

NOVA Hybrid Generator

Manual and Self-maintenance Guide V2.1



Read This First

首先阅读此内容

Apply NOVA Hybrid UAV Generator for extremely long endurance as following steps:
使用 NOVA 油电混动系统实现无人机超长时间续航需要如下步骤:

<p>1 Getting Started 准备工作</p>	<p>2 Operation 运行</p>
<p>3 Maintenance 保养</p>	<p>4 Trouble Shooting 常见故障</p>

Checking the bundled items
物品清单

- NOVA X1
- Cable 电缆 X1
- LiPo Battery 12S X1
- Battery Cable 电池线 X1
- Control Unit 控制器 X1

Complimentary Accessories
附赠物品

- Fuel Mixer X1
- Fuel Tank 燃油箱 X1
- Fuel Tank 燃油箱 X1
- Oil 润滑油 X1
- Starter & Battery 4S X1
- Starter & Battery 4S X1

Connecting to NOVA Controller 控制器接线



#6 cable connects to an assignable three-position switch (stop-idle-run) on Flight controller or RC receiver.
6 号线接飞控或遥控器接收机三位“控制开关”。

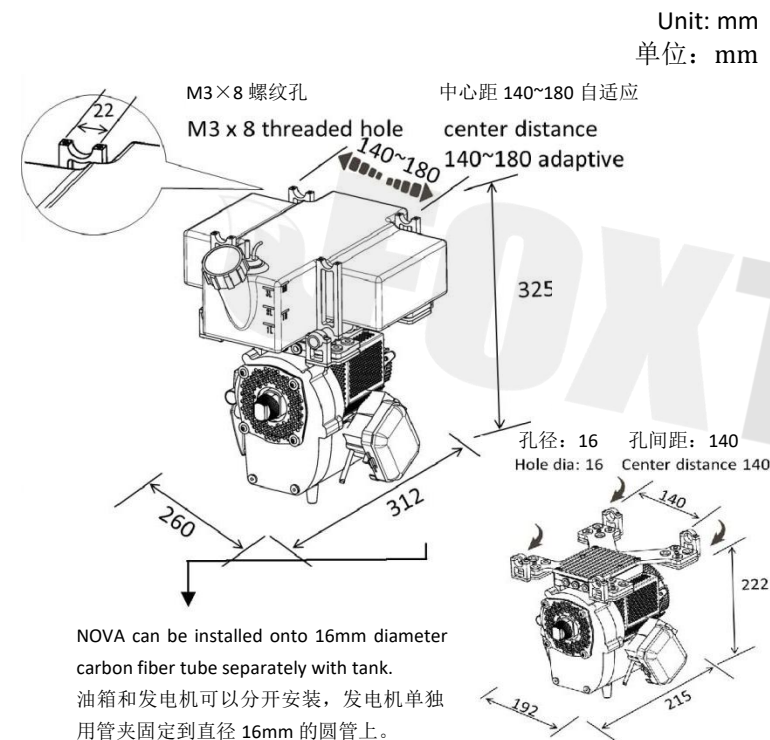
NOVA Controller Dimensions 90x50x24 (LxWxH mm)
控制器外形尺寸 90x50x24(LxWxH mm)

