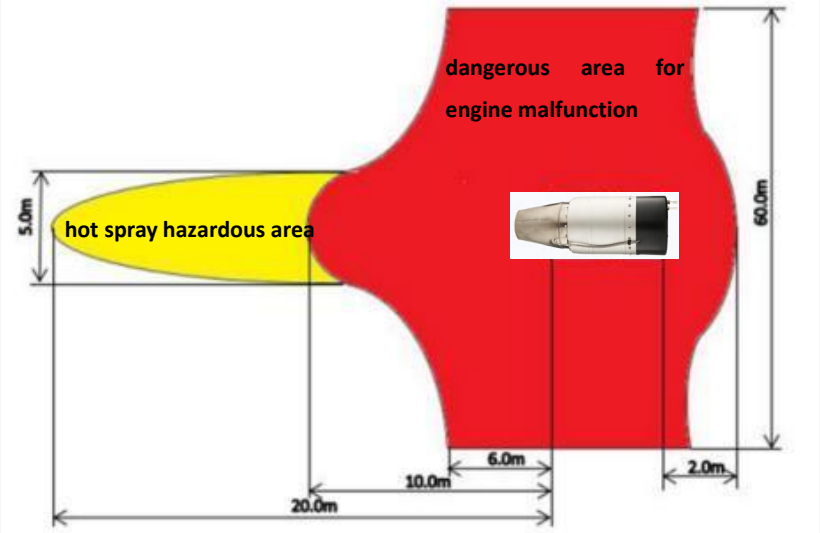
●keep your fingers away from the intake area when operating the engine.

●prepare fire extinguishing equipment before operating the engine.

DANGEROUS AREAS DURING ENGINE START- UP AND IDLE



ENGINE 20% THROTTLE TO FULL THRUST DANGER ZONE



sw600pro 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:

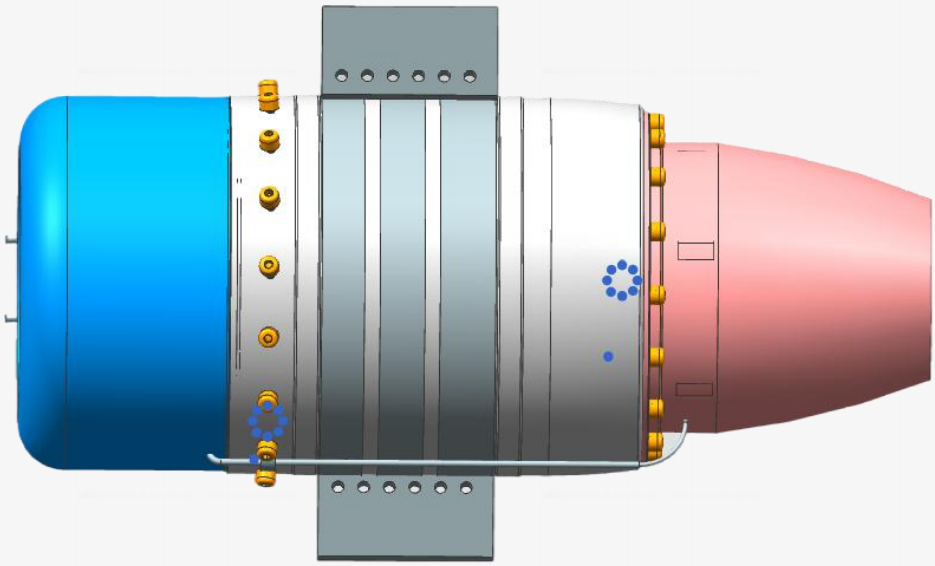
1.on site operators should maintain a high level of calmness, avoid panic, immediately evacuate unrelated personnel around, and first ensure personnel safety.

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

the sw600pro engine is equipped with a dedicated fixing clamp. before operating the engine, please make sure that the clamp is securely fastened and clamped in the groove of the casing. be careful not to overtighten the fixing screws to prevent deformation of the engine casing and affect the fixing effect. the schematic diagram is as follows.