1. Installation

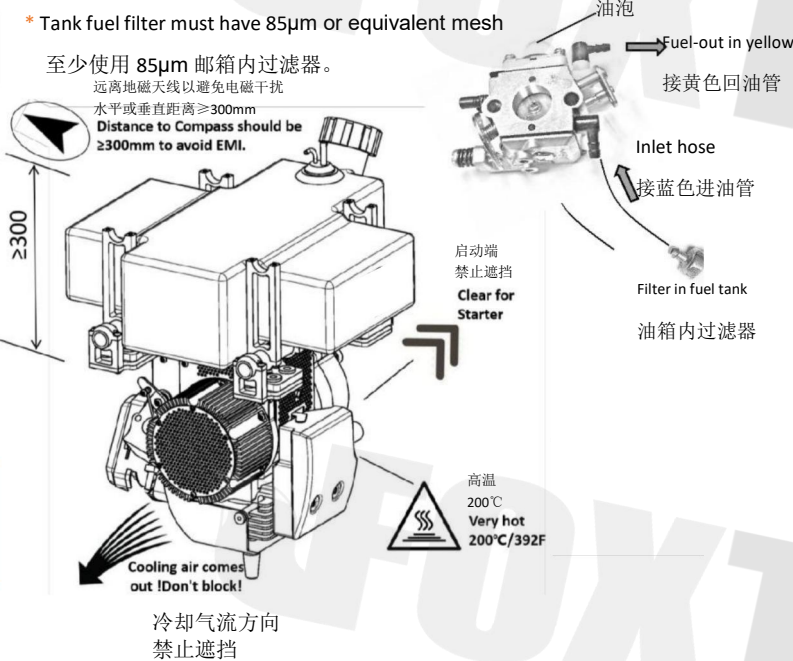
安装

Installing NOVA to UAV, default is lifted way.
将 NOVA 安装至无人机的合适位置，默认为吊装。

- ① Firstly mount the fuel tank under drone frame.
首先吊装油箱总成。
- ② Secondly install NOVA under the tank.
然后安装发电机。



Default mounting method is in the lifted way. Other mounting methods may lead to damper failure.
出厂默认为吊装，其他安装方式会导致减震器损坏。



Installation may differ from UAVs.
推荐的布置方案最终形式根据飞机个体差异而定。



- ① Plug 12S Lipo Battery with XT60. Default battery can be replaced with 2 x 5000mah 6S to increase emergency time.
XT60 插头与 2x6SLipo 电池组连接，可替换成 5000mah6S 电池增加备降时间
- ② Plug AS150 in UAV brushless ESC (Electronic Speed Controller)
AmassXT150 插头与无人机动力电调正负极连接

2. Fuel 燃料

Use Fuel Mixer to mix gasoline and oil.
使用附赠的比例桶准备燃料。



- ① Fill gasoline (octane over 95) until Mixer mark.
加入#95 以上汽油至刻度处。
- ② Fill lubricant until Mixer mark.
加入润滑油至刻度处。
- ③ Turn the mixer upside down to mix the fuel.
倒置比例桶摇匀，混合燃料。

* Gasoline/lubricating oil at 25:1
燃油/润滑油比例 25:1

Using recommended 2 stroke engine lubricant or JASO FC/FD ISO-L -EGD grade oil.
使用厂家推荐的两冲程润滑油或其他符合 JASO FC/FD ISO-L-EGD 标准的两冲程润滑油。

3. Start the Generator 启动发动机

<p>Fig1 图 1</p>	<p>Fig3 图 3</p>
<p>Fig2 图 2</p>	<p>Fig4 图 4</p>

Weight 重量	4.0kg(8.8lb) w/o Accessories/ 5.2kg(11.5lb) Total 4kg 不含配件/5.2kg 总重量
Generated Output 功率	1.8kW Continuous/ 2.0kW Max. Power 1.8KW 持续功率/2KW 最大功率
Dimension(L x W x H) 尺寸 (L x W x H)	260 x 312 x 325 mm/10 x 12 x 12 in
Applicable UAV Types 适用机型	Multicopters & VTOL Fix-wings 多轴旋翼、垂直起降固定翼
Max. Take-off Weight 适用机型最大起飞重量	18kg for Quadcopter 21kg for Hexacopter 四轴建议 18kg，六轴建议 21kg
Output Voltage 适用机型动力电压	12 S (49V) 12 S (49V)
Fuel Consumption 油耗	750 g/kw·h (hovering 1.5 L/h) 750 g/kw·h (悬停 1.5 升/小时)
Service Temperature 使用温度环境	-20 ~ 40 °C
Altitude 使用上限 (海拔)	2000 m
Rotating direction 启动旋转方向	Clock wise (view from starter) 顺时针 (面向发动机曲轴启动)
Fuel 燃油	Automotive #95 or above + 2T oil 车用#95 号或以上+2T 润滑油

1. Before every start, Push the primer pump several times until fuel supply pipe is filled with gasoline. (Fig.1)

每次启动前，按压透明油泡，直到供油管充满燃油，没有气泡。（图1）

2. Check the inlet filter if it is clogged. (Fig.2)

检查进气滤芯是否有燃油或异物。（图2）

3. Power on and switch the three-position switch to "idle". Make sure the status lamp on NOVA controller is "green". If not, please see Trouble Shooting chapter.

系统上电，将控制开关拨至“怠速”位置，确认控制器指示灯为“绿色”。如指示灯不是“绿色”，请参常见故障。（图3）

4. Close the Choke Lever (Fig.3), ①Push hard the starter to NOVA, ②Push the start button for seconds. Disconnect starter from NOVA. (For a warm start, choking may not be necessary.)

使用启动器，关闭风门（图3），①将启动器用力压入NOVA，②按下启动按钮，约2秒钟，脱离启动手柄进入第5步（热机启动无需关闭风门）。

5. Open the Choke (Fig.3). Push start button for 2~3seconds. Pull the starter until hearing running noise (Fig.4).

打开风门（图3），在此启动2~3秒钟，听到打火声脱离启动手柄。

* NOVA is able to start if the lamp on NOVA controller is "green". If the lamp is "blinking green", maintenance is required, but NOVA is still able to start. NOVA is unable to start, if the lamp is "red" and controller (蜂鸣) Beeps.

控制器为“绿灯”表示可以启动。为“绿灯闪烁”提示到达保养时间，仍然可以启动。控制器(蜂鸣)为“红灯”并听到“蜂鸣音”无法启动！请参见常见故障排除。

Over choking may cause starting difficulty due to wet spark plug. In this case change spark plug or dry it, and try to start again.

多次启动失败可能导致火花塞被淹，这种情况下更换或擦干火花塞，再尝试启动。

4. Run 运行

1. Before starting make sure the controller LED working as the Three position switch, referring to Trouble shooting.

启动NOVA前请首先确认控制器LED灯随三位开关正常变化（参见常见故障和指示灯）。

2. Switch the three-position switch to "run", and monitor the UAV input voltage.

将“三位”控制开关拨至“运行”位置，观察总线电压。

3. Voltage should be at $49 \pm 1V$

总线电压稳定在 $49 \pm 1V$ 。

4. Run NOVA for 1 minute for warming up.

观察总线电压稳定运行约一分钟预热发动机。

5. Take-off by moving throttle or running Auto-pilot program

推动遥控器或启动飞控程序，开始起飞。

5. Voltage may drop 2~3 V when encounters air turbulence or Hard maneuver. If the voltage drops rapidly below 45 V, Great attention should be given, and the drone should be landed and inspected when necessary.

飞行中遇机动操作或阵风总线电压会下降2~3V，属正常现象。若总线电压快速持续下降，并低于45V须引起特别注意，必要时立即降落检修。

NOTES 注意

- NOVA has LiPo Battery with capacity of 90 seconds for emergency landing. Contact us for bigger capacity.
- NOVA 预置了90秒紧急迫降锂电池，如需更长迫降时间，请与厂家联系。

5. Stop 关闭

1. Be sure to have NOVA cooled down for 30 seconds at "idle" after flight.

持续飞行后，NOVA系统需要冷却。因此降落后请将“三位”控制开关拨到“怠速”运行30秒钟。

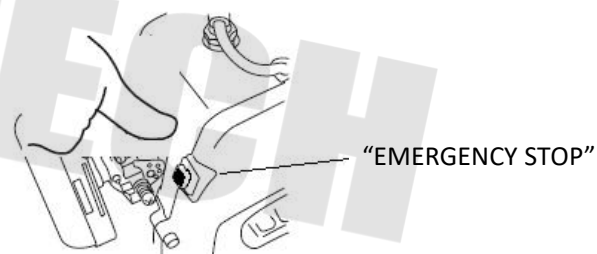
2. Switch the three-position switch to "stop". NOVA will stop.

将“三位”控制开关拨至“关闭”位置，NOVA系统将自动关闭。

- Fuel ran out may completely damage NOVA. Monitor fuel level with given sensor and land before fuel ran out. DISPLAY is optional for fuel level sensor incompatible flight controllers like DJIA3.

空中燃油耗尽会导致NOVA严重损坏，请务必使用标配的油位传感器监控剩余燃油量，在燃油耗尽前降落。如使用DJIA3等不兼容油位传感器的飞控，可选配地面油位显示器DISPLAY。

- NOVA has "EMERGENCY STOP" button. Press the yellow button in case of emergency. NOVA配备了“急停”按钮，紧急情况下按下机体上黄色按钮可紧急关闭系统。



Gasoline is flammable! At the end of the mission or during long-distance transport, the fuel tank should be emptied and fuel should be properly stored.