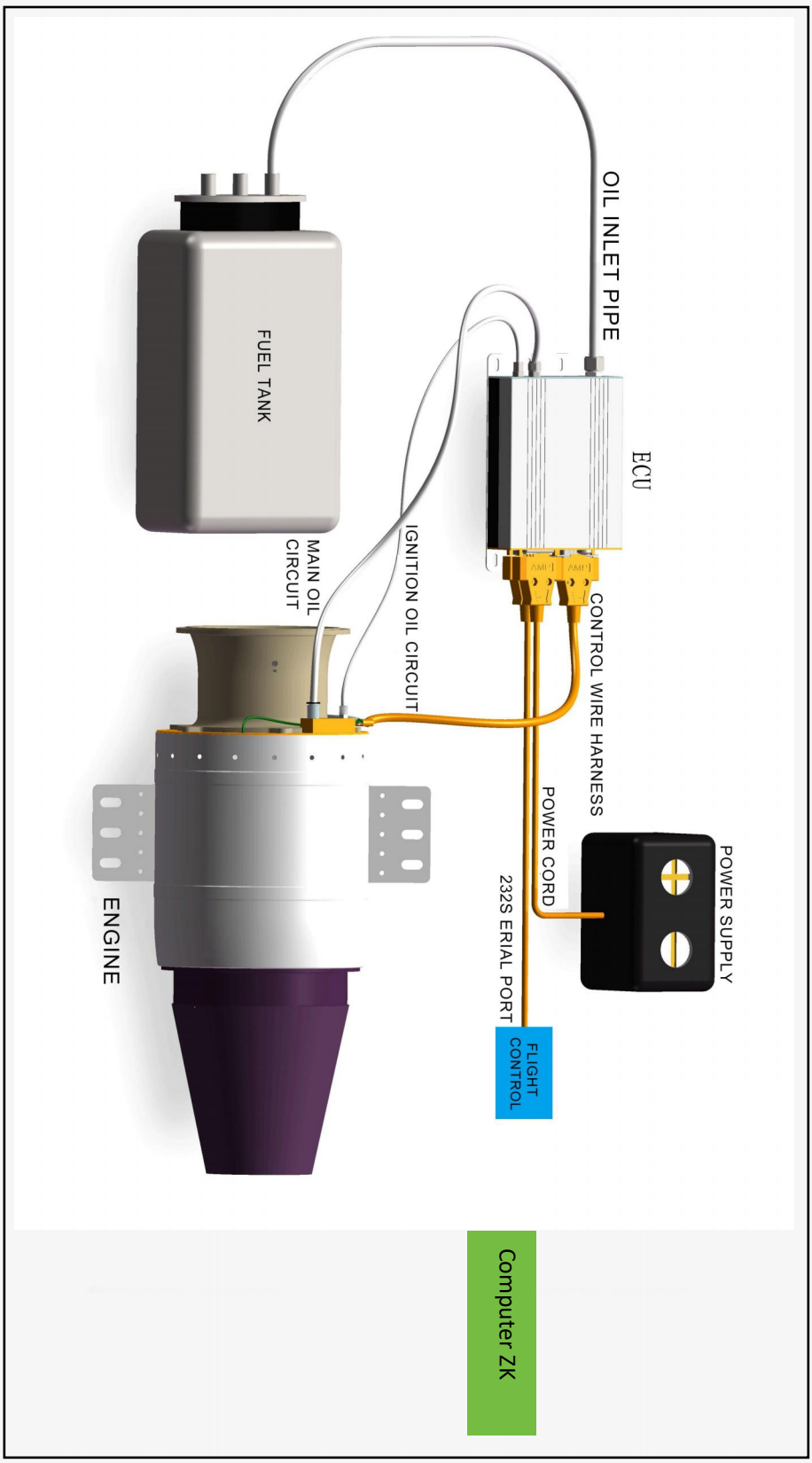
5. ENGINE USAGE INSTRUCTIONS

5.1 ENGINE PACKING LIST

open the package, the engine packing list is as follows

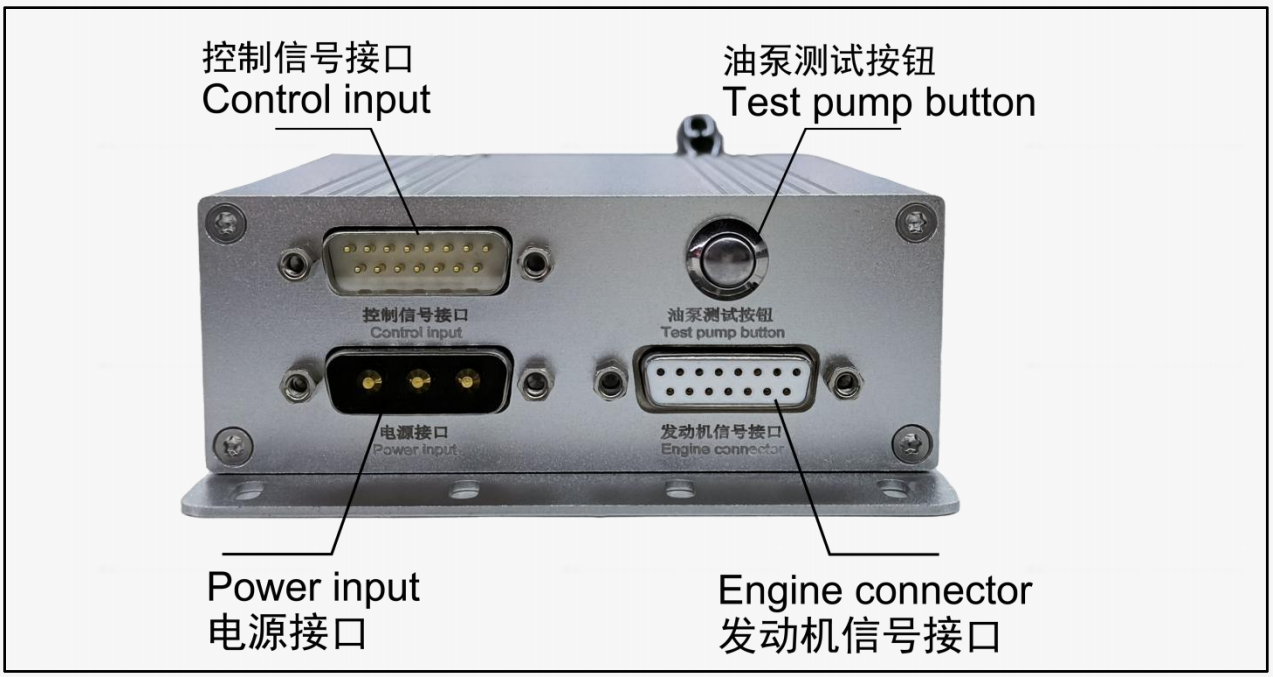
 Engine	 ECU（V5）	 GSU
 Fixture	 Upgrade Tool (One to Two)	 Connector
 DB3 Power Plug	 DB15 Signal Plug	 Power Line
 Serial Cable	 Φ10mm×Φ6.5mm（PU Tubing） Φ6mm×Φ4mm（PU Tubing） Φ4mm×Φ2.5mm（Teflon Tubing）	

5.2 ENGINE CONNECTION DIAGRAM



5.3 SW600PRO ELECTRICAL CONNECTION METHOD

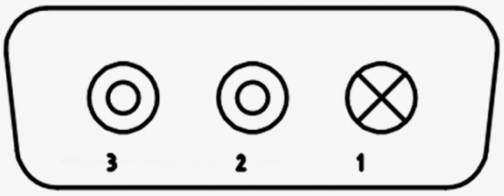
the engine data connection is completed through ecu (v5), which has three electrical connection sockets on the side, namely db15 (male) plug, db15 (female) plug, and db3 (male) plug.



5.4 DEFINITION OF EXTERNAL SIGNAL CONNECTION PLUG

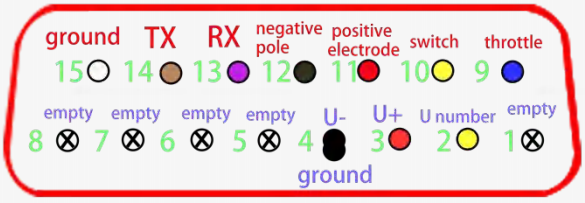
the sw600pro engine signal line plug adopts ws16j7 tq aviation plug, and the plug definition is as follows:

definition of power interface



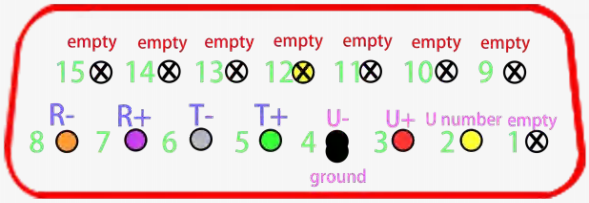
1：empty
2：positive electrode （VCC）
3：negative electrode（GND）

Rs232 Definition Of Signal Line Wiring



2：GSU data
3：GSU power supply positive
4：GSU negative power supply ground
9：PPM throttle
10：PPM switch
11：PPM power supply positive
12：PPM negative power supply
13：RX
14：TX
15：ground

rs422 definition of signal line wiring



2：GSU data
3：GSU power supply positive
4：GSU negative power supply ground wire
5：T+
6：T-
7：R+
8：R-

5.5 ABOUT CONTROL PROTOCOL

1. throttle signal

if the customer has no special requirements, the default communication protocol at the factory is "zk", with a baud rate of 9600, rs232 serial port, stop bit 1, and no checksum. the throttle adopts a pulse width (pwm) control method, with a pulse width of 1ms~2ms. 1ms corresponds to the minimum throttle (0%), 2ms corresponds to the maximum throttle (100%), and the pulse high level is 3.3v and 5v (3.3v and 5v are available on average), while the pulse low level is 0v.

2. start switch

the startup switch adopts a pulse width (pwm) control method, with a pulse width of 1ms~2ms. 1ms corresponds to off and 2ms corresponds to on. the pulse high level is 3.3v and 5v (3.3v and 5v are available on average), and the pulse low level is 0v.

3. telemetry data

①the engine has telemetry function and transmits data through a 232 standard serial port with a baud rate ranging from 9600bps to 57600bps.

②the data to be measured includes but is not limited to engine speed, engine throttle, fuel pump voltage, engine status, and error messages.

③to test the communication protocol openness of the data, provide detailed communication protocol documentation.

4. data recording

①the engine has a data recording function, which can record data from 2 hours before the engine failure.

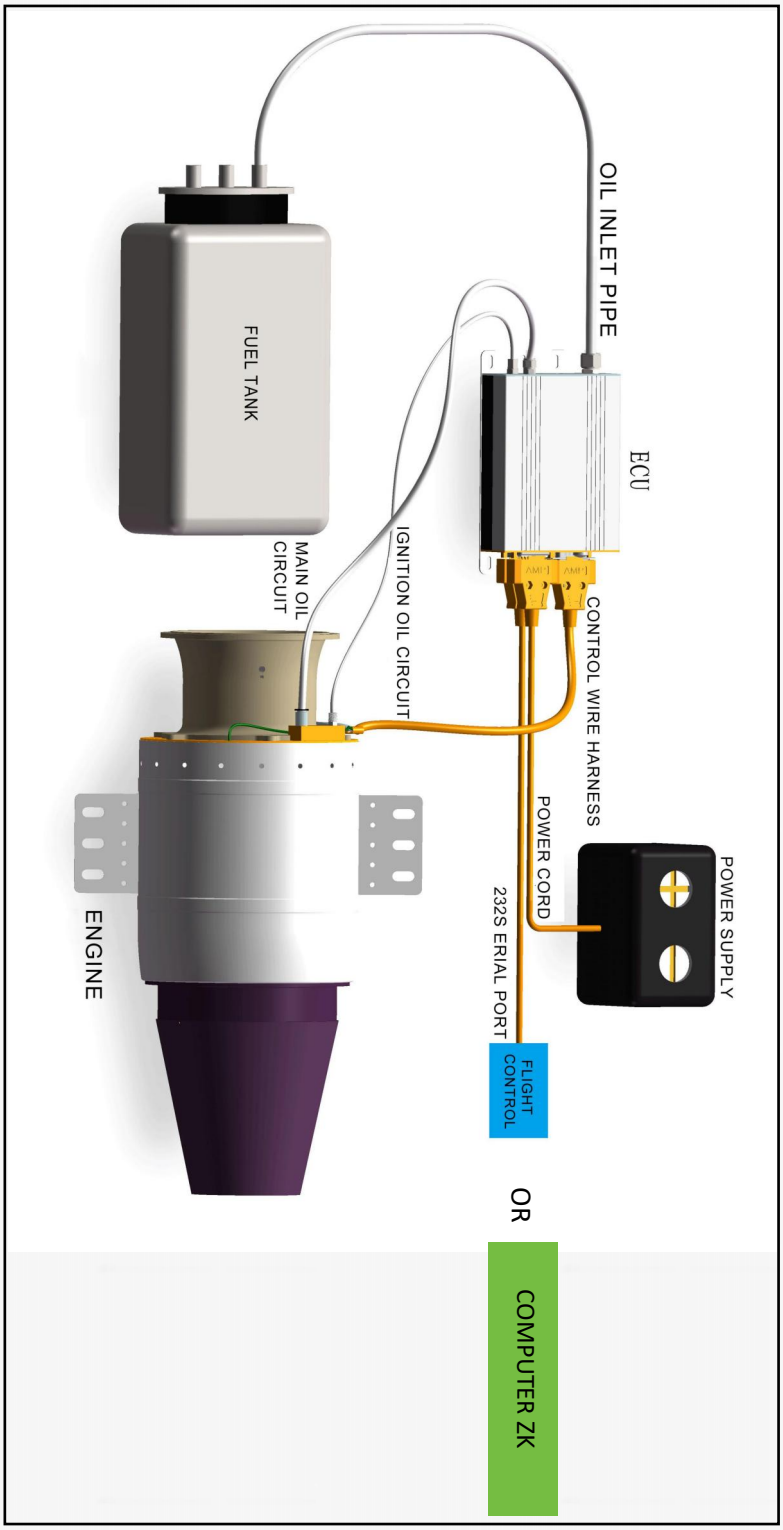
②the data recording content includes but is not limited to engine speed, engine throttle, oil pump voltage, engine status, and error messages.