汽油属于易挥发的易燃易爆液体。当天任务结束或长途运输过程中应将油箱中剩余燃油放出，妥善存放在油桶中，以免发生危险！

6. Maintenance 保养

（中国内地客户返厂保养或维修请联系售后人员。）

- Correct maintenance is necessary to keep NOVA at high performance. NOVA系统工作在较高转速，必须定期进行必要的保养，保持系统性能。

- Once NOVA controller lamp blinks "green and red", it is reaching the maintenance cycle (50 hours). NOVA is still able to be started. Please follow the MAINTENANCE in separate manual.

控制器“绿灯红灯交替闪”，表示到达保养周期（每50小时），系统仍可启动，但请尽快联系返厂保养。

If NOVA is NOT maintained at every 50 hours cycle, it will lead to performance degradation.

保养提示（控制器“绿灯红灯交替闪”）将持续至超过保养周期（每50小时）2小时。之后将不再提示。超过保养周期会导致性能下降或损坏。为始终保持NOVA工作性能，请按时报养。

Inspection and Service intervals

Item	Before Use	Every 50h	Every 200h	Remarks
LiPo 12s Battery	Inspection	Balance Recharge		12s 3100mah
Intake	Air Filter	Inspection	Inspection	
Carburetor	Primer pump	Push		
Carburetor	Fuel filter	Clean		Walbro WT-1107
Spark plug		Replace		NGK-CMR7H
Cylinder Kit		Replace		
Digital Servo			Replace	HITEC HS-5646WP

1) Backup Lipo Battery

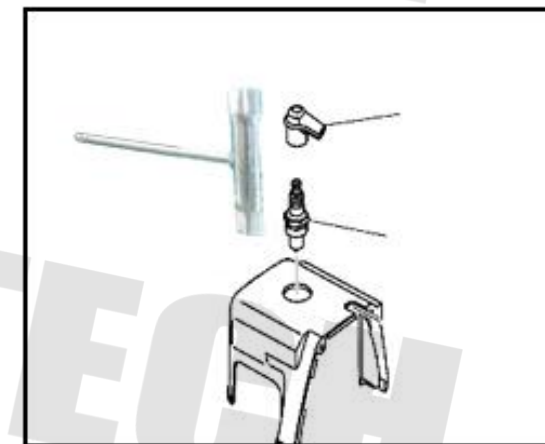
- Inspection before use:
LiPo 3100mAh 6s x 2
voltage: $49.5 \pm 0.5 V$ /All

3.9~4.2 V/Cell

If total voltage is below 48 V, please keep NOVA at RUN position to recharge it.

- Recharge after service intervals: Balance recharge by LiPo charger.

2) Spark Plug



- Replacement:

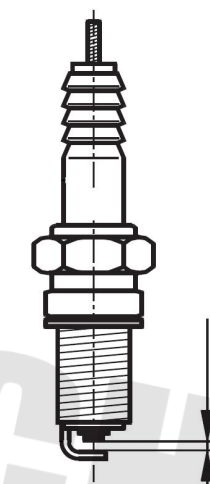
NGK-CMR7H

Use M10 (P=1.0) screw with torque 10.8 N.m (Limit 8.8~12.8 N.m)

- Inspection:

Visual inspection of the spark plug for carbonation, oil fouling and discoloration of the electrode. Clean the electrode.

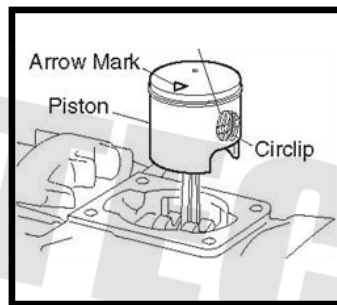
Check the electrode gap of the spark plug with a feeler gauge and adjust if required to $s=0.6\sim 0.7$ mm.



3) Carburetor Fuel Filter

- Cleaning:

1. Remove Carburetor from NOVA.
2. Remove fuel pump cover screw and pump cover.
3. Remove fuel pump gasket and pump diaphragm.
4. Inspect pump diaphragm. REPLACE if it deformed.
5. Clean pump diaphragm using Carburetor Cleaner.
6. Clean pump fuel inlet using Carburetor Cleaner.
7. Reassembly the pump cover.