③provide engine data analysis software for post flight data analysis.

④customization is supported within the scope of the engine control protocol.

5.6 INSTRUCTIONS FOR CONNECTING ENGINES WITH DIFFERENT STARTING MODES

5.6.1NSTRUCTIONS FOR CONNECTING AND STARTING THE ENGINE CONTROLLED BY THE RE232 SERIAL PORT TOOL



5.7 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.

5.7.1 INITIAL INTERFACE OF GSU AFTER CONNECTING THE ENGINE

when the engine is not started, the gsu displays rpm, temp, etc. after the engine is sta rted, the data displayed by the gsu is real-time measured data.

GSU SCREEN DISPLAY：
RPM：
TEMP：
CURRY：
PRE：
PWRVOL：
PEVVOL： ENGINE MODEL
TIME： ACC：
STATE：
COLUMN CHART (RPM,TEMP,PUMP,RC)

note:

① *acc represents the acceleration time from idle to 100% maximum speed, measured in seconds;*

② *the oil pump value is the output voltage multiplied by 1000. for example, if the maximum speed output is 4.0v, it will display 4000;*

③ *the temperature unit can be switched between celsius or fahrenheit and has calibration function;*

5.7.2 ECU SETTING INTERFACE

press the ok button to enter the settings directory. the data in the upper part of the display screen is the last run record, and the settings interface is below. it is divided into nine parts: engine start-up, engine operation, remote calibration, starter motor, engine cooling, other settings, test settings, data charts, language settings, etc. press the "+" and "-" buttons to manually select from nine options.

GSU SCREEN ISPLAY：
RUN INFORMATION
TOTAL TIME：
CYCLE：
STOPRPM：
STOPTEMP:
MAXRPM：
SETTING
STARTUP, RUNNING,STUDY RC,
STARTER,COOLING,OTHER,TEST,
DATACHART,LANGUAGE

5.7.3 ENGINE STARTUP SETTINGS

when the engine startup option is selected, press the ok key to enter the startup parameter setting interface. press the plus sign "+" and minus sign "-" to select various parameter options, press the ok key to select the option, and then press the plus sign "+" and minus sign "-" to set the size and value of the parameters. the meaning represented by each parameter is as follows:

➢*pump voltage: the driving voltage of the oil pump during ignition. if the oil pump cannot rotate smoothly or waits for too long to rotate during each ignition, increase this value. control the oil output during startup, the higher the voltage, the more oil is supplied during startup.*

➢ *rpm startup ramp: refers to the slope of the increase in starting motor speed during the period from ignition to clutch disengagement. the higher the slope, the faster the speed increase.*

➢ *pump startup ramp : adjust the fuel supply slope between clutch disengagement and idle speed; 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. when the weather is cold or the ignition only emits smoke without*

igniting, it is because the temperature of the ignition head is not high enough. you can try to slightly adjust it by 0.2v each time, and the maximum cannot exceed 7v. adjusting it arbitrarily can easily cause overheating and shorten the life of the ignition head;

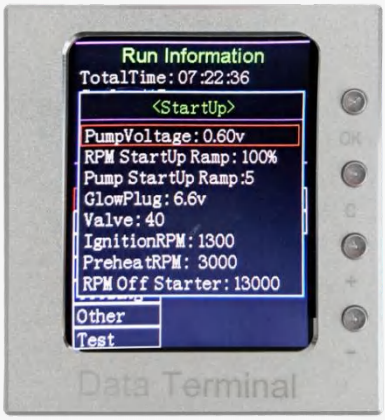
➢*valve: when the engine is ignited, it controls the amount of oil in the ignition oil circuit. the higher the oil threshold, the longer the opening time, and the more fuel is supplied.*

➢*ignition RPM: when the ignition speed is reached, the engine starts to ignite, the hot head lights up, and the ignition program enters.*

➢*prehea trpm: when the engine reaches the preheating temperature, the engine speed increases to the preheating speed and enters the preheating program.*

➢*rpm off starter: when the specified disengagement speed is reached, the starter motor clutch will disengage from the spindle clutch. speed: when the specified disengagement speed is reached, the starter motor clutch will disengage from the spindle.*

GSU SCREEN PUMP VOLTAGE：
START-UP
RPM VOLTAGE：
RPM STARTUP RAMP：
PUMP STARTUP RAMP
GLOW PLUG
VALVE
IGNITON RMP
PRECHEA TRPM
RPM OFF STAETER
OTHER
TEST



5.7.4 ENGINE OPERATING PARAMETER SETTING INTERFACE:：

press the c key from the previous interface to exit and enter the settings directory interface. press the plus "+" and minus "-" keys to select the engine running and enter the engine running parameter setting interface below. press the plus sign "+" and minus sign "-" to select various parameter options, press the ok key to select the option, and then press the plus sign "+" and minus sign "-" to set the size and value of the

parameters. the meaning represented by each parameter is as follows:

➢*rpm acc: the higher the acceleration value, the faster the fuel supply slope and the faster the acceleration time.*

➢*rpm dec: the higher the deceleration value, the faster the oil collection slope and the faster the oil collection time.*

➢*max rpm: the maximum rpm value reached by the engine setting.*

➢*idle rpm: the standby speed value set by the engine.*

➢*min rpm: below the minimum speed, the ecu defaults to engine shutdown.*

➢*max temp: temperature protection value. when the temperature exceeds the maximum temperature, flameout protection will be implemented.*

➢low colt: when the voltage falls below the minimum value, the engine will issue a low voltage alarm.

➢*restart glow plug: the ignition voltage during automatic startup.*

➢*puml imit: after reaching the specified limit value, the oil pump value will not increase.*

GSU SCREEN DISPLAY：
ENGINE RUNNING
RPM ACC:
RPM DEC:
MAX RPM:
IDLE RPM:
MIN RPM:
MAX TEMP:
LOW COLT:
RESTART GLOW PLUG:
PUML IMIT:

5.7.5 REMOTE CONTROL OPERATION CALIBRATION LEARNING INTERFACE

press the c key from the previous interface to exit and enter the settings directory interface. press the plus "+" and minus "-" keys to select the calibration remote control and enter the remote control operation calibration learning parameter setting interface below. press the plus sign "+" and minus sign "-" to select various parameter options,

press the ok key to select the option, and then press the plus sign "+" and minus sign "-" to set the size and value of the parameters. the meaning represented by each parameter is as follows.

➢*set the throttle stroke from this menu, and futaba's remote control must set the throttle channel to reverse phase;*

➢*max: indicates the highest throttle, maximum throttle, highest fine adjustment*

➢*failsatetime: for the out of control protection time, 1.0 represents 1 second*

➢*protocol：The factory setting is ZK. If you have any special requirements, please contact swiwin after-sales personnel*

➢*uart-band rate：The factory setting is 9600, which can be adjusted according to customer requirements*

➢*uart-stop bit：The factory setting is 2, which can be adjusted according to customer requirements*

GSU THE SCREEN WILL DISPLAY：
RC STUDY
MAX：
IDLE：
FAILSATETIME：
PROTOCOL：
UART-BAND RATE：
UART-STOP BIT：

5.7.6 STARTING MOTOR PARAMETER SETTING INTERFACE:

➢*eject time: control the time for the starter motor to pop up the clutch*

➢*eject voltage: the voltage value when the clutch is disengaged.*

➢*run voltage: the voltage value at which the motor operates normally during the start-up phase.*

➢*rpm stable: when starting, the speed will not have a significant up and down fluctuation stabilizing effect.*

GSU THE SCREEN WILL DISPLAY：
START
EJECT TIME:
EJECT VOLTAGE:
RUN VOLTAGE:
RPM STABLE:

5.7.7 ENGINE COOLING PARAMETER SETTING INTERFACE:

press the c key to exit from the previous interface and enter the settings directory interface. press the plus "+" and minus "-" keys to select engine cooling and enter the engine cooling parameter settings interface below.

rpm: after the engine is turned off normally, the starter motor will run to cool the engine until it reaches room temperature. the rotational speed refers to the operating speed of the starting motor during cooling.

GSU THE SCREEN WILL DISPLAY：
RPM：

remarks:

①*set the cooling speed after normal shutdown, and stop cooling when the engine automatically cools down to 80 ℃ after normal shutdown. cooling is the continuous operation of the starter motor, as the ecu cannot determine whether there is a fire*

condition in case of accidental shutdown. therefore, if the shutdown is not normal, it will not automatically cool down;

②when the engine unexpectedly stalls, it is also necessary to cool down as quickly as possible to protect the engine. at this time, manual cooling can be used by placing the fine adjustment at the lowest position and pushing the throttle to the highest position to perform manual cooling;

③if the temperature is above 80 ℃ during startup, it will also be cooled first until the temperature drops below 80 ℃ before starting;

5.7.8 OTHER PARAMETER SETTING INTERFACE:

press the c key to exit from the previous interface and enter the settings directory interface. press the plus sign "+" and minus sign "-" keys to select other parameters and enter the other parameter settings interface below. press the plus sign "+" and minus sign "-" to select various parameter options, press the ok key to select the option, and then press the plus sign "+" and minus sign "-" to set the size and value of the parameters.

the meaning represented by each parameter is as follows:

- *clearbatused: after the test is completed, reset all the battery used in the ecu to zero (for recording purposes)*
- *adjust temp: adjust according to the environment.*
- *pump type: adjust according to the oil pump used.*

GSU THE SCREEN WILL DISPLAY：
CLEARBATUSED：
ADJUSTTEMP：
TEMPERATURE UNIT：
TEMPTYPE：
ECU-VER VERSION：
GSU - VER：

5.7.9 TEST PARAMETER SETTING INTERFACE:

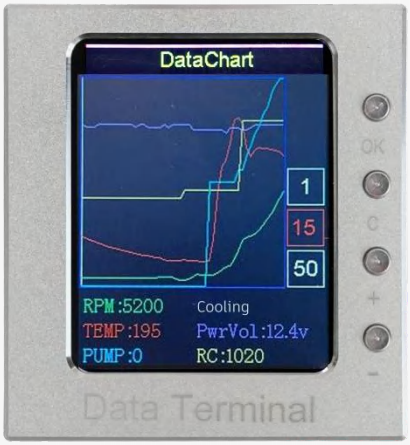
press the c key to exit from the previous interface, enter the settings directory interface, select the test by pressing the plus "+" and minus "-" keys, and enter the test parameter settings interface below. press the plus sign "+" and minus sign "-" to select from various parameter options, and press the ok key to select the option. the testing function is to test whether certain hardware can work properly.

GSU THE SCREEN WILL DISPLAY：
TEST ENGINE
TEST FUEL PUMP
TEST IGNITI PUMP
TEST FUEL VALUE
TEST GAS VALUE
TEST GLOWPLUG
TEST STARTER

5.7.10 DATA CHART DISPLAY INTERFACE:

data chart: record the status of engine start-up and operation. different colored curves represent different meanings. green represents speed, red represents temperature, light blue represents oil pump, and blue represents voltage.

GSU THE SCREEN WILL DISPLAY：
DATA CHART (CURVE CHART AREA)
RPM (GREEN TEXT)：
TEMPE(RED TEXT)：
PUMP (LIGHT BLUE)：
COOLING (WHITE TEXT)：
PWRVOL (DARK BLUE TEXT)：
RC (YELLOW TEXT)：



5.7.11 SET LANGUAGE INTERFACE:

by selecting, the monitor can be set to different languages such as english, 中文（简体）, 中文（繁体） and espanol.

GSU THE SCREEN WILL DISPLAY：
SET LANGUAGE
ENGLISH
中文（简体）
中文（繁体）
SPANISH
RESET CONFIG

5.7.12 TEMPERATURE CALIBRATION

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"

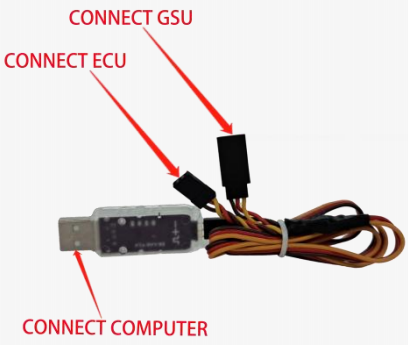
select 'adjust temp' and click '+-' to adjust the temperature up and down, keeping the corrected temperature consistent with the ambient temperature.

5.8 ECU（V5）USAGE INSTRUCTIONS

5.8.1 HARDWARE PREPARATION

the following hardware is required for downloading or changing settings and parameters of ecu (v5) data

① Engine

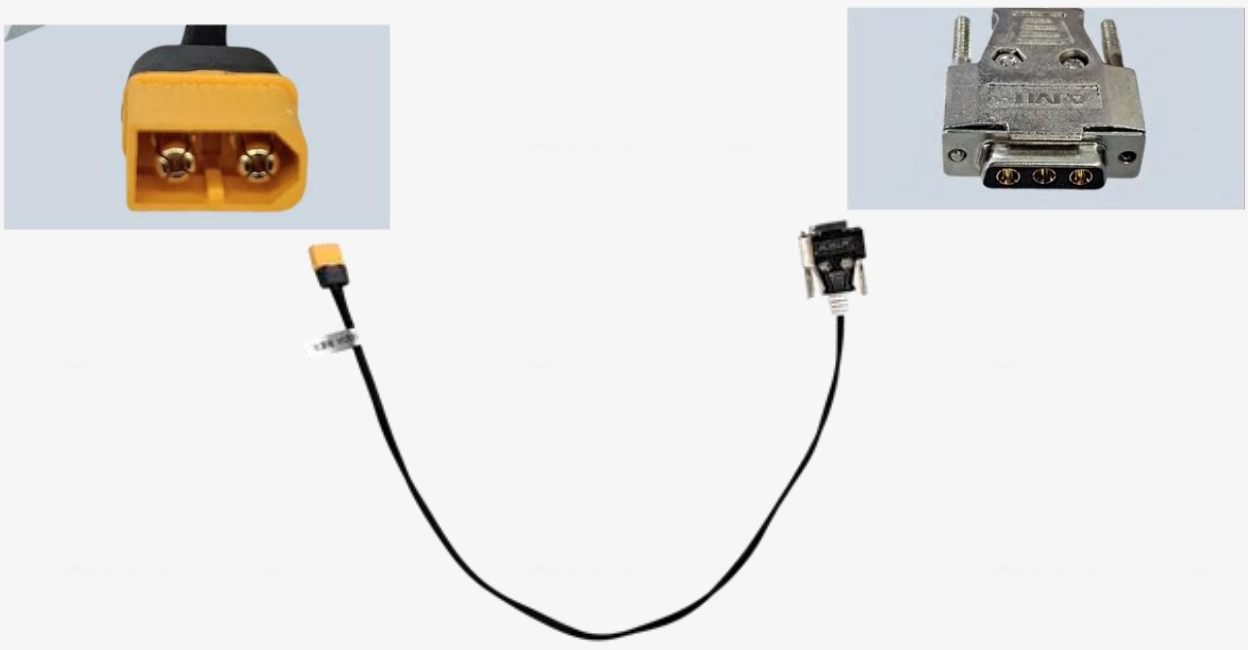


② Upgrade Tool (One To Two)

③ Computer

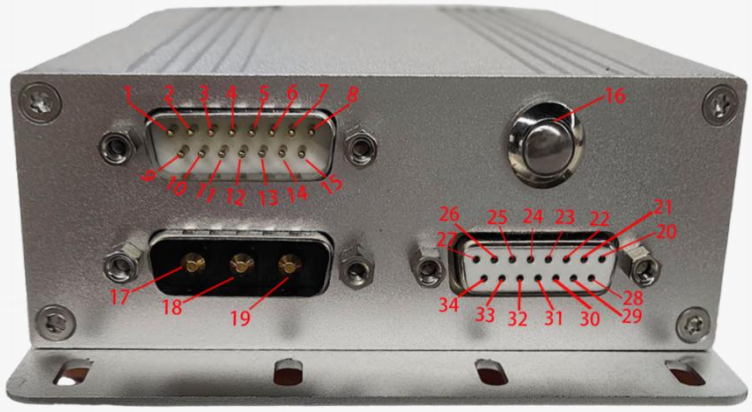
④ ECU(V5)

⑤ Signal Line



⑥ Power Cord

5.8.2 ECU(V5) DETAILED INTRODUCTION



pin 1-15 is an rs232/rs422 interface, used to connect external signal control devices and can be connected to rs232 or rs422 interfaces

WHEN CONNECTING TO RS232 INTERFACE：

Pin 1：reserved port

Pin 2：gsu data port

Pin 3：gsu positive pole of power supply

Pin 4：gsu negative pole or ground wire of power supply

Pin 5-8：reserved port

Pin 9：ppm throttle

Pin 10：ppm switch

Pin 11：ppm positive pole of power supply

Pin 12：ppm negative pole of power supply

Pin 13：rx port of rs232

Pin 14：tx port of rs232

Pin 15：rs232 ground wire

note: the rs232 signal cable supports both 232 serial port control and ppm control.