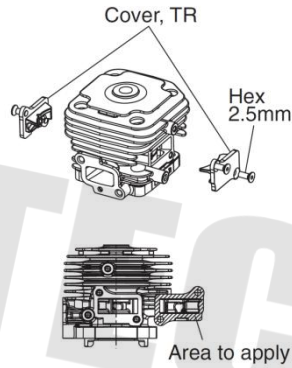


Install piston

1. Make sure to point the arrow mark on the piston to the exhaust side.
2. Fit the cir-clip in the groove so as to face the end gap below.

NOTES

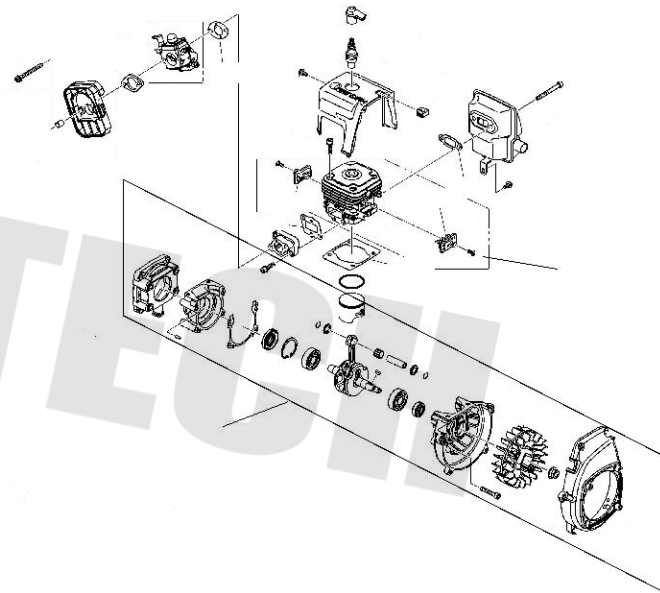
Deformed cir-clip may come off during engine operation and damage the engine.



Apply Liquid Gasket

Apply the liquid gasket (Three Bond TB1217F or equivalent) when taking the Cover, TR on or off.

Apply a thin layer. Do not let the liquid gasket enter the cylinder. This could cause damage to the engine.



NOTES

Please do NOT disassemble the Crankcase during cylinder kit replacement.

Replace damaged gaskets. Damaged gaskets could cause gas leakage or lack of power.

5) Running In

Before fly, install NOVA into drone or test bench. 40 minutes running in at "idle" position is needed. Takeoff without running in will damage the engine.

7. Trouble Shooting

常见故障和指示灯

1) Unable to Start 无法启动

	Lamp 报警灯	Possible Cause 原因	Solution 解决方法
开关	OFF 控制器“灯不亮”	Switch is not on "idle". 控制开关没有在“怠速”位置	Switch to "idle". 控制开关拨至“怠速”位置
	OFF 控制器“灯不亮”	Power is off. 控制器未供电	Check power wiring and voltages. 检查电池插头、电压是否正常
	Green or green blinking. 控制器“绿灯常亮或绿灯闪烁”	EMERGENCY STOP switch failure. 机体上“急停”按钮损坏。	Exchange 更换
Filter overflow or clogged. 空气滤芯存油过多堵塞		Carburetor Overflow 化油器堵塞	Repair Carburetor overflow. 维修化油器
		Bad environmental air condition. 使用环境恶劣	Wash the filter with mixed gasoline. 用燃油清洗滤芯
Wiring 线路	Stop, idle & run position LED "red flashing" and beeps. 停止、怠速、运行三个位置“红灯闪烁”，蜂鸣器响。	#6 wire Three-position switch cable is not connected. #6 三位控制开关断线。	Check wiring, change flight controller or RC receiver channel. 检查线路，更换飞控或遥控器接收机通道。
Maintenance cycle exceeded. 超过保养期	Controller led "green and red flashing". 控制器“绿灯红灯交替闪烁”	Maintenance cycle exceeded. 到达保养周期	Operate maintenance. 联系销售人员
Starter 启动器		Rotating direction wrong or voltage lower than 15V. 旋转方向错误、电压低于 15V	Clock wise (view from starter) or charge the 4S battery. 顺时针方向(面向启动曲轴)、充电