WHEN CONNECTING TO RS422 INTERFACE：

Pin 1：reserved port

Pin 2：gsu data port

Pin 3：gsu positive pole of power supply

Pin 4：gsu negative pole of power supply or ground level

Pin 5：rs422 t+mouth

Pin 6：rs422 t-mouth

Pin 7：rs422 r+mouth

Pin 8：rs422 r-mouth

Pin 9-15：reserved port

OIL PUMP BUTTON:

number 16：oil pump button, used to control the oil output of the oil pump

POWER INTERFACE:

connect the power interface to a 20-32v power supply

Number 17：reserved, the first reserved port

Number 18：positive pole, positive pole of power supply

Number 19：negative pole, power supply negative pole

SIGNAL INTERFACE:

used for connecting with the engine signal plug

Pin 20-22：interface for starting motor b

Pin 23-25：interface for starting motor a

Pin 26：negative pole of temperature sensor

Pin 27：positive pole of temperature sensor

Pin 28-30：interface for starting motor c

Pin 31-32：fire head ground wire interface

Pin 33：interface of huotou 2

Pin 34：interface of fire head 1

OIL INLET

number 35:oil inlet, connected to the fuel tank

OIL OUTLET

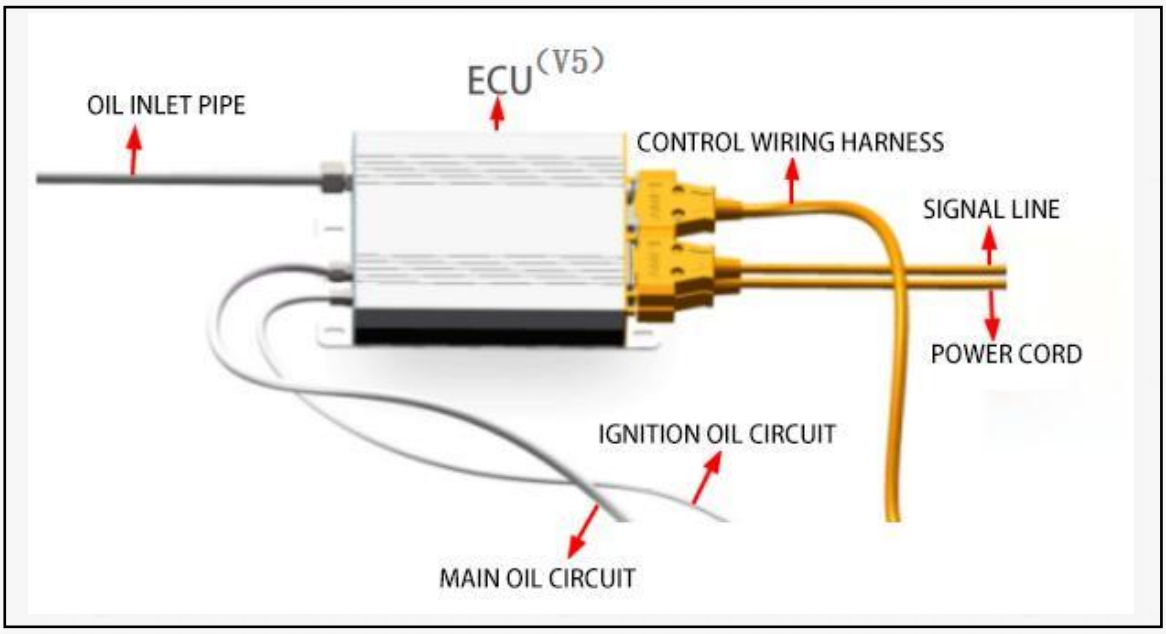
number 36:oil outlet, responsible for supplying oil to the main oil circuit of the engine

number 37:oil outlet, responsible for supplying oil to the engine ignition oil circuit

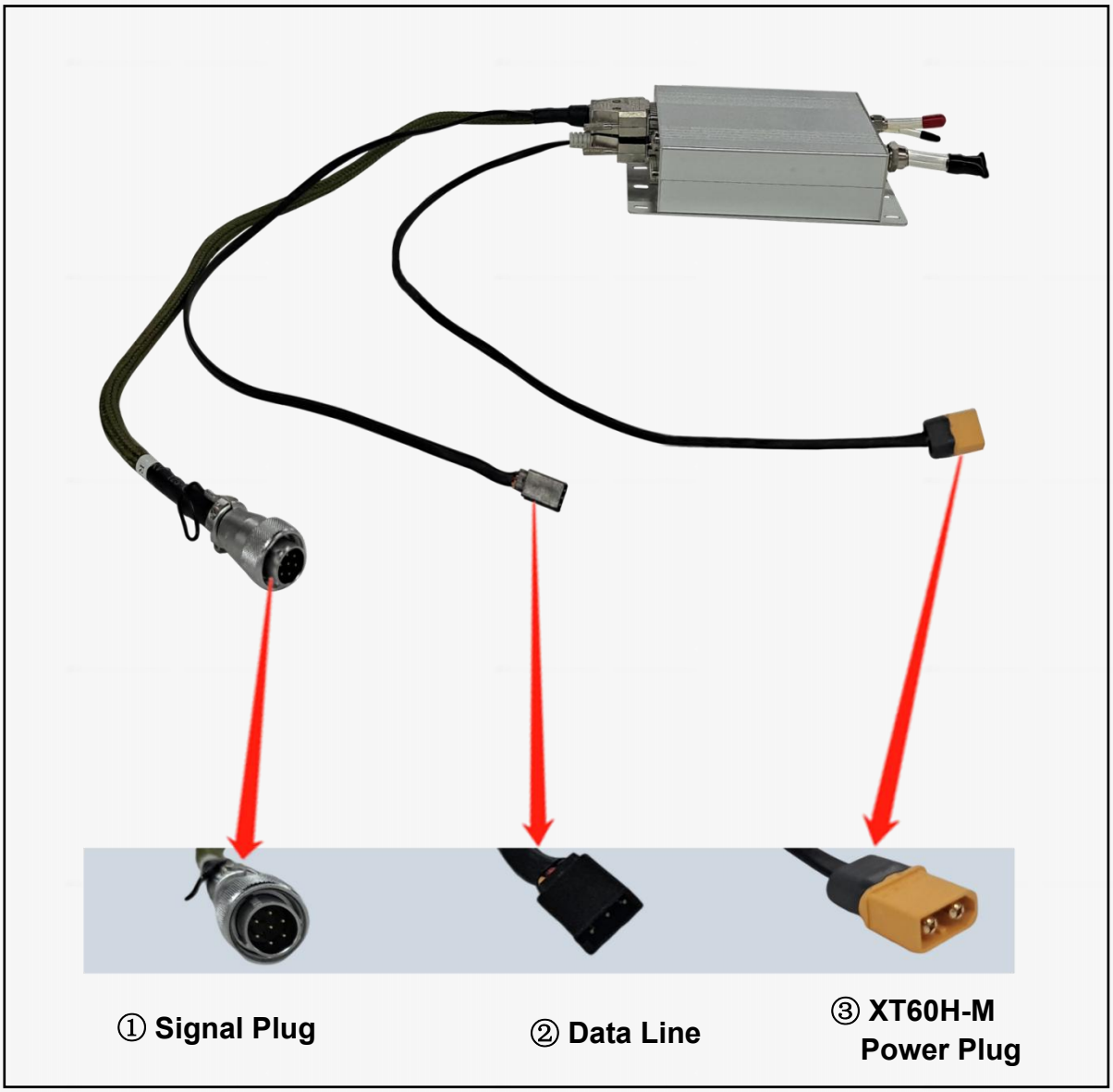
CONNECT AS SHOWN IN THE FOLLOWING DIAGRAM ECU（V5）

5.8.3 CONNECT

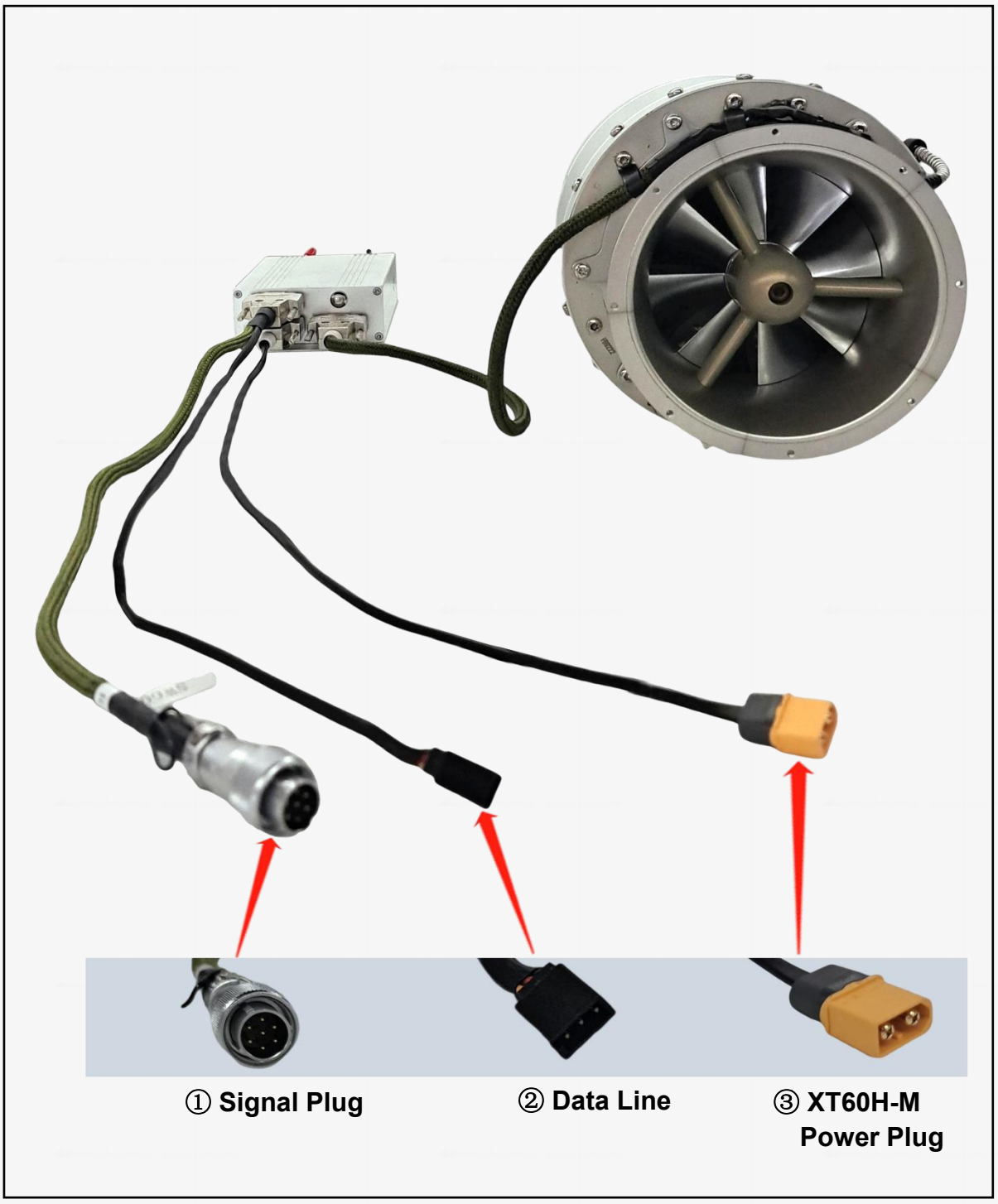
1.ECU(V5) CONNECTION DIAGRAM

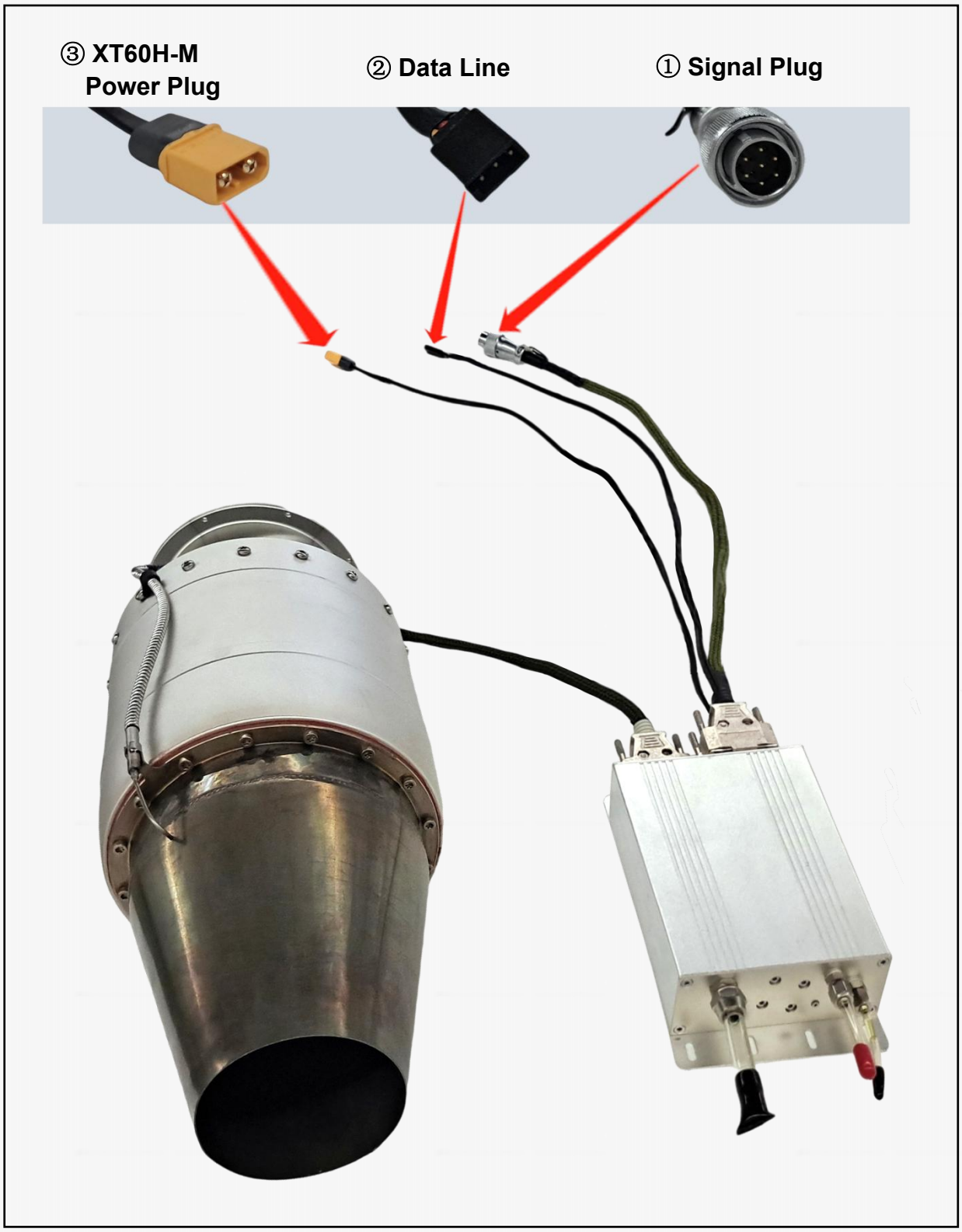


2. CONNECT THE ECU (V5) AND WIRING HARNESS AS SHOWN IN THE FOLLOWING FIGURE

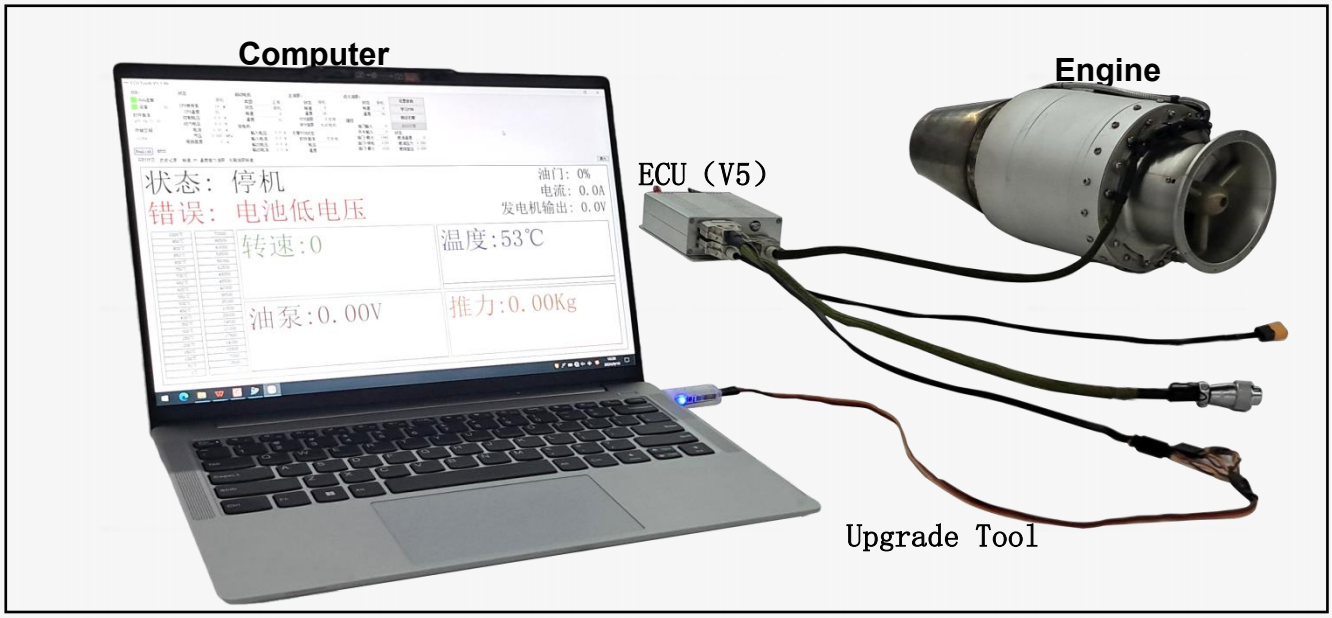


3. CONNECT THE ECU (V5) TO THE WIRING HARNESS AND ENGINE AS SHOWN IN THE FOLLOWING DIAGRAM

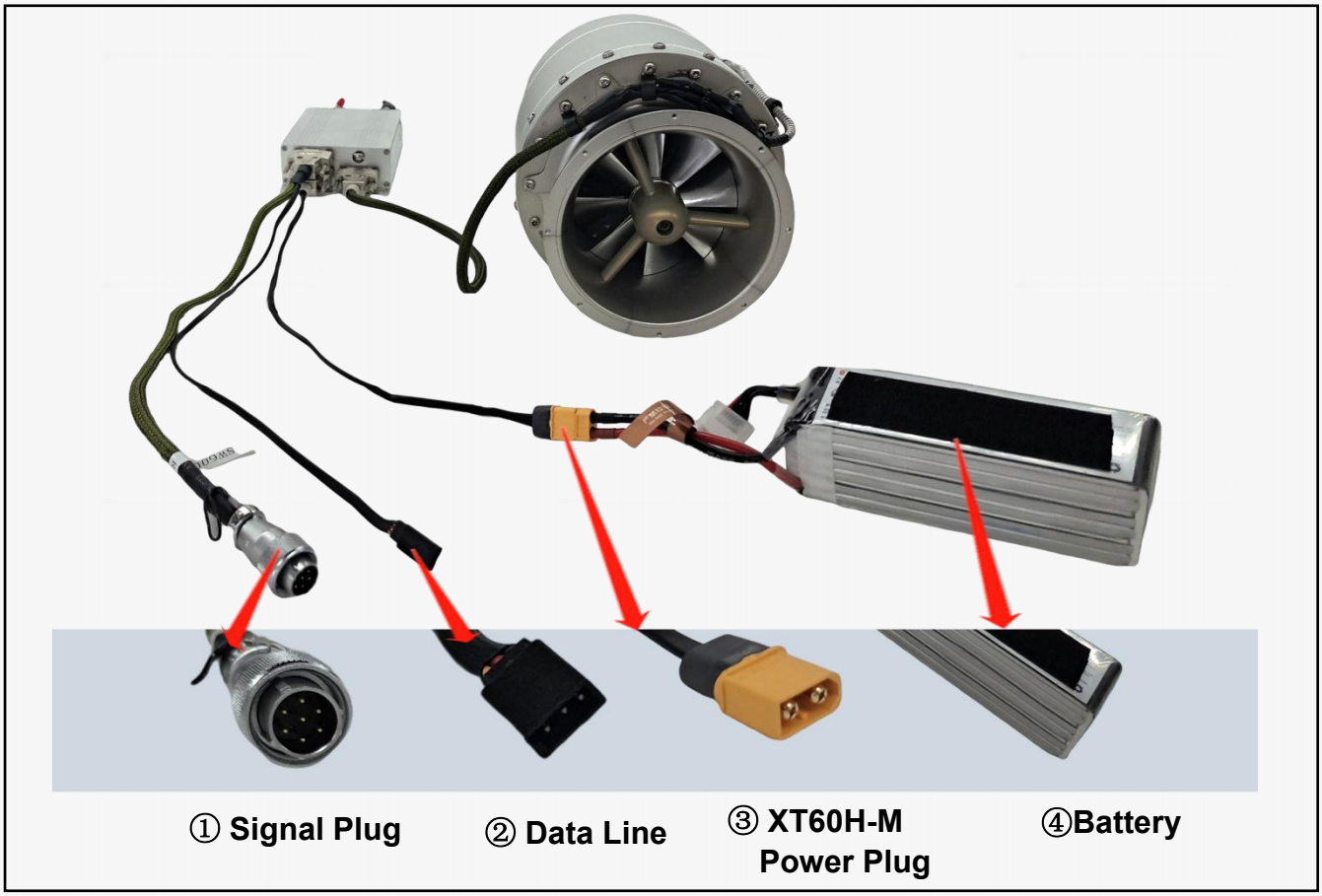