2) Lack of Power or Unstable Running 性能下降

	Lamp 报警灯	Possible Cause 原因	Solution 解决方法
Unstable running. 转速波动、浓烟		Water in fuel, wrong, poor fuel quality or mixed longer than 2 months. 燃油含水或燃油质量差、燃油存放超过 2 个月	Change with proper fuel. 更换燃油
		Poor oil quality. 润滑油质量差	Change with good fuel. 更换燃油
		NOVA controller failure. 控制电路损坏	Contact us. 联系销售人员
		Air in fuel-in pipe. 供油不畅，蓝色油管中有气泡	Press primer pump several times. Make sure tank is connected

	Lamp 报警灯	Possible Cause 原因	Solution 解决方法
Lack of power. 输出功率不足	Controller lamp "green blinks twice." 控制器“绿灯红灯交替闪”	Maintenance required. 到保养周期	Operate maintenance. 联系销售人员
		Filter clogged. 空气滤芯过脏	Wash the filter with mixed gasoline. 用燃油清洗滤芯
Voltage drops rapidly after take-off. 起飞后电压迅速下降		Carburetor Clogged 化油器堵塞	Clean(As Below) 清理
	"Red Flashing" 控制器“红灯闪烁”	Voltage is too low. 电池电压过低	Run NOVA for 1 minutes until "solid green" before take-off. 起飞前三位开关拨至“运行”等待约 1 分钟,直到“绿灯长亮”
Others 其他		Structure failure. 机械部件损坏	Contact us. 联系销售人员

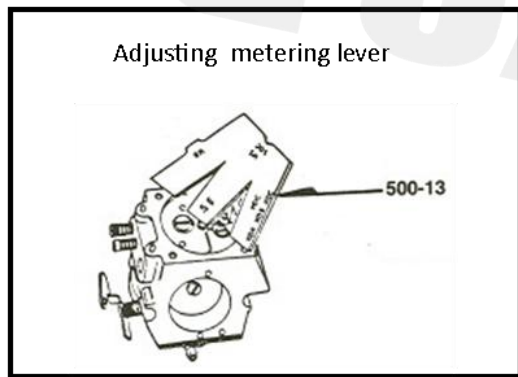
Carburetor Cleaning 清洗化油器

Dirty operating environment (dusty) or unfiltered fuel can lead to clogging of carburetor and lack of power. It can be solved by simple carburetor cleaning.

使用环境（沙尘）或燃油未有效过滤导致化油器堵塞和输出功率不足，通过简单清洗化油器可排除此故障。

- Remove fuel pump cover screw and pump cover.
拆下化油器盖螺钉，打开化油器盖。
- Clean diaphragm and fuel inlet using carburetor cleaner.
用化油器清洗剂清洗膜片和进油口上附着的杂质。
- Reassemble the pump cover and make sure gasket and diaphragm direction is correct.
重新安装滑油器盖，保证密封垫和膜片安装方向正确。

Do NOT disassemble carburetor from NOVA. Only remove pump cover and clean diaphragm and fuel inlet.
化油器无需从 NOVA 上拆下。只需拆下滑油器盖清洗“膜片”和“进油口”。



Inspection

Place gage or depth micrometers across Carburetor body casting as illustrated. Metering lever should just touch the gage without opening the inlet needle valve. The metering lever set should be 1.65 + 0.16 mm.

4) Cylinder Kit

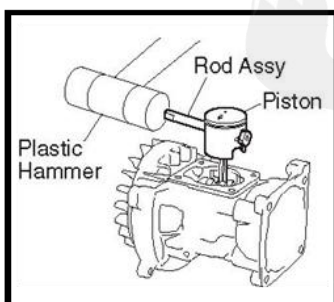
Replacement:

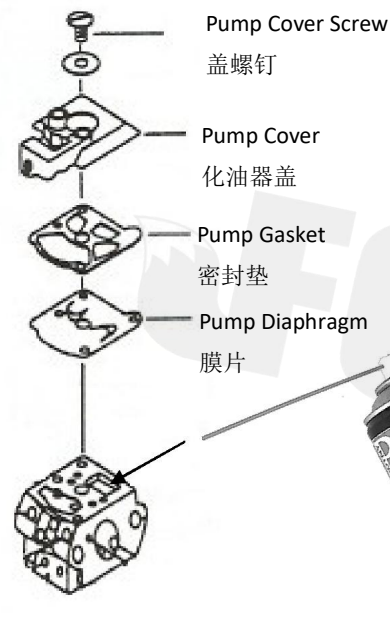
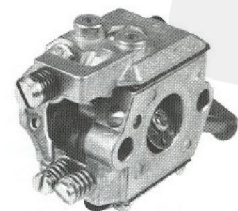
First clean the surface of piston and cylinder. They may be dirtied during transportation.