③ XT60H-M
Power Plug
② Data Line
① Signal Plug

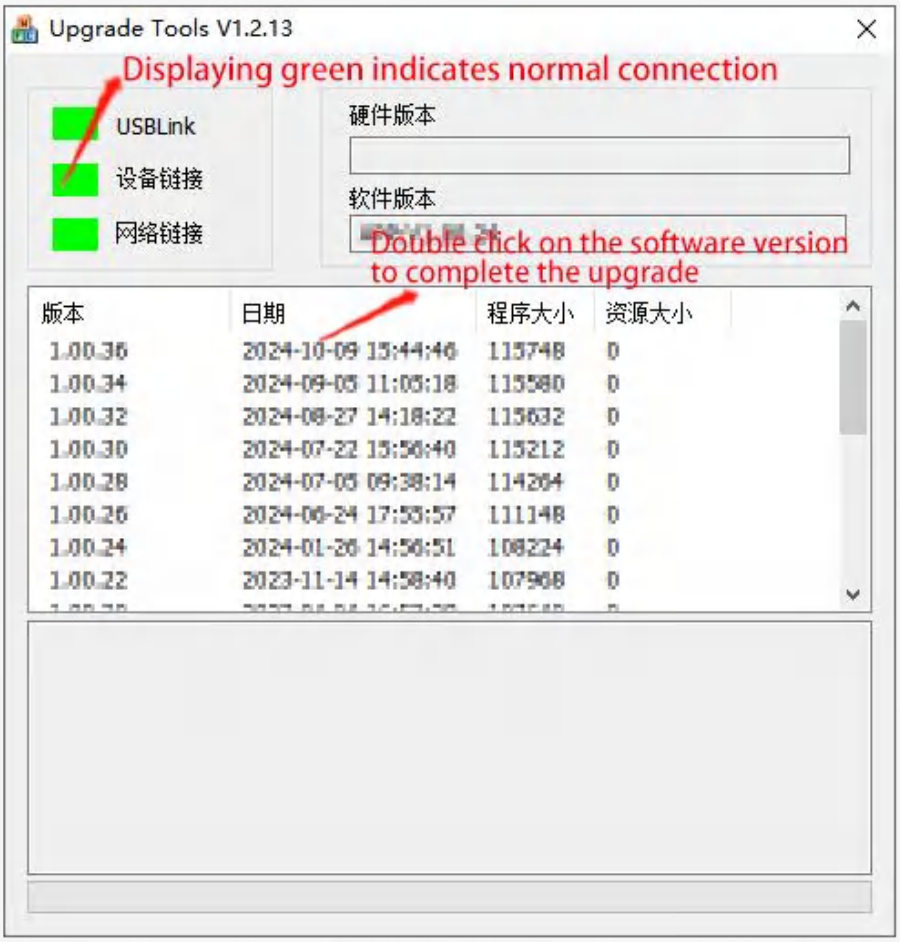
4.CONNECT AS SHOWN IN THE DIAGRAM BELOW, ECU (V5) IS CONNECTED TO THE COMPUTER THROUGH AN UPGRADE TOOL



5.CONNECT THE BATTERY AS SHOWN IN THE FOLLOWING DIAGRAM



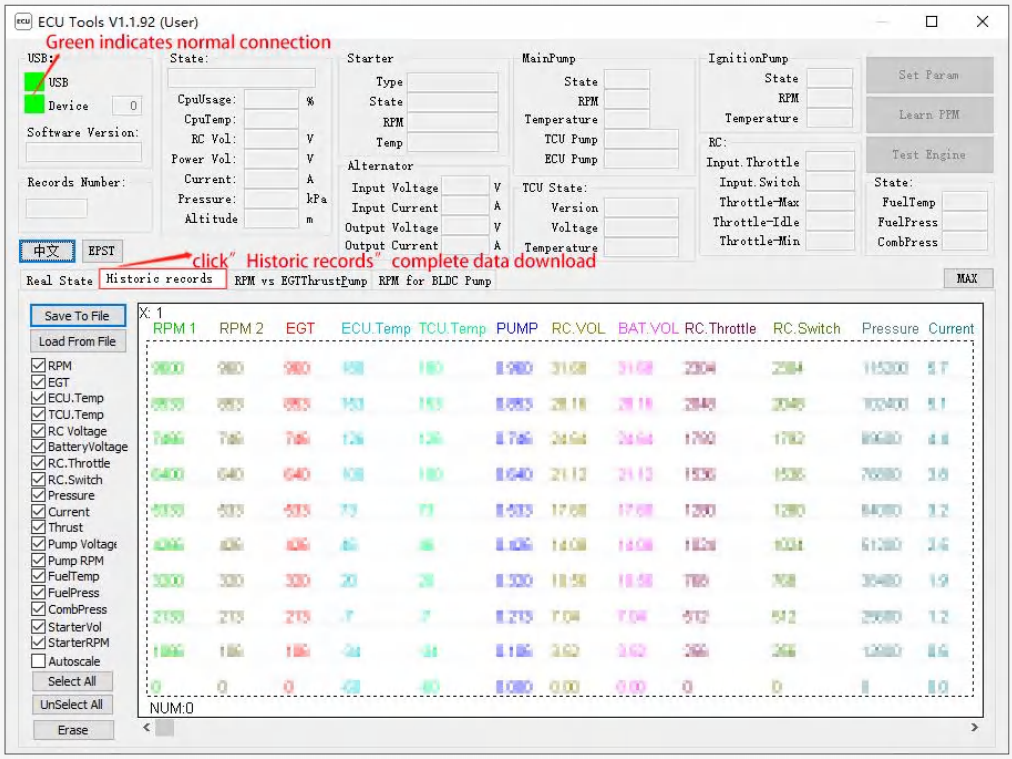
5.8.4 SOFTWARE UPGRADE



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.