- Remove Cylinder from NOVA
- Remove Piston Pin
- Install Piston
- Apply Gaskets
- Install Cylinder

Remove Piston pin

1. Remove snap rings from both sides of the piston pin.
2. Engage the rod assy to the piston pin and gently tap with a plastic hammer to push out the pin while holding piston firmly.





2) Port Description and Connection 通道定义和说明



PWM output port/PWM:
Signal: 5V, 50Hz Minimum liquid level 0%—1100us
Maximum liquid level 100%—1900us

5V: power supply +
GND: power supply -

信号输出端定义:

Signal: 幅值 5V, 50Hz

最低油位 0%-1100us; 最高油位 100%-1900us

5V: 工作电源正极

GND: 工作电源负极

3) Installation 安装

- Liquid may damage sensor. So we recommend to install sensor above the liquid container. A/B pipes go into the container through the top of the container.
禁止被测液体通过 A/B 管流入液位传感器。传感器尽量安装在被测容器上方。A/B 管必须从容器顶部进入。
- A pipe goes into container from top. Keep pipe end above the liquid and in the container.
A 管接入容器即可，100%液位时不能接触液体。
- B pipe goes into container from the top. Make sure its end lie on the bottom of liquid container.
B 管要求保证测量重锤可以平躺在容器底面。
- The 2.5L fuel tank equipped with the NOVA generator has been installed with sensor before delivery.
使用 NOVA 发电系统标配燃油箱 A/B 管出厂时已安装到位，无需重新安装。

4) Calibration 标定

- Sensor installed on 2.5L fuel tank has been calibrated before delivery.
首次使用 NOVA 发电系统标配燃油箱无需标定。
- The green status light is on when power supplied.
安装好控制器、线路及管路，供电后绿色指示灯常亮。
- Calibrate 0% empty level: when container is empty, press calibration button 5 seconds, status light begin to blink.
0% liquid level is calibrated.
标定 0%油位：空容器时，按住标定按钮 5 秒以上，指示灯开始闪烁，0%液位标定成功。
- Calibrate 100% full level: Fill the container full with liquid. Press calibration button 5 seconds, status light stops blinking.
100% liquid level is calibrated.
标定 100%液位：加入被测液体至需要的最高液位。再次按住标定按钮 5 秒以上，指示灯常亮，100%油位标定成功。
- Calibrate again when container is changed or the sensor does not work properly.
使用中发现测量不准确可以再次标定。

5) Operation 使用

- Connect PWM output port to UAV flight control or Data Acquisition Module.
PWM 液位输出信号接入无人机飞控或其他采集模块。
- Power on. The green status light is on. The sensor works.
接上电源，绿灯指示灯常亮，液位传感器正常工作。

8. Liquid Level Sensor 油位传感器



1) Specification 技术参数

LIQUID LEVEL SENSOR 液位传感器	
Weight 重量	31 g (0.03 oz)
Power Supply 供电	DC 3 ~ 6 V
Dimension/尺寸 (L x W x H)	60 x 35 x 25 mm / 2.4 x 1.4 x 1.0 in
Range 里程	30 cm water or other liquid comparable. 30cm 水或按照与水的比密度换算的液体
Output 输出	5V 50 Hz PWM 0%—1100us 100%—1900us 幅值 5V50 Hz PWM 信号
Liquid Type 液体类型	Water, oil, gasoline, diesel, kerosene, Pesticide etc. Check the Corrosion Resistance between pipe and liquid first. 水、机油、汽油、柴油、煤油、农药等。(如测量腐蚀性液体需确认测量重锤和管路的耐腐蚀性)
Working Temperature 环境温度	-20 ~ 40 °C