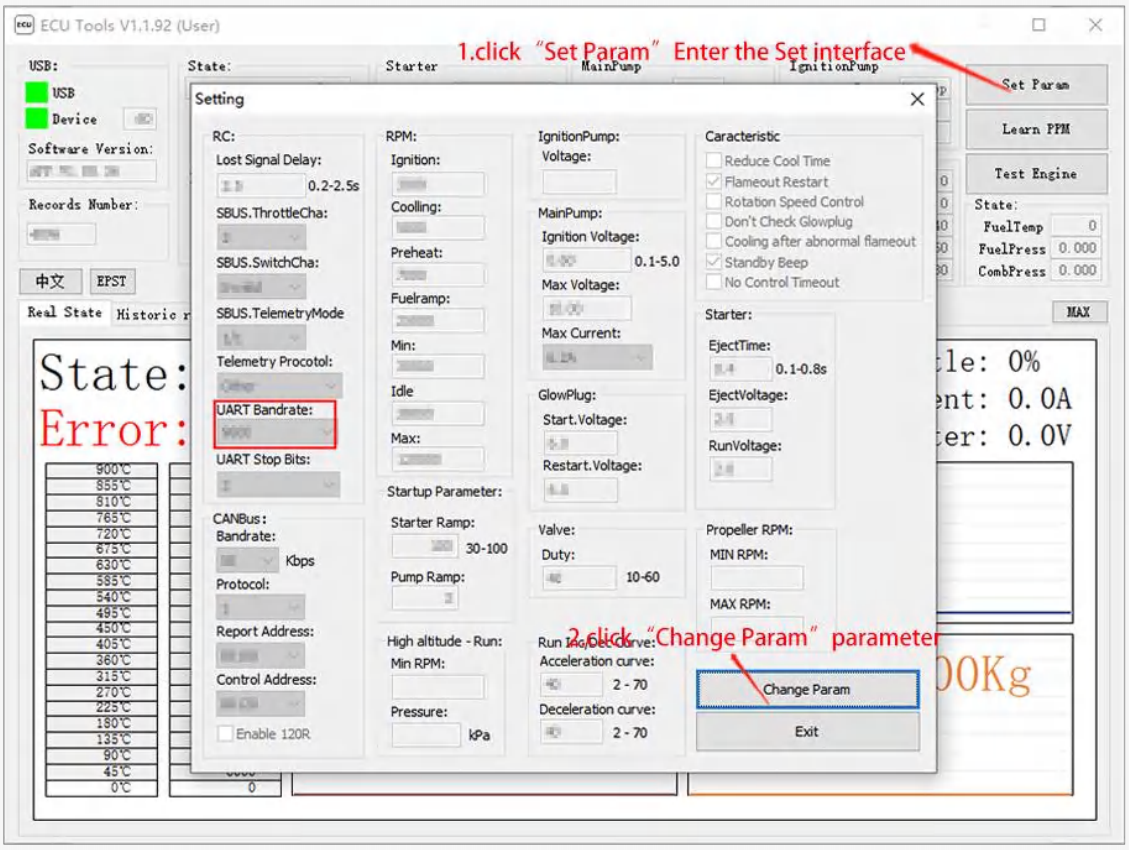
5.8.5 DATA DOWNLOAD



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.

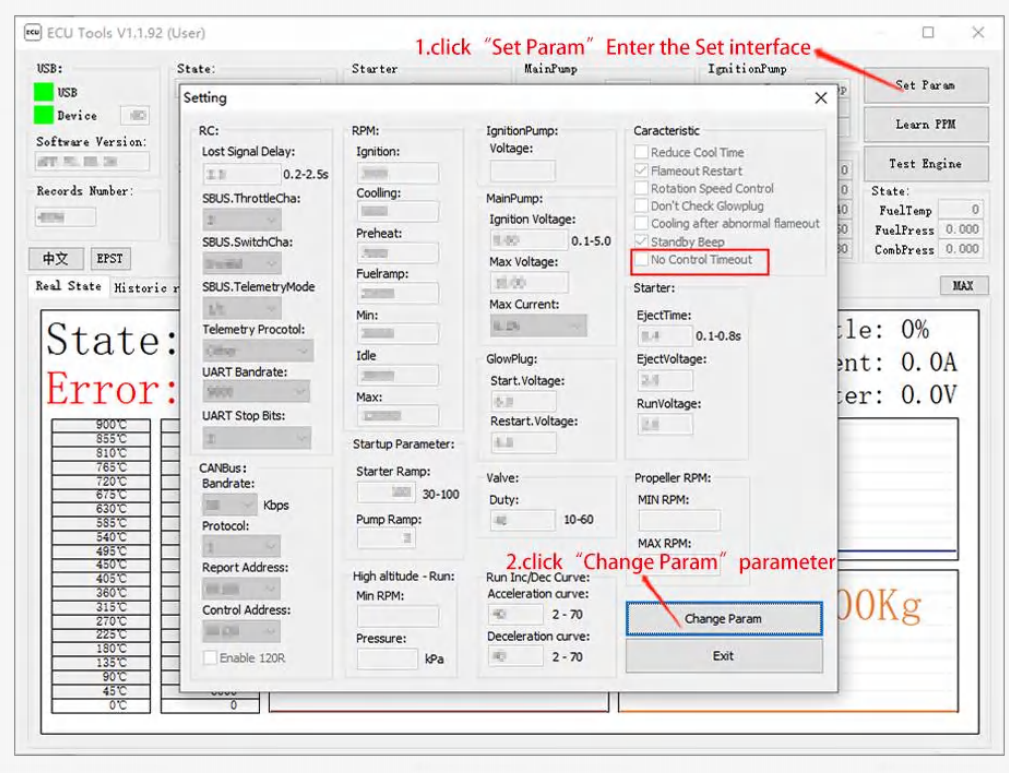
5.8.6 MODIFY BAUD RATE/CHANGE SETTING PARAMETERS



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

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

5.8.7 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 SETTING 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.

STARTUP METHOD	REQUIRED SOFTWARE/HARDWARE	WIRE HARNESS CONNECTION
232/422 SERIAL PORT STARTUP	ZK V0.1.32	THE SIGNAL LINE+RS232/422 SERIAL PORT TOOL
FLIGHT CONTROL	FLIGHT CONTROL SOFTWARE	ECU TO FLIGHT CONTROL ADAPTER CABLE

choose the correct battery type sw600pro requirements for engine power supply voltage：18V-32V。

6.2 CHECKLIST

preparation before starting the engine

- *check the battery voltage.*
- *prepare at least one co2 fire extinguisher. prepare earplugs and other noise proof personal protective equipment.*
- *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.*
- *confirm that 3% -5% lubricating oil is mixed in the fuel.*
- *the fuel tank is full, and the sw600pro engine has a fuel consumption of 1690g/min. the sufficient fuel level will be determined based on the flight time you have booked.*
- *the engine wiring harnesses are connected correctly, the remote control throttle calibration is normal, or the handheld terminal/ground station data feedback is normal.*

●the engine is firmly fixed, ensuring the safety of the surrounding environment, and checking that there are no debris within a range of 10 to 20 meters near the engine intake and exhaust nozzle.

●check if there are any other personnel within a range of 10 to 20 meters near the engine intake and exhaust nozzle.

6.3ENGINE START AND STOP

the checklist must be checked and all wiring harnesses of the engine must be connected before starting the engine.

6.4 PC CONTROL 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 or directly use the shortcut button on the ecu to fill the fuel inlet pipe with fuel. pay attention to stopping the fuel 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 (counterclockwise rotation of impeller), ignition head (current changes on the test function interface), 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 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 model	the gsu operating interface displays the engine model within the white box below the swiwin logo.
time	indicates the total time the engine has been running this time

speed	gsu operating interface, "rpm" represents the real-time engine speed during operation.
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. FREQUENTLY ASKED QUESTIONS AND ANSWERS

8.1 COMMON PROBLEM ELIMINATION

PROBLEM DESCRIPTION	CAUSE ANALYSIS	REMEDIAL MEASURES
engine ignition failure	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
unable to reach maximum speed	oil pump issue oil circuit blockage	check if the oil pump and the entire oil circuit are unobstructed
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

8.2 ANALYSIS OF ECU ERROR FAULTS

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
over time	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 during acceleration: 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.

9.1 COMPATIBILITY OF SERIAL PORT ADAPTER CABLE CONNECTORS

NAME	PERFORMANCE INDEX	COMPATIBILITY
RS232 ADAPTER YHL-B232	USB2.0,COMPATIBLE USB1.1 SUPPORT 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：WINDOWS2000、WINDOWSXP、WINDOWS SERVER 2003（32、64 位）/VISTA/WINDOWS 7（32、64 位）、WINDOWS 8、WINDOWS10

9.2 UPGRADER COMPATIBILITY

NAME	PERFORMANCE INDEX	COMPATIBILITY
UPGRADER（ZK-LINK V1.4）	-----	SUPPORT 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

the 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 sw600pro 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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